EUROPEAN ECONOMY

ECONOMIC PAPERS

Number 293 – November 2007

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Directorate-General for Economic and Financial Affairs

Economic and Financial Affairs
DIRECTORATE-GENERAL

EUROPEAN COMMISSION

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European Commission
Directorate-General for Economic and Financial Affairs
Publications
BU-1
B - 1049 Brussels, Belgium

ISSN 1016-8060 (print)

ISSN 1725-3187 (online)

Asset Booms and Tax Receipts: The case of Spain, 1995-2006(*)

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ABSTRACT

At about 3¾% for more than 10 years in a row, Spain is enjoying the longest period of sustained growth above the euro area since the late sixties. This period is also characterised by a combination of persistently low real interest rates and a dynamic demography, which has been feeding unprecedented growth in asset markets. In parallel, total-tax receipts have grown by about 4¼ percentage points of GDP, thus recording an elasticity with respect to GDP of 1.2. This paper discusses and assesses the extent to which the increase in tax receipts can be associated to changes in the composition of GDP, which would fade out after the current expansion tapers off. Econometric analyses provide evidence that 50 to 75 percent of the increase in tax revenues, observed in Spain between 1995 and 2006, might be of a transitory nature and would disappear with the asset boom. On this basis, in a context of significant composition effects, using standard tax elasticities may lead to an overestimation of structural revenues and to an incorrect assessment of the fiscal stance. This may be relevant in EMU because the likelihood of occurrence of asset booms may be relatively high when the monetary-policy stance is far from consistent with the country's inflation. Furthermore, in the specific case of Spain, the size of transitory composition effects associated to the current asset boom highlights the interest for the policymakers of the country to carefully assess the implementation of unfunded tax cuts and/or expenditure increases, especially those more difficult to revert in bad times.

(*) We thank P. Claeys, R. de Frutos, V. Gaspar, J. Gonzalez-Minguez, J. Kröger, M. Mamatzakis, R. Morris, R. Ramos, J. Surinach, P. van den Nord and participants at the ECFIN seminar on Tax Elasticities for useful comments, and M. Watson for stimulating discussions. This work has been developed within the framework of the Working Group C of the Euro Area Project 2, benefiting from discussions with A. Deruennes, M. Larch, and A Turrini. The views expressed here do not necessarily represent those of the European Commission. The authors can be contacted at:
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1. Introduction

Since the mid-1990s, Spain has been growing at an average rate of 3¾% per year. Although this is not the highest growth rate attained in past expansions, it is the longest period of sustained growth above the euro area since the late sixties. Such an exceptionally long expansionary period of the Spanish economy appears to be led by a succession of credit-led impulses, demographic shocks and adjustment processes. Among them, and as in some other Member States, nominal interest rates converged rapidly toward the levels of core countries, such as Germany, France or the Netherlands, on the back of the macroeconomic-stability policy framework put in place by Spain in order to ensure euro adoption. More over, already since the beginning of the 1990s, the inflation rate (CPI) fell by 5¾ percentage points and reached 2% in 1998. In parallel, real interest rates fell by 570 basis points. Since 1999, with the monetary policy already in the hands of the ECB, real interest rates kept on falling until 2005, albeit at a much slower pace than in the pre-EMU period. The fall of risk premia, together with other factors, including the liberalisation of credit markets and a large demographic shock, significantly raised the economy's indebtedness and stimulated an asset boom, in terms of both activity and prices, without precedent in the Spanish history. It induced a significant change in the composition of the GDP towards investment in dwellings, whereas, on the back of extraordinarily high unusual incomes associated to the asset boom, corporate profits soared.

Within this context of high growth, strong domestic demand and the asset boom, the total tax burden (direct and indirect taxes plus social security contributions) rose from 32½% of GDP in 1995 to about 37% in 2006. This increase in tax revenues, together with a significant reduction in expenditures is behind the improvement of 8 percentage points of GDP in the Spanish budget balance, from a deficit of 6½% in 1995, to a surplus above 1½% in 2006. As measured by the ratio of total expenditures in GDP, the size of the public sector fell from 44% in 1995 to 39% in 2006. Interestingly, the increase in the tax burden has taken place in spite of the direct tax reforms of 1999 and 2003, which aimed at reducing the tax burden on personal incomes. Although this period has also seen discretionary increases in some indirect taxes, especially excise duties, these are not large enough as to compensate for the reduction in revenues associated to direct tax cuts. As a result, the annual average elasticity of total tax revenues with respect to GDP has been of 1.2. However, given the high weight of proportional taxes in the Spanish tax system, the tax elasticity over such a relatively long period should have hovered around 1 in the absence of tax reforms, or even below 1 if tax-reducing reforms were taken into account.

The purpose of this paper is to assess the extent to which the tax-revenue increase recorded in Spain during the last decade can be associated to changes in the composition of GDP rather than to permanent factors, which would remain after the current asset boom tapers off. While the models applied here are mainly based on specifications of tax revenues, the paper also follows an alternative route by directly modelling the annually recorded tax elasticities. Composition effects are expressed here in terms of the relative weight of those tax bases more directly linked to the asset boom, namely the market value of new dwellings and corporate profits. This approach diverges from other contributions, such as Morris and Schuknecht (2007), where composition effects are represented in terms of asset prices.

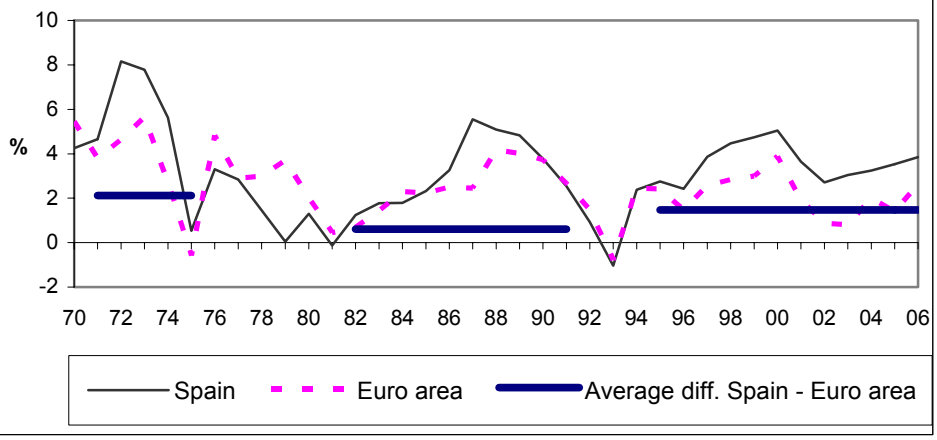
The structure of the paper is as follows. Section 2 reviews the main characteristics of the current expansionary phase of the Spanish economy, paying particular attention to developments in broad tax revenues and bases. Section 3 reviews developments in main

categories of government receipts and its components over the last four decades. This section also carries out a first discussion of the relative importance of discretionary and composition effects in the current expansion. Section 4 associates different categories of tax revenues with their corresponding tax bases to obtain estimates of short-run tax elasticities. The section also reports econometric results from models aiming at explaining the observed series of tax elasticities over the period of reference. Such econometric models of tax revenues and elasticities are used to assess net composition effects. Section 5 concludes.

2. Growth, asset booms, government receipts and tax bases

Compared with the euro area[1], the annual average growth rate of 3¾% recorded by the Spanish economy since 1995 represents an average growth differential of 1½% per year (Graph 1). The GDP deflator has been growing at 3¾% per year, which contrasts with just below 2% in the euro area.

Graph 1.- Real GDP growth in Spain and in the Euro Area



Source: AMECO

Although it would not be the first time that the Spanish economy is growing by more than the euro area, this is the longest period of high and sustained growth since the early 1970s[2]. During the first half of the seventies, the growth differential attained 2 percentage points of GDP because, by subsidizing energy prices in the domestic market, the Spanish economy did not endure immediately the first oil shock. However, economic growth was abruptly interrupted between the mid-1970s and the early 1980s. This was the toll the country paid for implementing inadequate economic policies, which wrongly aimed at stabilising output in front of supply shocks. Since then, and for 9 years in a row, until 1991, Spain grew on average by 0.5 percentage points above the euro area.

[1] Excluding Slovenia.

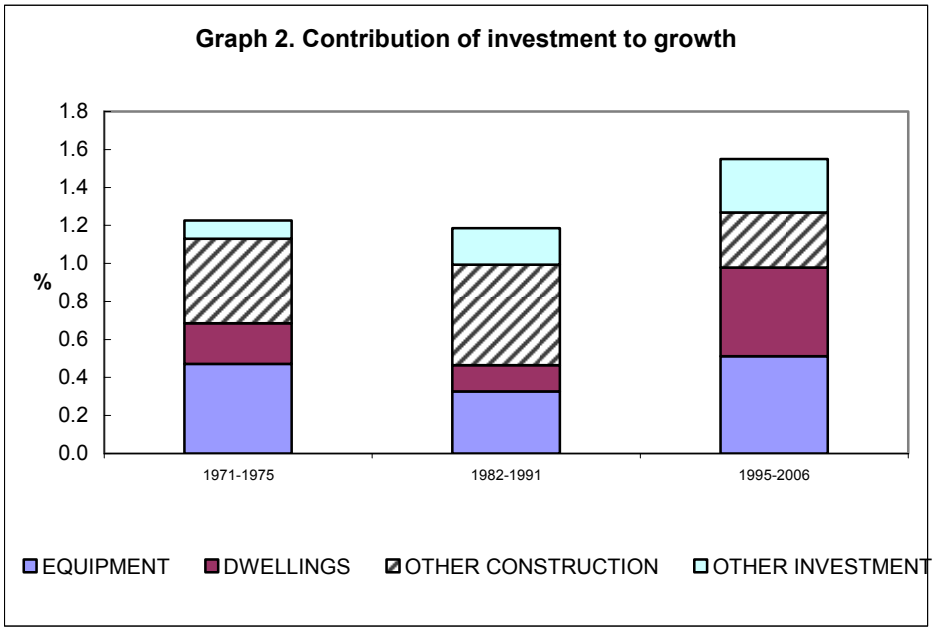
[2] For a more detailed analysis of the Spanish economy in EMU, see Ayuso et al (2005).

The period between the early eighties and the early nineties, which includes two major recessions, coincided with the accession to the EU and with a steady increase of the size of the public sector, especially on the back of strongly rising social protection expenditures. As a result, in terms of total expenditures, the size of the public sector rose from 20% of GDP in the early 1970s to 45% in the aftermath of the crisis of the 1990s. By 2006, total expenditures had fallen to 39% of GDP.

2.1. Growth composition in an asset-boom context, 1995-2006

The current economic expansion of the Spanish economy displays two distinctive features, namely a relatively larger contribution of investment and a higher negative contribution of net exports. The expansion of economic activity between 1995 and 2006 has been driven by domestic demand, with net exports detracting ¾ of a percentage point to GDP growth on average each year[3]. In contrast, the euro area has recorded a positive contribution of both domestic and foreign demand, although economic growth has been overall deceiving. Private consumption has been growing in real terms in line with GDP, while real investment is rising at an average rate of 6¼% per year. As a result, private consumption and investment are contributing to growth with about 2 and 1½ percentage points, respectively.

Graph 2. Contribution of investment to growth



Source: AMECO and own calculations

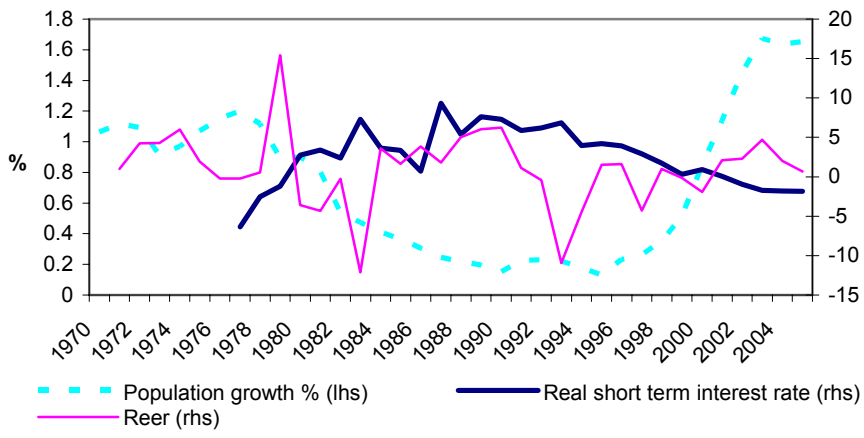
The larger contribution of investment to GDP in the current expansion is mainly explained by the extraordinary dynamism recorded by housing investment, while other construction seems to have played a rather modest role in comparison with the economic booms of the seventies and the eighties (Graph 2). Equipment and other investment increased by 7¼% per year in real terms, which compares with the rates of 4% and 8% recorded by infrastructure construction and housing respectively.

[3] Unless otherwise stated, all the figures mention in this paper have been taken from or calculated on the basis of the European Commission's AMECO dataset.

Concomitantly, investment in equipment and dwellings contributed with half of a percentage point to GDP each, while the remaining half point is equally shared by construction other than housing and other investment. Interestingly, private consumption and housing investment, which, as discussed below, represent the bulk of total households' expenditures, account for about 60% of GDP growth.

On the external sector, while imports have been growing at an annual average rate of 9½% in real terms, exports have increased at a rate of 6¾%. This, together with a progressively increasing deficit of the balances of primary incomes and current transfers, led to a significant widening of the current account deficit, which attained 8½% of GDP in 2006. This is the largest external deficit recorded since 1970. Indeed, the current account deficit mirrors the widening gap between investment and savings, which has shifted from an almost balanced position in 1995 to over 8% of GDP in 2006[4].

Graph 3. Interest rates, exchange rates and demography



Source: AMECO

In parallel, the Spanish economy is recording a steady appreciation of the real effective exchange rate. This results from persistent and positive inflation and wage differentials with the euro area, combined with an also persistent but negative productivity differential. On the back of not only a strong domestic demand but also a number of structural factors, especially rigidities in some utilities and services markets, the inflation differential of the Spanish economy vis-à-vis the euro area has amounted to 1.1 percentage points per year since the mid-1995s[5]. In line with this inflation differential, the wage inflation differential attains 0.8 pp per year, while productivity has been growing below that of the euro area by 0.8% per year. This is the result of a relative specialisation of the Spanish economy in low-to-medium technology sectors, which is in turn behind a deceiving productivity growth in tradeables, as well as a very low productivity growth in non-tradeables, mainly reflecting a high weight of construction

[4] For more detailed analyses of the Spanish external accounts see Cabrero and Yaniz (2006) and Cabrero, Maza and Yaniz (2007).

[5] For a more detailed discussion of the causes of inflation in Spain, see Ayuso, de Castro and Gomez (2004)

and tourism activities. In terms of nominal unit labour costs vis-à-vis the euro area, the Spanish real exchange rate has appreciated by more than 10% since 1995 (Graph 3).

In the absence of the exchange-rate instrument, the steady appreciation of the real effective exchange rate is one of the factors explaining the negative contribution of net exports to growth and, therefore, the large current account deficit. Everything else equal, a sustained negative contribution of net exports to growth over such a long period should have put significant downward pressures on economic activity. However, in the Spanish case, a number of EMU-specific and idiosyncratic impulses and shocks are offsetting the effects of the competitiveness channel.

Already since the first half of the nineties, a large fall in the risk premia, coupled with easier access to credit within a framework of a substantial financial market liberalisation, lowered the households' savings ratio and, thus, accelerated private consumption and housing spending. As in some other Member States, which would include Greece, Italy, Ireland or Portugal, nominal interest rates in Spain converged rapidly to those in core countries (Germany, France, the Netherlands or Belgium, among others). Since the early 1990s, and on the back of the macroeconomic-stability policy framework put in place by the Spanish authorities in order to ensure euro adoption, the inflation rate (CPI) fell by 5¾ percentage points and reached 2% in 1998. However, since the inflation differential with the euro area remained positive over most of the period, in real terms interest rates went below those prevailing in core countries. During the 2000s, with monetary policy already in the hands of the ECB, the inflation differential actually widened and real interest rates kept on falling until 2005, albeit at a much slower pace than in the pre-EMU period. Indeed, in terms of monetary conditions, this persistently low level of real interest rates has been compensated by the cumulative appreciation of the real exchange rate.

During this period of sustained reduction of real interest rates and easier credit conditions, the Spanish economy recorded a strong and steady acceleration of growth, only interrupted by the crisis of 2001, which was short lived in Spain. As mentioned above, higher growth came hand in hand with a sharp increase in household expenditures, large current account deficits and real exchange rate appreciation. Specifically, the total debt of the Spanish economy against the rest of the world jumped from 70% of GDP in 1995 to almost 200% in 2006, while the households' indebtedness ratio rose from 40 to 80% of GDP. Interestingly, this took place in a context of decreasing public debt in terms of GDP.

At first sight, this would look like the typical profile of economic adjustment to a credit impulse predicted by intertemporal models, such as those discussed by Fagan and Gaspar (2007), which foresee a strong and positive reaction of output followed by a pretty slow adjustment process towards the initial equilibrium. In intertemporal models, slow adjustment can be explained through external habit formation[6]. However, in the Spanish case, this adjustment process was not yet visible in the first half of 2007, while, albeit in a context of low real interest rates, the credit impulse started to fade out in the first half of the 2000s. This would suggest that other factors, such as demographic developments, might be providing and additional impulse to the economy. Since the early 2000s, a strong migration-led population shock is keeping domestic demand growing at high rates.

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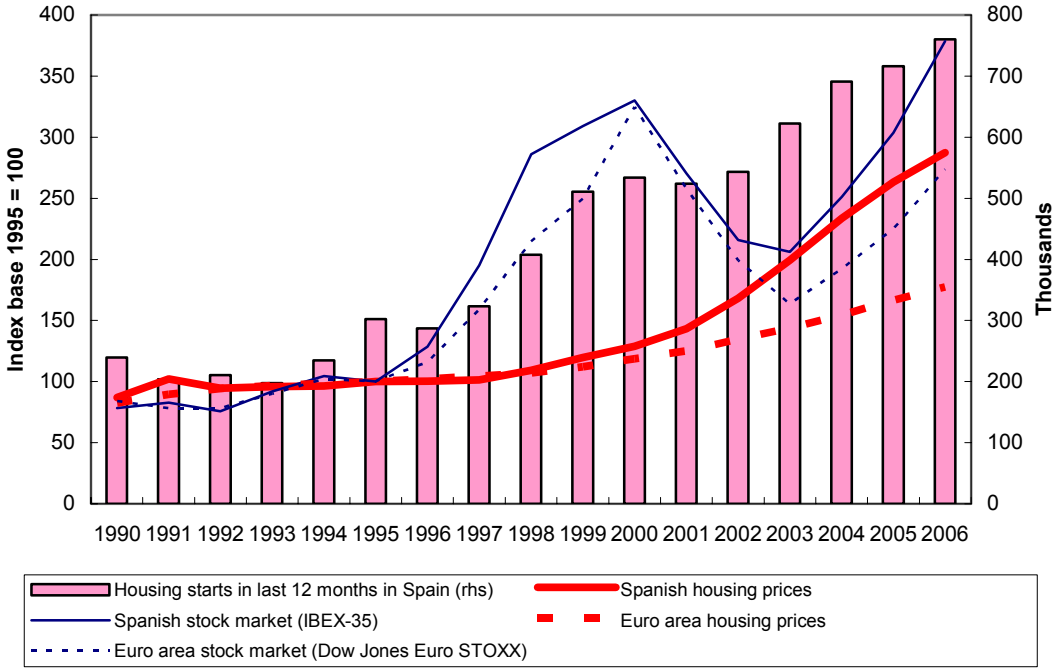
[6] According to this hypothesis, individual consumption also depends on the average consumption in the economy as a whole.

Specifically, the Spanish population has grown by more than 3 million people in the last five years, representing half of total migrant inflows to the euro area (Graph 3)[7].

Graph 4. Asset market indicators



Source: AMECO, Bolsa de Madrid, Banco de España and own calculations

This combination of low real interest rates and dynamic demography fed asset markets, as reflected by developments in housing and equity prices. Where the housing market is concerned, a property worth of 100 in 1995 would have been sold at almost 300 in 2006[8]. The bulk of this increase reflects developments in the price of land. Interestingly, this sharp increase in prices has come hand in hand with an unprecedented increase in the number of new dwellings built each year. While the number of new residences had hovered around one quarter of a million between the mid-1970s and the mid-1990s, the figure had raised to three quarters of a million by 2006. Equity markets have also boomed in Spain during the last decade. Using the index of the Spanish stock exchange market (IBEX 35), which was around 3,500 points in 1995, the cumulated increase until 2006, when it closed at above 12,000 points[9], would have been of about 380%[10]. When compared with their counterparts in the biggest euro area countries, these figures provide evidence of the magnitude of the asset boom in Spain.

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[7] For a more detailed analysis of the adjustment process of Spain in EMU, see chapter VII of European Commission (2006).

[8] See Yaniz (2005) for a more detailed discussion about the Spanish housing market (see also box 1 on data sources).

[9] At the beginning of the summer 2007, the index was above 14,000.

[10] See www.bolsamadrid.es.

For instance, a property worth of 100 in 1995 would have been sold in 2006 at about 90, 220 and 180 in Germany, France and Italy, respectively, while taken together the number of residences built in these countries is lower than those built in Spain. Where equity markets are concerned, the representative stock exchange market indices grew by 280% in Germany (DAX 30) and France (CAC 40), and by 260% in Italy (MIB 30), thus well below the increase recorded in Spain. However, as measured by the same indicators, the asset boom is being more intense in Ireland, where housing prices grew by 500% between 1995 and 2006, and the number of new dwellings was multiplied by a factor of three[11]. Moreover, at 400%, the Irish ISEQ index grew slightly above the IBEX 35.

2.2. A tax-rich growth model

Between 1995 and 2006, total taxes have been growing at 8½% per year in nominal terms, which compares with the 7½% recorded by the nominal GDP (Table 1). As a result, the tax burden has increased by more than 4 percentage points of GDP (from about 32½ % in 1995 to around 37% 2006; see graph 5)[12]. In contrast, the tax burden has remained broadly unchanged in the euro area at around 40%. While, in the mid-1990s, the Spanish tax burden was 8 percentage points of GDP lower than that of the euro area, ten years later the gap has bottomed out at only 4 percentage points.

Table 1. Total tax receipts, 1970-2006

	1970-2006	1971-1975	1982-1991	1995-2006
Revenues(1)	14.5	20.9	15.4	8.6
GDP(1)	12.1	17.9	12.2	7.4
Tax Burden(2)	29.4	19.4	30.2	34.7
Elasticity(3)	1.2	1.2	1.3	1.2

(1) Average annual nominal growth rate in %
(2) Ratio of nominal tax revenues to nominal GDP in %
(3) Annual average elasticity of nominal tax revenues with respect to the nominal GDP
Source: AMECO and own calculations

Although developments in tax revenues over the last ten years, and especially in the most recent past, may appear striking, they might not be so when taking a longer-term perspective. The average of the annually recorded elasticity of total tax revenues with respect to the GDP during the last decade (1¼) does not differ significantly from the average recorded over the last 35 years and other sub-periods[13]. However, there is a difference between the last ten years and the seventies and eighties. While, leaving aside the cuts in direct taxes, the most recent past is characterised by no significant changes in tax codes, the rapid increase recorded by the tax burden, especially between the mid-1970s and the late eighties, is closely linked to the modernization of the Spanish fiscal system. This process mainly concerned the reform of direct taxes in 1977, which raised

[11] However, the size of the market is indeed much lower. The number of new dwellings built in Ireland in 2006 remained below 100,000 units.

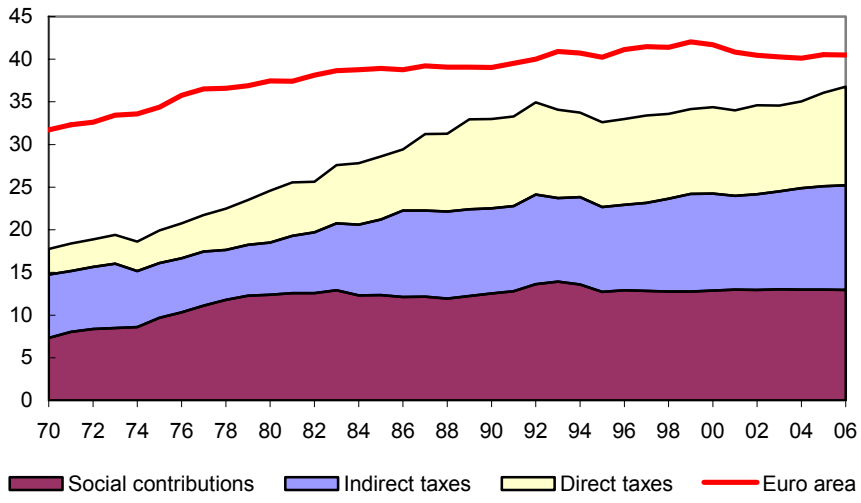
[12] Interestingly, the trend has no ceased to accelerate over the reference period. For instance, in 2006, total tax revenues grew at around 11% in nominal terms, while nominal GDP growth was just below 8%.

[13] However, witness of the current acceleration in tax revenues, the observed tax elasticity in 2006 was close to 1½ and the tax burden grew by almost one percentage point of GDP.

substantially direct tax rates and revenues, as well as the introduction of the VAT in 1986 coinciding with the accession of Spain to the EU, which implied a substantial increase in indirect tax rates and revenues as well.

The successive reforms of direct and indirect taxation drastically changed the tax mix of public receipts (Graph 5). While direct tax revenues accounted for 17% of total tax receipts in 1970, the share had risen to around 30% (10% of GDP) in the middle of the 1990s. On the back of the introduction of the VAT, the share of indirect tax revenues rose over the eighties from 25% to 30%. Although following a long swing, which pushed their share in total tax receipts up to 50% in the early 1980s, social contributions actually remained around 40% of the total tax burden between the early seventies and the mid-1990s. However, in terms of GDP, social contributions jumped from 7% of GDP in 1970 to about 13% in 1995.

Graph 5. Total tax burden by taxes category, 1970-2006
(in % of GDP)



Source: AMECO

The last ten years have brought about further changes in the composition of tax revenues, some of which, such as the fall in the relative weight of social contributions, seem to be a continuation of trends already observed since the early 1980s. Specifically, the share of social contributions in total taxes has declined by around 5 percentage points to attain 35% in 2006. More than half of it went to indirect taxes, whose share in total government receipts rose from about 30% in 1995 to close to 33% in 2006. In spite of two reforms that reduced significantly the statutory tax rates of the personal income tax, the share of direct taxes rose by about 2 percentage points.

2.3. Estimating tax bases in an asset-boom context

The composition of growth in Spain has induced significant changes in the relative weights of the GDP components. Unsurprisingly, investment recorded a dramatic change over the last decade. The share of total investment in GDP rose from 21½% in 1995 to about 30% in 2006. Half of this increase is accounted for by housing (from 4½%

of GDP to 9¼%). In contrast, following a decreasing long-run path, the weight of private consumption in GDP marginally fell to about 60% in 2006.

On the external front, the almost secular negative share of net exports attained historical levels. After representing about 1% of GDP in the mid-1990s, the balance of the external sector quickly entered red territory and amounted to about -6% of GDP in 2006.

Although useful to analyse the drivers of growth from the demand side, the economic breakdown of GDP into domestic and external sectors, and, within the former, into private and public consumption and investment, may not be the best way to identify developments in the tax bases, which in the absence of tax reforms, largely determine government receipts. For example, although private consumption represents the bulk of the indirect tax base, it does not reflect household spending on housing, which, as discussed above, has recorded unprecedented growth rates, not only in terms of real or nominal gross value added, but also, and especially, given housing price growth, in terms of the market value of dwelling transactions. Yet, transactions of new dwellings are subject to VAT, and those of second-hand residences pay some indirect taxes (other than VAT). Analogously, nominal GDP growth may be a poor proxy of the growth of corporate incomes, while, as shown below, extraordinary profits, which are not included in the GDP accounting but are part of taxable profits, may increase significantly in asset booms. In sum, to better understand developments in tax revenues one needs to determine the implications of growth trends in terms of labour costs, personal and corporate incomes, and final purchases subject to indirect taxes.

Consistent with sustained economic activity, and underpinned by increasing female participation and immigration, employment has been rising by an annual average rate of above 3% (full-time equivalent) since the mid-1990s. This would correspond to 5.5 million new jobs, or almost 40% of the total employment created in the euro area. Overall, total wage costs, the proxy to labour income, rose at 6¾% in nominal terms, while the labour share (including the imputed wages of the self-employed) measured by the ratio of labour costs to GDP, declined from 60½% in 1995 to 54¼% in 2006 (Graph 6, panel A)[14]. Labour costs are the typical proxy to the tax base of social security contributions, which are levied on gross wages.

Labour costs are also the main driver of household income. This is why some authors (see, among others, Morris and Schuknecht, 2007) use labour costs as the proxy to households' income, which, in turn, would be the base of the personal-income tax. However, a likely better proxy of household income is straightforwardly available. Specifically, households receive income from their work, from their properties (net capital income) and from the public sector in the form of transfers. The household labour income comes net of social contributions, while the household capital income includes distributed corporate profits net of corporate taxes. Households pay direct taxes on their income and wealth, although the latter represent a marginal contribution to the Spanish government receipts. On this basis, a proxy to the household income can be obtained from gross disposable income after adding direct taxes paid by households. Between 1995 and 2006, mainly on the back of the above-mentioned fall in the labour share, household income declined from about 58% of GDP in the mid-1990s to 56% in the mid-2000s (Graph 6, panel A).

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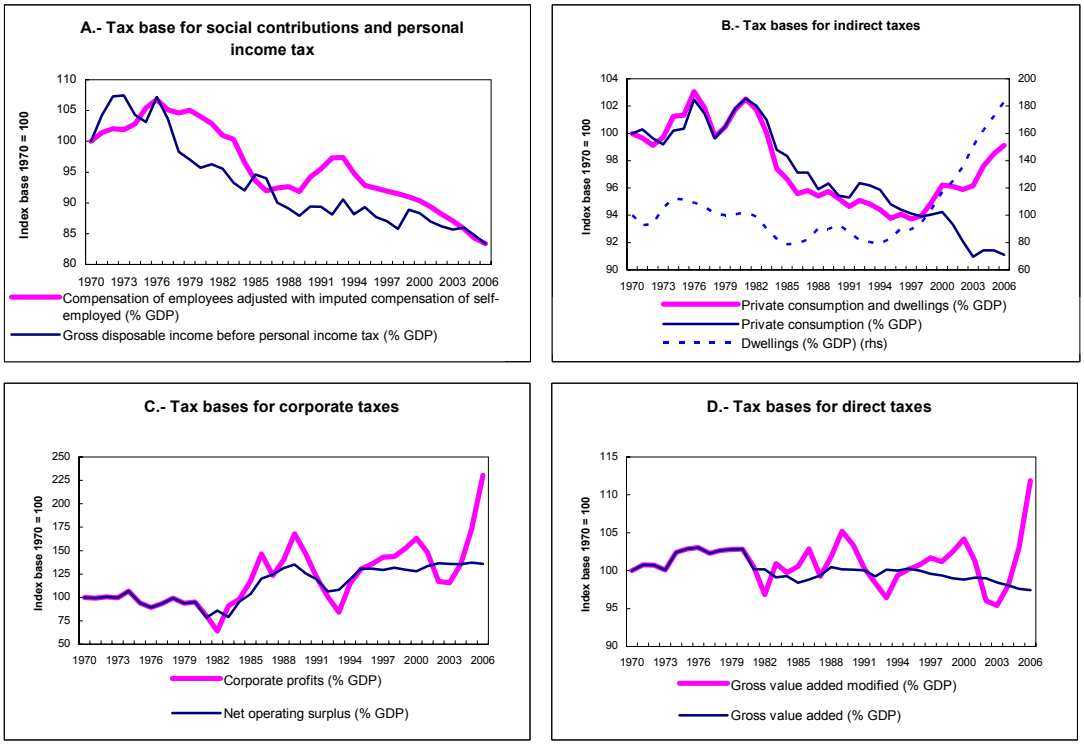
[14] Note that GDP shares in graph 6 have been re-scaled by making the figure recorded in 1970 equal to 100. This allows for a quick visual comparison of developments of alternative proxies of the tax bases.

Graph 6. Broad tax bases



Source: AMECO and own calculations

Usually, the indirect tax base is approximated by private consumption[15], although transactions in the housing market, which does not enter private consumption, are also subject to VAT (new dwellings) and other indirect taxes (second-hand transactions). If no significant changes in the relative size of housing spending were recorded, developments in private consumption would adequately capture developments in the total indirect tax base. However, this does not seem to be case of Spain, since, as we have seen, the relative importance of the housing sector in the country has changed dramatically (Graph 6, panel B). Housing investment has not only become a significant contributor to growth (Graph 2), but, witnesses of the asset boom, housing prices have rocketed and the number of new houses traded in the market multiplied by a factor of three. Against this background of fast-growing value of dwelling transactions, private consumption may not be the best proxy to analyse the dynamics of the total indirect tax base. In order to better approximate this tax base, we have added to private consumption the estimated market value of new dwellings, which is calculated taking into account the number of dwellings built each year, their average surface in square meters and the average price of the square meter (see box 1)[16]. In contrast with private consumption, the

[15] In some countries, intermediate public consumption may be subject to indirect taxes, in which case it would also be added to the indirect tax base.

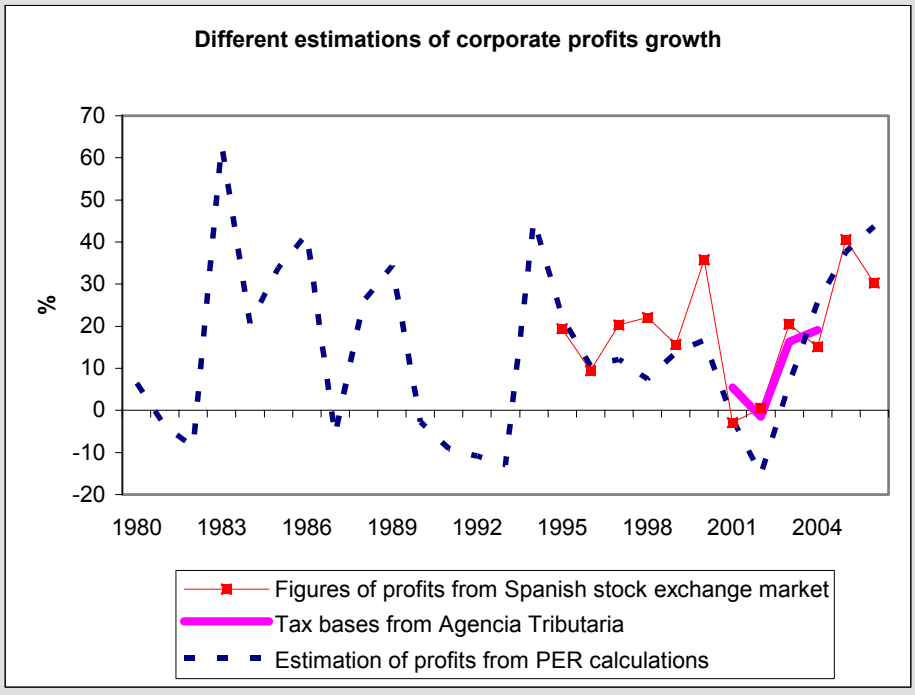
[16] In representing the total value of housing transactions by just transactions in new houses, we assume that the secondary market broadly evolves in parallel with the primary, which seems an overall reasonable hypothesis that reduces information costs while seems supported by the econometric results in section 4.

share of this indirect tax base in GDP has increased by about 3 percentage points since the mid-nineties.

Box 1. Estimating housing spending and taxable profits

In order to obtain a proxy of the market value of new dwellings, which is added to the typical measure of private consumption to obtain the indirect tax base, we multiply the number of new dwellings built up each year by the average price per square meter and by 90 square meters as the average dwelling surface. The number of new dwellings built per year is available at the Ministry of Public Works (Ministerio of Fomento; www.fomento.es), while the average price per square meter can be found at the Ministry for Housing (Ministerio de la Vivienda; www.mviv.es). Finally, the average size of 90 square meters of the residences has been estimated from the housing census available at Spanish National Statistical Institute (www.ine.es). This information is also available at Banco de España (www.bde.es). In terms of GDP, the market value of new dwellings hovered around 5-6% between the mid-1970s and the mid-1990s. In 1995, at 5% of GDP, the share was close to its historical low (4.8% of GDP in 1994), but it quickly grew to reach 7% in 2000, above the maximum of 1974 attained until then. The share had reached more than 11% of GDP by 2006.

A proxy to taxable profits can be obtained from the ratio of the value of the shares (the value of the firm) in the stock exchange to profits (the so-called price-earning-ratio (PER)). The sample covers all the quoted corporations in the Madrid Stock Exchange (MSE). The series is available since 1980 in several, but comparable sources: Fernandez (2002) for 1980-1988, MSE (Bolsa de Madrid; www.bolsamadrid.es) for 1989 and 1990 and Banco de España (www.bde.es) for 1991-2006.



that p The index for corporate profits is obtained by dividing the stock exchange index by the PER, which leads to a series of corporate profit growth rates directly comparable with alternative measures of taxable profit growth (see graph below). The series of corporate profit growth so obtained compares quite well with the series of the growth rate of declared profits of a sample of around 150 companies quoted in the Spanish stock exchange market (www.bolsamadrid.es) over the period 1995-2006. Albeit shorter, additional comparable figures are directly available in the website of the Spanish fiscal administration (Agencia Tributaria at www.aeat.es) on actually

declared corporate tax bases between 2000 and 2004. As shown in the graph, this information provides evidence rofit growth rates obtained on the basis of PER series are a good proxy to the nominal growth of the actual tax base.

The advantage of the latter source is that the Spanish fiscal administration also publishes the series in levels, which can be used as a benchmark in the process of transforming profit growth from PER series to nominal profit levels. Assuming that the series of the net operating surplus and based-PER profits were comparable in 1980, we have estimated the series in levels and verified that the estimated series and figures provided by the tax administration over 2000-2004 were reasonably close. Compared with the market value of new dwellings, PER-based corporate profits have exhibited a much sharper cyclical profile. In terms of GDP, profits had attained a low of 9% of GDP in the aftermath of the 1981 crisis, and then they quickly grew beyond 20% in the late eighties. By 1993, the share had gone down to 12%, but in very few years it attained again the level of 20% of GDP. Nowadays, PER-based profits are recording historical heights at above 30%. As discussed in this section, soaring corporate tax revenues are witnesses of the current boom in corporate profits.

The typical base for corporate taxes, which, together with personal income taxes, make up for direct taxes, is the net operating surplus. Accordingly, the tax base for total direct taxes would be the sum of household income and the net operating surplus, which is usually approximated by the gross value added or, equivalently, by the GDP[17]. The net operating surplus grew by 8½% per year in nominal terms, thus slightly above nominal GDP growth. As a result, its share in gross value added, increased from below 18% of GDP in 1995 to about 19 % in 2006. However, although it seems to capture part of the surge in profits of the last decade, the net operating surplus may not be the most adequate base for taxable profits, especially in the context of an asset boom. The net operating surplus calculated in accordance with ESA95 rules may diverge from taxable corporate profits for at least four reasons. *First*, extraordinary profits stemming from, among others, changes in asset prices are not included in the net operating surplus, since certain financial operations cancel out when calculating the GVA. However, such extraordinary or unusual incomes may represent a non-negligible part of taxable profits at the firm level, especially during asset booms. *Second*, while the net operating surplus is the difference between profits and losses, corporate tax bases only include profits. *Third*, taxable profits and net operating surpluses may diverge because of the way depreciations are calculated. For ESA95 purposes depreciation is largely calculated on the basis of a number of standard criteria, relatively stable over time, but the rules to calculate depreciation for tax purposes may change significantly from one year to another. *Finally*, tax legislation allows losses to be carried-over the next fiscal period, while the operating surplus only takes account of aggregate profits in the reference year. Many firms would not pay corporate taxes during recessions, whereas it would be possible to deduct past losses from the tax base in subsequent years, which would significantly lower current profits for fiscal purposes in the reference year.

Box 1 discusses a way to overcome such shortcomings of the net operating surplus in a context of high unusual profits associated to the asset boom. The proposal of this paper is based on publicly available series of the ratio of the price of corporate shares of quoted enterprises in the Spanish stock exchange to profits (price-earning ratio; PER). The result

[17] *Strictu sensu*, one should use the gross value added (GVA) or the GDP net of depreciation. However, since depreciation has remained broadly stable in terms of GDP, using the net or the gross or net measures of the tax base does not make much of a difference in comparisons over time.

is displayed in panel C of graph 6. While corporate profits and the operating surplus follow a similar path in the long run, for shorter periods corporate profits exhibit a more pronounced pro-cyclical behaviour. Overall, profits should increase faster in expansions, while receding during slowdowns. In addition, as mentioned before, unusual profits seem paramount to understand developments in corporate profits during an asset boom. Extraordinary incomes stemming from non-core business activities related to the favourable evolution of asset prices, which encompasses, not only shares, but also real estate prices, would largely explain a rapid, likely transitory increase of profits and, concomitantly, as shown below, corporate tax revenues. This profile seems to correspond to PER-based corporate profits rather than to that followed by the net operating surplus.

Finally, panel D of graph 6 compares developments in the typical measure of the total direct-tax base, namely the gross value added, and the same series after substituting the operating surplus by our measure of PER-based corporate profits.

3. Disentangling composition effects on tax revenues

The combination of a steady appreciation of the real effective exchange rate, the reduction of the risk premia and the increase in population is supportive of a demand-based growth model, highly rich in taxes. In effect, while exports, which have low tax content, are not growing as fast as the whole economy, private consumption and the boom in the housing market are pushing indirect taxes up. Moreover, the economic boom is raising unusual profits, especially those linked to real state and financial operations, and consequently revenues from corporate taxes.

Against this background, the rest of the chapter will analyse the main drivers behind the recorded developments in tax receipts, as discussed in section 2.2, broken-down in the three main tax categories (social contributions, indirect and direct taxes) and, as much as possible, in some relevant sub-categories. Our purpose is to determine the extent to which developments in particular tax revenues are explained by changes in the relative weight of the tax base in the GDP (composition effects), by discretionary measures (discretionary effects) or by other factors. The way such effects have been disentangled is discussed in box 2.

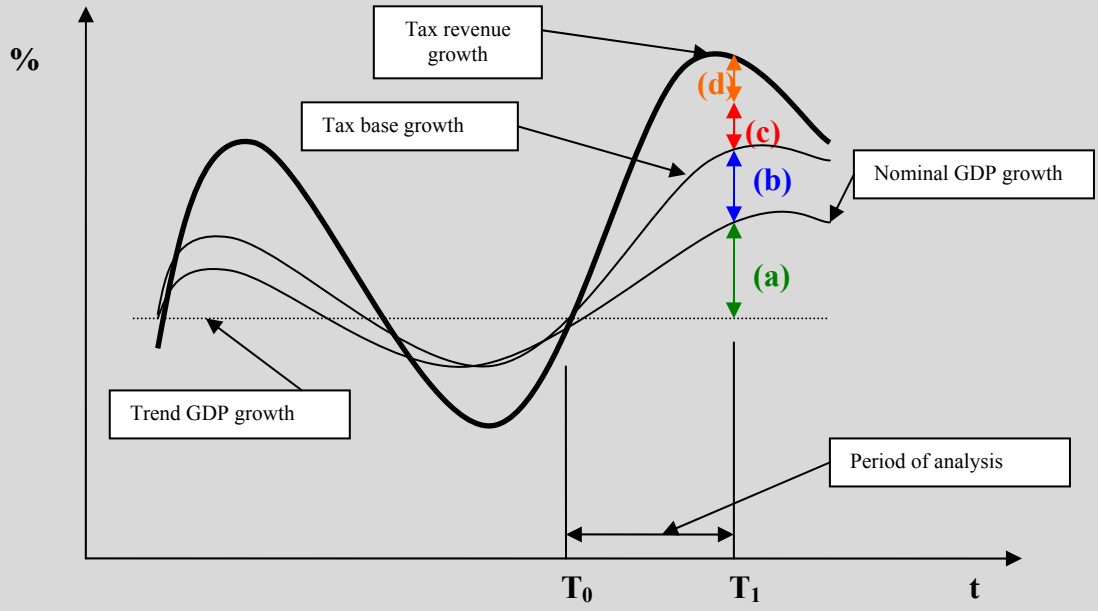
Box 2. Decomposing changes in tax revenues

If taxes were strictly proportional with respect to the tax base, and the share of the tax base in the GDP remained constant, in the absence of changes in the cyclical position, discretionary measures and other shocks to tax collection, the corresponding tax revenues would change in the same proportion as nominal GDP. Therefore, a deviation from the unit of the tax elasticity with respect to the trend GDP, or equivalently the growth differential between nominal tax revenues and nominal trend GDP, may be attributable to:

1) *Cyclical effects: Headline GDP is not growing at the same rate as trend GDP)*. Everything else equal, changes in the cyclical position would lead to an elasticity with respect to trend GDP higher (positive output gap) or lower (negative output gap) than the unit. Cyclical effects on tax revenues could be assessed through the difference between headline and trend growth. However, such effects will not be calculated here because the application of the commonly agreed methodology (see Denis, McMorrow and Roeger (2002) and (2006)), for the estimation of the potential output to Spain might lead to an overestimation of the potential output. On the other hand, alternative methodologies, such as the HP filter, lead to a relatively low differential between both growth rates, which might not be surprising given the long expansionary period of the Spanish economy of

a high and relatively stable growth rates. For instance, if trend GDP would be estimated by using the HP filter, the budgetary impact of the cycle between 1995 and 2006 would be lower than ¼% of GDP.

2) *Composition effects: The tax base is not growing at the same rate as the GDP*. In this case, there is a change in the composition of GDP. Under the strict proportionality assumption, the difference between the nominal growth rate of the base and that of GDP would provide an estimate of composition effects. As discussed below, some composition effects can show up in the residual due to failure to adequately proxy developments of the actual tax base.



(a) Cyclical effect (growth at nominal GDP)
(b) Composition effect (growth at base rate)
(c) Discretionary measures
(d) Others

3) *Discretionary measures*. Changes in the tax codes (statutory rates and/or bases) of particular taxes would lead to changes in the tax elasticity with respect to the observable tax base in the years that the reforms take place. If the reform would not affect the degree of proportionality of the tax, and in the absence of composition effects, the tax elasticity with respect to the base should return to the unit. In the opposite case, the reform would lead to a permanent change in the tax elasticity, which would increase/fall if the reform would lead to a more/less progressive system. The impact of discretionary measures can be calculated on the basis of ex ante assessments of the effects of the changes in the tax rates/bases on government receipts.

4) *Other factors*. In the absence of composition and discretionary effects, an increase in tax revenues above GDP growth may stem from:

- *Unobservable composition effects within the observable tax base*. For example, aggregated private consumption includes different categories of goods with different tax rates. Everything else equal, divergences between the growth rates of the tax base and the tax revenues might be the result of asymmetric growth rates of tax categories of consumption goods. Estimation or calculation errors of the actual tax base would lead to similar,

unobservable effects;

- *A non-proportional tax system*. A non-proportional tax system will lead to tax revenues to grow above (progressive tax) or below (regressive tax) the tax base. Although it is well known what taxes are progressive/regressive, disentangling the impact of non-proportionality is always difficult due to the complexity of tax codes. This also applies to the effects of changes over time, including effects on tax revenues associated to inflation, where it is not easy to go beyond a qualitative assessment;

- *Improvements in tax administration.* Tax revenues can grow above GDP because of changes in tax administration, and in particular, tax enforcement. Again, it is possible to know the direction of the change, but estimating its size is a rather difficult task, even more when working with broad tax categories; and

- *Others.* The effects of one-off measures, such as tax amnesties and changes in the general economic regulatory framework (viz. regularisation of immigrants), which can lead to changes in tax revenues without changing the tax base, will show up in the residual group of other factors, including pure random effects. As a rule, it will be possible to identify some of the factors behind the residual, but it would not always be possible to disentangle the various effects in terms of tax revenues.

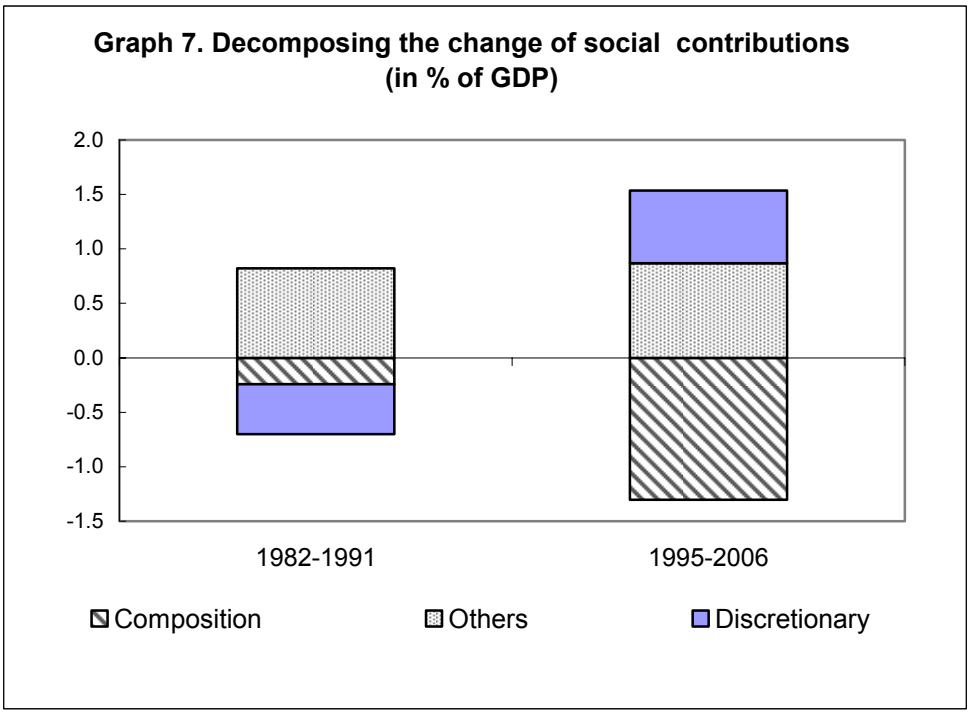
3.1. Social Contributions

Between 1995 and 2006, social contributions have been growing at an average annual rate close to nominal GDP. However, the average effective tax rate, which can be calculated as the ratio of receipts from social contributions to total labour costs[18] (Martinez-Mongay, 2003), has increased from 21% to 24%. Concomitantly, the elasticity with respect to GDP has remained close to one, while that to the base has attained 1.2 (see table A1 in the appendix). This compares with developments over the whole period 1970-2006, when the average elasticities have been 1.2 with respect to both GDP and the base. The first half of the 1970s, coincidental with a change in the legal framework aiming at raising revenues from social contributions, is the period when the elasticities of social contributions with respect to both the GDP and the base were the highest, while they were close to the unit in the eighties.

The difference between the average elasticities with respect to the GDP (1.0) and the base (1.2) over the last decade can be explained by the steady decline of the total labour share (graph 6). Following the methodology outlined in box 2, graph 7 decomposes the

[18] Within the methodological framework developed by Mendoza, Razin and Tesar (1994) the average effective tax rates are the ratios of the receipt from a given tax to its tax base, both expressed in nominal terms. Martinez-Mongay (2003), among others, defines total labour costs as social security contributions and taxes on payroll and workforce. Since in the Spanish case the latter are negligible, non-wage labour costs are identical to social contributions. The corresponding tax base, total labour costs, encompasses the total compensation of employees (the before-tax wages paid to employees), plus an estimate of the before-tax labour income of the self-employed. The latter is the opportunity costs of being self-employed, or, in other words, the wage this category of workers would have earned had they been working as employees, which can be approximated by the average wage of employees. Therefore, the total labour costs can be calculated as the total compensation of employees multiplied by the ratio of the occupied population, thus including the self-employed, to the wage and salary earners (employees).

difference between the recorded changes in social contributions since 1995 and those that would have been observed had contributions grown fully in line with GDP. For comparison purposes, the same decomposition is carried out for the period 1982-1991.



Source: AMECO and own calculations

In both the eighties and during the last decade, social contributions increased only marginally in terms of GDP (by 1/8% and 1/4% respectively). Composition effects were negative also in both periods, although, as expected, they are particularly notorious in the most recent past (1¼% of GDP). As discussed in box 3, legislative reforms lowered social contributions in the eighties (½% of GDP). However, other factors, closely related to improvements in tax administration and enforcement, coincidental with the establishment of the modern social security system, fully offset negative composition and discretionary effects. In contrast, during the nineties, the negative composition effect would have been more than compensated by the increase of contribution rates (discretionary effect close to ¾%) and by the immigrants' regularization of 2005, which would have raised social security contributions by around ¾% of GDP, and is reflected in other effects. While the national accounts include an estimate of non-declared jobs, illegal workers do not contribute to the social security funds until they are regularised. As a result, social contributions would have increased in the most recent past, while total labour costs, as calculated in national accounts, would have followed a path apparently independent of the regularisation.

Box 3: Discretionary measures on social security contributions

Until the late seventies, social contributions were calculated in function of the professional category in which the worker was included, thus contributions were largely independent of the before-tax wage. A major legislative change took place in 1979 when, in line with major industrialised countries, the actual base of social contributions became gross wages. This reform explains why the average effective non-wage labour costs rate fell from about 50% in the mid-1970s to around 35% in the early 1980s. However, the total tax burden on labour did not fall by the same proportion, since, as shown below, the reduction in social contributions was compensated by the introduction of the personal income tax (see Martinez-Mongay, 2003, for a discussion about the labour-tax wedge).

This modern structure of social contributions introduced at the end of the seventies has remained relatively stable during the last 30 years, although an important legislative change took place in the eighties. It led to a reduction of contribution revenues on the back of a cut of the average contribution rate. The reform was linked to the assumption by the central and regional governments of a large part of health-care spending, which had been managed by the social security sector until then. Since this lowered social security expenditures, social contribution rates were cut accordingly, while the other two government layers financed their additional expenditures with general taxes. This reduction of social contributions can be estimated at around ½% of GDP, based on the information released by the Spanish Minister of Labour on the evolution of the Social Security contributions rates since 1982 in the 2007 Social Security Budget (see also Gago et al., 2002). The fall in social security revenues was partially reversed in 1992 through a substantial increase of the contribution rates on unemployment benefits, which is not included in graph 7 because it did not take place in an expansionary phase of the economy.

Two relevant reforms of social contributions were introduced between 1995 and 2006. Firstly, in 1995, the general contribution rate was reduced by one percentage point. Given that social security contributions are a broadly proportional tax, that they represented around 12¾% of GDP in 1995 and that the general contribution rate passed from 29.3% to 28.3%, its impact in revenue terms would have roughly attained around ¼% of GDP. Secondly, between 1997 and 2004 contribution bases were gradually increased. Up to 1997, each professional category had different maximum contribution bases. The reform aimed at aligning and equalling by above such ceilings. All of them became equal to the highest maximum contribution base. Such a broadening of the tax base resulted in an increase of social security revenues, and, consequently, in an increase of the effective rate. An estimate of the impact of this measure can be calculated by comparing old and new maximum tax bases, and multiplying the difference by the number of employees in each category. On this basis, the reform would have gradually increased social security contributions by around ¾% of GDP between 1997 and 2004. Therefore, the net positive impact on tax revenues of these two main reforms implemented in the period 1995-2006 can be estimated at around ½% of GDP.

3.2. Indirect taxes

Indirect tax revenues, which mainly include receipts from VAT and excise duties, have been growing at a nominal average annual rate of 9½% over the last ten years, clearly above nominal GDP (Table A2). As a result, while indirect taxes represented 10% of GDP in 1995, they account today for 12¼%. The annual average elasticity of indirect taxes with respect to the GDP has been 1¼. In contrast, taking as the tax base private consumption plus the value of new dwellings at market prices (see section 2.3), the elasticity with respect to the tax base has remained around 1, as expected from a quasi-proportional tax, not subject to fundamental reforms.

The figures for the last ten years compare with the annual averages since 1970, as well as with those recorded in other selected periods. Specifically, the comparison between the 1970s and the 1980s highlights the role of the introduction of the VAT as a main driver of indirect tax revenues (see box 4). While indirect taxes represented 7% of GDP in 1982, they accounted for 10% in 1991. In fact, the bulk of this increase took place between 1982 and 1986, coinciding with the legislative measures introducing the VAT at the time of the accession of the country to the EU. Not surprisingly, the tax elasticities to GDP and to the base attained high values, 1.4 and 1.5 respectively.

Box 4: Discretionary changes in indirect taxes

The various reforms of indirect-tax codes implemented during the last 25 years can be grouped in three periods. Between 1980 and 1986, reforms were carried out to introduce the VAT in line with the Community *acquis*. The decade between 1986 and 1995 saw a series of changes in VAT rates. Finally, once the VAT system had been successfully settled and adapted where needed, most of legislative changes implemented over the last ten years concerned indirect taxes other than VAT.

During the first half of the eighties, the introduction of the VAT not only represented the substitution of a myriad of indirect taxes and excise duties but also a significant increase of the tax burden on consumption, which was multiplied by two. This represented an increase of above 3 percentage points of GDP.

The table below shows how the initial VAT system set up in the mid-1980s was reformed over the following ten years. The most relevant modification of the tax rates took place in 1993, when the maximum VAT rate (28%) was eliminated and a new extremely reduced category was created with a rate of 3-4%. This reform had a budgetary cost, since the products initially taxed at the maximum rate were included in the medium rate category, thus taxed at almost a half rate. In addition, the new lowest-rate category at 3% was filled with products that had previously been taxed at 6%. The cost of this reform of 1993, which is not reflected in graph 8, can be estimated at around ½% of GDP.

Table 1. VAT tax rate developments 1986 - 1995

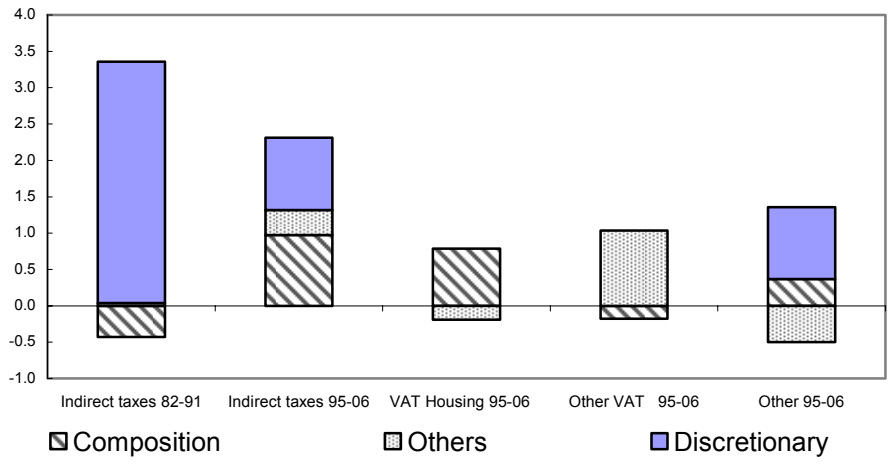
	1/01/1986	1/01/1992	1/08/1992	1/01/1993	1/01/1995
Lowest	-	-	-	3	4
Reduced	6	6	6	6	7
Medium	12	13	15	15	16
High	33	28	28	-	-

Since the mid-1990s, tax reforms have almost exclusively affected excise duties and other indirect taxes on alcohol, tobacco, hydrocarbons and cars. Main reforms can be summarized as follows: The hydrocarbons tax was raised by an average of 3.5 percentage points in 1996; in the same year, excises on alcohols rose by about 8 percentage points and those on tobacco were increased by almost 20 percentage points (black varieties) and 5 percentage points (blond brands); in 1997, taxes on lead-free petrol of 98 octanes increased by more than 8 percentage points, while excise duties on alcohols grew by an average of 8 percentage points; taxes on tobacco also recorded a substantial increase, 18 percentage points (black) and 17 percentage points (blond); in 2002, a new tax on retail sales of hydrocarbons was created and transferred to regional governments; finally, in 2005, excise duties on alcohols were increased once again by an average of 10 percentage points. The budgetary impact of such reforms can be estimated at about 1½% of GDP.

Also within the last decade, indirect tax receipts have been affected by changes in the accounting rules of the contribution to the EU from VAT budget since 1996. Before that year, such contributions were directly deducted from government receipts and not considered in the spending side. However, from 1996 the contributions are fully recorded as revenues and, then, as a transfer to the EU budget. Therefore, the impact of the change of the accounting rule has been neutral in terms of the government balance, but has increased indirect tax receipts. The effect of this change in accounting rules can be estimated at just below ½% of GDP.

The decomposition of the changes in tax revenues recorded in the eighties and during the last ten years (see graph 8) confirms that discretionary measures were predominant in the former period, which were only marginally offset by the fall in the tax base (negative composition effect). In contrast, since 1995, discretionary measures would account for just ¾% of GDP, which is half the also positive contribution of other factors (1%) and composition effects (½%) taken together.

Graph 8. Decomposing changes of indirect taxes and selected categories of indirect taxes (in % of GDP)



Source: AMECO, Agencia Tributaria and own calculations

Since indirect taxes actually include different taxes, whereas VAT is applied at different rates to different taxable consumption goods, the decomposition of indirect tax revenues in accordance with major classes of indirect taxes and the corresponding bases can shed some light on the factors driving government receipts from this tax category. In order to strike a balance between the level of detail, data availability and analytical relevance, indirect tax revenues have been decomposed in only three categories: VAT from housing transactions, other VAT, and other indirect taxes.

During the last decade, and in parallel with their increase in terms of GDP, the composition of indirect taxes recorded significant changes. Between 1995 and 2006, the relative weights of other indirect taxes and of VAT other than housing fell from 52 to 49½% and from 45% to 43½%, respectively. In contrast, housing VAT has grown by 19% per year, accounting for 7% of total indirect tax revenues in 2006 (1% of GDP), compared with less than 3% in 1995 (¼% of GDP). These developments have resulted in an average elasticity of VAT on new dwellings with respect to GDP of 2¾ (Table A3), while, as expected from a proportional tax, the elasticity with respect to the base (the estimated value of new dwellings) is close to the unit. Consequently, the bulk of the increase in revenues from VAT on housing would be explained by changes in the tax base (Graph 8).

Concerning VAT other than housing[19], the associated receipts have expanded at an annual average rate close to 10%, which has resulted in a tax elasticity to GDP of 1.2. The elasticity to the base[20] is comparable to that to GDP (1.3). This is in line with the findings of the previous section, in particular those referring to the share of private consumption in the GDP, which has remained broadly unchanged over the current period. As shown in graph 8, the bulk of the increase in non-housing VAT revenues is explained by factors others than the change in the tax base and discretionary measures; changes in the tax base would have lowered tax revenues and no significant discretionary measures have taken place. The importance of other factors would be reflecting income effects, the changes in the way the contribution to the EU budget from VAT is accounted (see box 4), and improvements in tax administration and enforcement. The cumulated effect of other factors over the last decade could be estimated at around 1% of GDP, of which almost ½% of GDP would be reflecting the changes in the accounting rules for the contribution to the EU budget. The somewhat progressive nature of the tax would account for part of the remaining half a point of GDP. Specifically, most goods with a high income elasticity are taxed at high rates, while their consumption accelerates in the expansions above the average. Finally, another part of these effects would reflect improving enforcement. Between 1995 and 2004, the number of VAT taxpayers has increased from 2.2 to 3.2 millions.

Finally, other indirect taxes encompassing mainly energy, alcohols and tobacco, as well as tax revenues stemming from the secondary housing market[21] have been growing at an annual average rate of 9%. In terms of GDP, the elasticity attained 1.2.

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[19] Revenues have been estimated by deducting to total VAT receipts the fraction corresponding to housing

[20] The chosen tax base for consumption VAT is private consumption

[21] Other indirect taxes include a heterogeneous tax group, which can be grouped in two tax categories. On the one hand, special taxes and excise duties on certain products (viz. alcohol drinks, tobacco, hydrocarbons or cars), and, on the other, taxes related to legal registration of market operations (creation, acquisition, merge or take-over of firms), including transactions of second-hand houses.

The elasticity to the base (private consumption)[22] recorded an average of 1.1. Discretionary measures consisting of tax rate hikes or even of the introduction of new taxes (see box 4), as the one related to retail sales of hydrocarbons implemented in 2002, seem to be the main factor behind the increase in tax revenues. In addition, at almost ½% of GDP composition effects seem also sizeable. Although no reliable information is available, part of this composition effects might be an effect of the housing boom. In effect, transactions of dwellings in the secondary market are not subject to VAT, but to a number of special taxes, which enter the category of other indirect taxes. Since the secondary housing market has boomed in parallel with the market of new dwellings, the receipts from other indirect taxes would have recorded a concomitant increase. Finally, the negative effect of other factors might be explained by the fact that many of the taxes in this category are excise duties independent of the price of the goods, thus displaying a regressive profile when prices rise, as is being the case of petrol derivatives.

3.3.- Direct taxes

Between 1995 and 2006, direct taxes, which mainly include personal and corporate income taxes, have been growing at an annual average rate close to 9% (Table A4). As a result, the elasticity to GDP has attained 1.2. However, when considering as the tax base the GVA modified by substituting the net operating surplus by the PER-based corporate profits, the elasticity is close to unit, which might appear relatively low when compared with previous expansions, and would look at odds with the progressive nature of a large part of direct taxes, especially personal-income taxes. However, as discussed below this could be reflecting the impact of discretionary cuts in personal-income taxes.

Until the mid-1990s, direct tax revenues grew even faster and by much more than GDP, especially during the late seventies and the eighties. This is not surprising since the first reforms of direct taxes, which gave form to the current tax codes, were carried out during the political transition to democracy. Specifically, the design and first implementation of modern direct taxes following standards comparable to those of other European countries took place in 1977[23]. Given the somewhat strong progressive nature of this tax category, the elasticity has been substantially above the unit during expansions when income and profits grow fast. This is particularly true during the eighties, when the legislative framework was further developed and tax rates increased steadily (see box 5). The average elasticity to GDP and the base attained 1.5. As a result, while direct taxes represented 6% of GDP in 1982, they accounted for 10½% in 1991.

Leaving aside the fact that the tax base includes an estimate of corporate profits, which might carry some bias[24], the relative low tax elasticity in the current expansion compared

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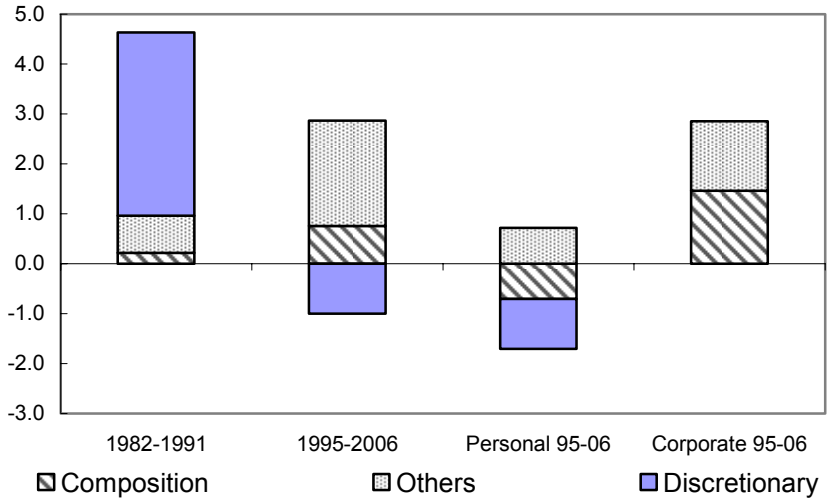
[22] Although a better proxy might be obtained by just including transactions in the secondary housing market, energy, and alcohol and tobacco consumption, the tax base for other indirect taxes (excluding VAT) is total private consumption. Unfortunately, the necessary information to build an alternative tax base is not available in a systematic way.

[23] It was the result of a general political agreement, the so-called "Pactos de la Moncloa".

[24] Since the PER-based corporate profits reflect the profits of quoted corporations in the Spanish stock exchange, it might include some more or less systematic biases when estimating the profits for the whole economy. For instance, profits of quoted firms might grow faster than profits of other firms in expansions. This could be particularly true in the case of an asset boom in which unusual, financial profits might be predominant. The largest firms might be especially well placed to carry the operations behind such unusual profits.

with whole 1970-2006 period, would reflect the effects of tax reforms. Specifically, the low elasticity would be the result of the changes in the personal income tax codes implemented in 1999 and 2003, actually aiming at cutting tax rates, with an estimated cost of about 1% of GDP (Box 5). This is displayed in graph 9, while composition effects would have added to total direct taxes around ¾% of GDP. Behind the current buoyancy of direct-tax revenues, factors others than tax reforms or composition effects are playing a crucial role. Such factors would account for 2% of GDP in additional revenues. Since tax brackets have not been regularly updated in line with inflation, the progressivity of the tax system would provide a likely partial explanation of the size of residual factors.

Graph 9. Decomposing changes of direct taxes and selected categories of direct taxes (in % of GDP)



Source: AMECO, Agencia Tributaria and own calculations

To further analysing changes in direct tax revenues, developments in their two main components, the personal income tax and the corporate tax, have been considered. Interestingly, while corporate tax revenues represented less than 20% of total direct tax revenues in 1995, the share had attained 40% in 2006. In contrast, as expected, given the tax cuts of 1999 and 2003, personal income tax revenues grew less than proportionally with GDP and saw their share in GDP to fall from 8% in 1995 to 6¾% in 2006. Table A5 in the annex summarizes the main features of personal income and corporate taxes during the last decade. Annual average tax elasticities of personal-income tax revenues with respect to GDP and to the base have remained slightly below the unit. This is actually the result of the transitory effects of the tax cuts of 1999 and 2003, which lowered the tax elasticities to 0.8 and 0.7 in those years. In contrast, the nominal increase of 17½% per year of the receipts from corporate taxes has led to an increase in terms of GDP by close to 3 percentage points of GDP. As a result, the average tax elasticity with respect to GDP is close to 2.5. This is twice the elasticity with respect to the tax base (PER-based profits).

The fall of the share of personal income tax revenues in GDP stems in part from the above-mentioned reforms of 1999 and 2003, which aimed at reducing tax rates (Graph 9), and in part from negative composition effects of about ¾% of GDP.

Such composition effects would have been fully offset by the positive impact of other factors, which likely reflect the progressivity of the tax in a context of high growth and, more recently, the impact of better enforcement and the massive regularisation of immigrants, which would have increased the number of taxpayers. The number of personal-income taxpayers rose from 13.6 millions in 1994 to 16.5 millions in 2006. It is worth noting that part of these residual effects might also be linked to the asset boom through unusual returns after, for instance, selling shares in investment funds, which would have led to a additional personal income, not recorded in the national accounts' disposable income, but still subject to the personal income tax.

Where corporate taxes are concerned, graph 9 indicates that the estimated composition effect would account for half the total increase recorded by this tax. As mentioned before, unusual profits seem paramount to understand this large composition effect. Extraordinary incomes stemming from non-core business activities related to the favourable evolution of asset prices, which encompasses, not only shares, but also real estate prices, would largely explain high profits. Overall, as with indirect taxes, the asset/housing boom would also be to a significant extent behind the buoyancy of corporate tax revenues, which emphasises further the link between buoyant tax revenues and growth composition. Composition effects in corporate taxes could be estimated at about 1½% of GDP. The remaining effects of other factors might not only reflect biases in the PER-based corporate profits, but also better tax administration and enforcement. Between 1994 and 2004, the number of firms declaring profits for corporate-tax purposes rose from 0.5 to 1.2 millions.

Box 5: Discretionary changes in direct taxes

1977 marks the year of the introduction of a full-fledged, modern personal income and corporate taxes in Spain. Although a proportional personal income tax existed before that year, it played a limited role as tax collector due to relatively low average tax rates and deficient enforcement, as indicated by a figure of actual contributors well below the potential population of taxpayers. On the back of such a first reform, complemented by successive more or less drastic amendments, and by significant improvements of tax administration, tax collection increased dramatically between 1980 and 1995, while the number of contributors rose from 6 million to 15 million between these two years. Two major reforms took place during the eighties:

- In 1987, the authorities introduced monthly withholdings for employees of small and medium sized enterprises, as well as for capital gains.
- In 1989 such monthly withholdings were increased.

There have been two major reforms of the personal income tax since the mid-nineties. The first one was adopted in 1998 and entered into effect on 1 January 1999, coincidental with the adoption of the euro. The last reform of the personal income tax law had been adopted in 1992 and was subject to criticisms on mainly two grounds: (i) too high marginal tax rates, which risked discouraging participation in the labour market, especially among females, and (ii) too high and distortionary taxation on savings. Responding to those criticisms, the 1999 reform modified both the maximum and the minimum tax rate, from 56% to 48%, and from 20% to 18%, respectively. As a result, the increase in households' disposable income was estimated at around 2.5%.

A further personal income tax reform was adopted at the end of 2002 and entered into effect in 2003. This reform can be considered as a continuation of that of 1999. Its main features refer to the number of tax brackets, which were reduced from 6 to 5. Furthermore, the maximum and minimum marginal tax rates were lowered from 48% to and 45% and from 18% to 15% respectively. Ayuso et al. (2005) provide additional information on the details of this tax reform

According to official estimates released in the analysis carried out by the Instituto de Estudios Fiscales (2001) and in the corresponding Stability Programmes, the reforms would have lowered tax revenues by around 0.6% and 0.4% of GDP in 1999 and 2003, respectively.

Concerning corporate taxes, no major reforms took place during the eighties. 1995 represented the start-up of a series of discretionary changes, with almost an annual cadence, adopted in a context of increasing international competition on the fiscal treatment of corporate income. Although the general tax rate remained untouched at 35%, new tax allowances were introduced, while existing ones were raised. They referred to deductions from the tax base of part of R&D investments, exports and direct investments abroad. Additionally, unusual or extraordinary profits enjoyed an advantageous (although complex) fiscal treatment when reinvested.

Simultaneously, tax reforms also aimed at supporting small and medium size enterprises, by introducing a more favourable tax regime with measures such as higher thresholds for accelerated depreciation than bigger firms, or a reduced tax rate of 30% for the first € 90,000 profit (updated to €120,000 in 2005). Other legislative changes aimed at broadening the tax base and thus increased corporate-tax receipts, targeting investment companies under the so-called "fiscal transparency regime". Up to 1996, profits of these companies were not subject to corporate taxes. In 1997, the authorities introduced a tax rate of 10% on such profits, which increased year after year up to 35% in 1999. As a result, the number of firms under this regime represents nowadays around 7% of total corporate taxpayers.

Concerning the impact on tax collection of this set of measures, a quantitative estimation would be difficult since it should encompass the impacts of many measures, relatively small and running in opposite directions. Overall, the aggregated impact of all these measures on corporate taxes might be broadly neutral.

3.4. Composition effects and the impact of the asset boom on tax revenues

In order to provide a first order of magnitude of the size of composition effects over the last decade, this section summarizes the main findings of the rest of the chapter. Table 2 presents the decomposition of the actual change of the tax burden and its components over the last decade into composition, discretionary and other factors. The total tax burden has increased by about 4¼ percentage points between 1995 and 2006, the bulk of which has been driven by direct and indirect taxes, while the contribution of social security contributions has been relatively marginal. As explained in box 2, cyclical effects, if any, are included in factors other than discretionary and composition.

Although the total composition effect is relatively small compared with the increase recorded in the tax burden, table 2 shows that the asset boom in Spain may have induced relative large composition effects on indirect and corporate taxes. Specifically, this composition effect might amount to 2¼% of GDP. According to the table, it would have been almost fully offset by the negative composition effects recorded by social contributions and personal income taxes, which would be reflecting the same phenomenon, namely the steady fall of labour costs in terms of GDP. On the other hand, the figure would go beyond 2½% of GDP if part of the composition effects estimated in indirect taxes other than VAT would be associated to the effect of the asset boom in the secondary housing market (see section 3.2). In addition, the asset boom might have also positively affected personal incomes, through extraordinary returns from, for instance, investment funds, which would have induced an asset-related composition effect on direct taxes, actually reflected in 'other effects' in the column for the personal income tax in table 2. Unfortunately, such asset-related composition effects in other than VAT indirect taxes and in the personal income tax cannot be quantified on the basis off available information.

Table 2. Decomposing the changes in the tax burden, 1995-2006(1)

	Total	SSC	Indirect				Direct		
			Total	VAT excluding housing	VAT housing	Others	Total	Personal income	Corporate tax
Total	4.3	0.3	2.3	0.9	0.6	0.9	1.7	-1.0	2.9
Discretionary	0.7	0.7	1.0	0.0	0.0	1.0	-1.0	-1.0	0.0
Composition	0.4	-1.3	1.0	-0.2	**0.8**	0.4	0.8	-0.7	**1.5**
Others	3.3	0.9	0.3	1.0	-0.2	-0.5	2.1	0.7	1.4

(1) In % of GDP

Data on structural tax revenues directly taken from the AMECO dataset, which have been calculated by applying standard methods to estimate the trend GDP and the tax elasticities, would estimate the structural increase of the tax burden at around 3% percentage of GDP. According to this, about 75% of the total increase in the tax burden recorded between 1995 and 2006 would be of a permanent nature. However, table 2 suggests that a large part of this apparently permanent effect might go once the asset boom fades out. The size of this part largely depends on the extent to which the negative composition effects from the fall in the labour share can be associated to the asset boom. Should this fall in the labour share be the consequence of the boom, the fall in revenues induced by its end would be relatively small (less than ½% of GDP). However, if the steady fall in the labour share would be independent of the asset boom, the part of revenues gone with a change in the growth model would be sizeable.

Graph 6, panel A, would show that the observed fall in gross wages in terms of GDP is actually a continuation of a long-run trend already present in the 1970s, thus suggesting that it could be independent of the asset boom. Moreover, such a fall would not only follow long-run trends, but it would also be common to most OECD countries.

Specifically, while the labour share[25] fell by 4¾% of GDP in Spain between 1995 and 2006, the fall represented 3.5% of GDP in the euro area. Moreover, many EU-15 Member States, as well as US and Japan, also exhibit a declining path. The figure recorded in Spain is comparable with that recorded in Germany, Ireland or Japan. Although a link between the asset boom and the decline in the labour share cannot be discarded altogether, this international evidence suggests that a significant part of the negative composition effects in social contributions and personal income taxes would be independent from the asset boom. Therefore, the net composition effect associated to the asset boom would be sizeable and would situate somewhere between 2 and 2½% of GDP. The next section presents econometric estimates of the composition effects, which take implicitly into account the long trends not only in the tax bases associated to the asset boom, but also in other GDP components.

4. Econometric estimates of tax elasticities and their determinants

This section presents an econometric analysis of the determinants of tax revenues and provides estimates of the short-run elasticities of different categories of tax revenues with respect to the corresponding tax bases. After introducing indicators of the asset boom in models for total tax revenues, the second part of this section presents estimates of the associated composition effects on government receipts. For comparison purposes, an alternative estimation of composition effects is based on an econometric specification of the annually recorded elasticities of total revenues with respect to GDP.

4.1. Estimating short-run tax elasticities from tax revenues models

The most usual approach to estimate tax elasticities is based on detailed information on tax laws and codes, as well as on the corresponding statutory tax bases, such as, for instance, income distribution, profits or consumption structure. This is the way certain international organisations (viz. OECD, ECB), have estimated short-run tax elasticities in industrial countries, including the euro area members (see, Bouthevillain et al, 2001, and Girouard and André, 2005). In order to take account of discretionary tax reforms over time, updates of such elasticities have to be calculated on a regular basis. Overall, this is a time and resource-consuming exercise, which is often beyond the analyst's capacity.

An alternative approach, more pragmatic and easier to implement, is to specify models for tax revenues in function of, among other factors, GDP and/or tax bases consistent with the particular category of taxes under analysis. Such models provide direct estimates of short-run tax elasticities of tax revenues with respect to GDP or the corresponding base. The flexibility of the econometric models allow for timely updates of tax elasticities at a relatively low cost.

In this sub-section, we specify error correction mechanism (ECM) models for total tax revenues and their three main tax categories under ESA95, namely social contributions, indirect taxes and direct taxes. Total tax revenues are specified taking nominal GDP as their tax base. Following the previous sections, two alternative bases have been considered for social contributions: total labour costs and GDP. In the case of indirect

[25] Including the imputed wages of the self-employed, as obtained from AMECO.

taxes, the number of alternative bases is three: private consumption plus the value of new dwellings, private consumption and GDP. Finally, three different tax bases have also been considered for direct taxes: the gross value-added (MGVA) modified according to PER-based corporate profits, the standard GVA and GDP. In all the cases, the sample covers the period 1975-2006, instead of the full sample period available in AMECO, 1970-2006. The reason is that, as explained in section 3, the second half of the seventies is witness of the first steps towards the implementation of a modern tax system in Spain. Therefore, the sample in the first part of this decade would not add much to the understanding of the determinants of tax revenues over the last three decades. For the same token, given the drastic reforms implemented in the Spanish tax system between the mid-seventies and the mid-eighties, the first part of sample period might not be comparable with the second part. This latter part would reflect developments in tax revenues corresponding to a mature tax system, while the profile of the first part of the sample would rather correspond to a tax system in transition. However, econometric estimates showed in tables 4 and 6 below suggest that using the whole sample 1975-2006 does not reduce significantly the explanatory power of ECMs, except perhaps for indirect taxes. In this particular case, the introduction of the VAT in the mid-eighties, together with the implementation of a myriad of scattered reforms and the continuous improvement of tax administration over the whole sample period would induce a structural break difficult to handle in our models.

The econometric analysis starts by testing the existence of a cointegration relationship between nominal tax revenues and the corresponding bases both in logarithms[26]. The relevant results of the Johansen test are presented in table 3, according to which the null of the absence of a cointegration relationship can be rejected in all the cases. For total and indirect tax revenues, the null is rejected in the presence of a deterministic trend in the cointegration equation. Overall, given the low power of cointegration tests, table 3 presents reasonable evidence on the existence of cointegration relationships between the various tax revenues and the corresponding bases here considered.

The existence of such cointegration relationships would be consistent with a specification of the changes of tax revenues as an ECM. According to it, the first difference of nominal revenues would depend on the changes in the contemporaneous and, possibly, lagged changes in the corresponding tax base, as well as on other macroeconomic variables, and on variables representing discretionary changes in the corresponding tax codes. The existence of a stable long-run relationship (cointegration) would imply that the changes in tax revenues would correct the lagged deviation from the long-run path in a non-explosive way. The models to be estimated take the form:

$$\Delta REV_t = \delta_0 + \alpha_1(REV - \alpha - \beta\, BASE - \tau\, TREND)_{t-1} + \delta_1 \Delta BASE_t + \delta_2 \Delta BASE_{t-1} + \ldots + \gamma_1 I1_t + \gamma_2 I2_t + \ldots + \gamma_j Im_t + \varepsilon_t \quad (1)$$

where REV is nominal fiscal revenues, BASE is the nominal relevant base, both in logarithms, while TREND is introduced or not in function of the results in table 3, and Ij (j = 1, 2, …., m) capture discretionary fiscal policy measures. Since variables are in logarithms, their first differences approximate growth rates in nominal terms. Therefore, δ_1 measures the short-term, instantaneous elasticity of the fiscal revenues with respect to their base. As usual, $\alpha_1 (REV - \alpha - \beta\, BASE - \tau\, TREND)_{t-1}$ is the error-correction term and, if, as

[26] The series of tax revenues and bases in logarithms and their first differences are displayed in Graphs A1 and A2 of the statistical annex, respectively.

suggested by results in table 3, a long-run relationship between tax revenues and their base would exist, α_1 should be significant, negative and lower than unit in absolute terms.

Table 3. Cointegration relations. Johansen test

	TOTAL FISCAL REVENUES	SOCIAL CONTRIBUTIONS		INDIRECT TAXES			DIRECT TAXES		
	BASE: GDP	BASE: Total labour costs	BASE: GDP	BASE: Private consumption plus dwellings	BASE: Private consumption	BASE: GDP	BASE: Modified GVA	BASE: GVA	BASE: GDP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exogenous variables	Trend			Trend	Trend	Trend			
Trace statistic	**29.0**	**21.3**	**23.6**	**33.9**	**34.9**	**36.2**	**14.3**	**19.6**	**21.6**
5% critical value	*25.9*	*15.5*	*15.5*	*25.9*	*25.9*	*25.9*	*12.3*	*15.5*	*15.5*

The dummies that represent the impact of specific tax reforms on the growth rate tax revenues have been selected considering the information on tax reforms provided in the various boxes in section 3. Since the ECM is in first differences, the impacts of the reforms are represented by interventions, i. e. variables that take value 1 in specific years and 0 otherwise. We therefore assume that tax reforms affect the growth rate of revenues in the year(s) in which they are implemented. Once the reform is implemented, the growth rate of tax revenues is determined by developments in the corresponding tax base. This seems a reasonable hypothesis for proportional or quasi-proportional taxes. Indeed, tax reforms aimed at increasing or lowering progressivity would change the elasticity of tax revenues with respect to the tax base. In the Spanish tax system, this would apply to the personal income tax, which is not explicitly modelled here, but subsumed with corporate taxes in the broad category of direct taxes. In addition, the reforms implemented before the mid-1980s have not been explicitly included as interventions. As explained in section 3, the modern tax system of Spain was set up between the mid-1970s and the mid-1980s either through a big reform that took place in the early years (viz. social contributions), which would not require any intervention, or through a series of cumulative reforms (direct and indirect taxes), which would practically require an intervention per year until 1985. Specifically, the following interventions have been considered ex-ante: reforms of the direct tax of 1987, 1989, 1999 and 2002, and the reforms of social contributions of 1992 and 1995. Table 4 summarises econometric results for the ECM models estimated for total tax revenues, social contributions and indirect and direct taxes.

When modelling total tax revenues, the only tax base considered here is nominal GDP (see column (1) in table 4). The explanatory power of the model is very high; more than 95% in adjusted terms. Moreover, according to the usual specification tests, the model appears to be reasonably well specified. As expected, the error correction term is significant, lower than one in absolute terms and negative, thus implying that the deviations from the long-tem relationship between total tax revenues and GDP are of a temporary nature. The implied elasticity for such a long run elasticity would be higher

than one[27], which might be reflecting the extraordinary increase of government receipts recorded in Spain over the whole period, especially until the mid-1990s (see graph 5). Four interventions representing the tax reforms of direct taxes (1987, 1989) and social contributions (1992, 1995) seem to have had a significant impact on the change in total tax revenues in the corresponding years. They exhibit the expected signs in accordance with the ex-ante assessments in section 3. Surprisingly, in spite of their apparently large direct cost (about 1% of GDP; see box 5), the reforms of the personal income tax code of 1999 and 2002 do not appear to have had a statistically significant impact on revenue growth. Since the same result is found for direct taxes, we come back to this issue below. The estimate of the short-term elasticity is only slightly higher than 1, and would not diverge from unit in statistical terms[28].

Table 4. Estimating short-term elasticities (a) (b)

	TOTAL FISCAL REVENUES	SOCIAL CONTRIBUTIONS		INDIRECT TAXES			DIRECT TAXES		
	BASE: GDP (1)	ASE: Total bour costs (2)	BASE: GDP (3)	BASE: Private consumption plus dwellings (4)	BASE: Private consumption (5)	BASE: GDP (6)	BASE: Modified GVA (7)	BASE: GVA (8)	BASE: GDP (9)
Intercept	-1.20*** (-3.35)	-0.62*** (-4.72)	-0.27 (-1.60)	-0.81 (-2.21)	-0.92** (-2.53)	-1.10** (-2.48)	-0.59* (-1.98)	-0.88*** (-3.20)	-0.88*** (-3.19)
Error correction term (α_1)	-0.47*** (-4.04)	-0.30*** (-5.04)	-0.13** (-2.35)	-0.18** (-2.13)	-0.20** (-2.36)	-0.22** (-2.39)	-0.18** (-2.31)	-0.21*** (-3.07)	-0.20*** (-3.00)
Tax base t-1 level ($\alpha_1 * \beta$)	0.61*** (3.69)	0.33*** (4.95)	0.13** (2.06)	0.30** (2.54)	0.34*** (2.79)	0.35** (2.66)	0.21** (2.14)	0.27*** (3.14)	0.26*** (3.09)
Tax base t (change)(δ1)	**1.04*** ** (8.47)	**1.07*** ** (10.05)	**1.08*** ** (6.20)	**0.83** ** (2.43)	**1.21*** ** (2.88)	**1.17** ** (3.00)	**0.41*** (1.73)		
Tax base t-1 (change)(δ2)							**0.52** ** (2.44)	**1.28*** ** (4.08)	**1.35*** ** (4.20)
Trend	-0.01** (-2.10)			-0.01* (-1.86)	-0.01 (-1.48)	-0.01 (-1.54)			
I87	0.04*** (2.99)						0.18*** (4.58)	0.16*** (4.31)	0.16*** (4.23)
I89	0.04*** (3.20)						0.11*** (2.92)	0.14*** (3.74)	0.15*** (4.05)
I92	0.05*** (3.48)	0.03** (2.06)	0.06** (2.29)						
I95	-0.03** (-2.44)	-0.05*** (-3.56)	-0.06** (-2.32)						
Adjusted R^2	0.96	0.97	0.88	0.51	0.54	0.54	0.85	0.85	0.85
DW	2.13	1.93	1.71	1.68	1.45	1.51	2.29	2.08	2.21
Q(1)	0.82	0.02	0.70	0.88	2.51	1.99	0.82	0.25	0.84
Q(2)	1.16	0.17	1.16	3.92	6.30	3.71	3.53	2.35	4.14

(a) The estimations are made in one stage. The variables are in logarithms, ***,**,* denote the rejection of the null hypothesis at significance levels of 1%, 5% and 10% respectively.
(b) R^2 is the adjusted coefficient of determination, DW is the Durbin Watson residual autocorrelation statistic and Q(k) is the value of the Box Pierce Ljung statistic of k order.

[27] Note that the elasticity implied by the cointegration equation between revenues and GDP can be obtained by dividing the estimate of $-\alpha_1\beta$ (see cell in the first column and third row: -0.6) by the estimate of α_1 (-0.5). This gives 1.2, which is identical to the observed annual average elasticity in table 1 for the whole period 1970-2006.

[28] Graph A3 in the annex presents the instantaneous impact and the long-run accumulated tax elasticity of total tax revenues with respect to GDP. Everything else equal, an increase in GDP of 1% would raise tax revenues by around 1.3% in the long run.

Shifting to the components of total tax revenues, and starting by social contributions, when considering their typical base, namely total labour costs (compensation of employees plus the imputed compensation of the self-employed; see column (2) in table 4), the goodness of fit is close to one. Unsurprisingly, since social contributions are raised on labour costs rather than on GDP, the explanatory power of the model, albeit remaining high, falls when considering GDP as the alternative tax base. In no case, possible misspecification errors seem significant. Although, as explained in box 3, the main reform of this tax dates back from the late seventies, the final specification includes two interventions to take account of the increase (1992) and the reduction (1995) of contribution rates (see box 3). Both interventions are significant and have the expected sign. As with total taxes, the error correction is statistically significant, negative and less than one in absolute terms. The estimated short-term elasticities with respect to either labour costs or GDP are close to 1, which would be consistent with a quasi proportional tax code. However, the improvement in enforcement, combined with the recent regularisation of immigrants, would have pushed social contributions to grow on average slightly faster than total labour costs and GDP over the whole period.

Columns (4), (5) and (6) show the results for indirect taxes. The results in column (4) have been obtained by specifying private consumption plus the market value of new dwellings as the tax base, while column (5) includes private consumption only, and the model in column (6) takes GDP as the relevant tax base. Compared with other models displayed in table 4, the goodness of fit is much poorer. Overall, the best models only explain about 50% of the variability of indirect tax revenues within the sample. However, usual tests do not point to serious misspecification problems. The low explicative power of the model seems to be result of wide and rather frequent changes in the growth rates in the series reflecting the introduction of VAT in the mid-eighties, and continuous improvements in tax administration, as well as the effects of scattered reforms implemented over the whole sample period (see box 4). The error correction is indeed negative, lower than 1 in absolute value and significant. The differences between the models including private consumption (5) and GDP (6) are negligible. Interestingly, the estimated short-term elasticity is below 1 if the extended base is used[29], while the estimates of the elasticities with respect to the private consumption and GDP jump to around 1.2. The difference provides an order of magnitude of the impact on the indirect tax elasticity of composition effects associated to the housing market. On the one hand, since new dwellings are taxed at the reduced VAT rate, the inclusion of housing in the base makes indirect taxes to behave as relatively regressive. On the other, since a portion of the increase in tax revenues over the second part of the sample period can be attributed to the housing boom, the exclusion of the value of new dwellings at market prices from the base makes indirect taxes to behave as strongly progressive. Needless to say, given the structure of the VAT and other indirect taxes, one would expect a slightly regressive behaviour of the tax, in line with model (4) in table 4.

Columns (7) to (9) show the results for direct tax revenues, for which three alternative tax bases have also been considered: the modified gross value added (MGVA; see column (7) of table 4), the standard gross value added (GVA; see column (8)) and the nominal GDP (column (9)). The three models appear reasonably well specified, and their goodness of fit is identical and high (85%). The three selected specifications include two interventions, in 1987 and 1989, to take account of major reforms of the personal and

[29] This would be in line with other analyses on the degree of progressivity of indirect taxes (Calonge and Manresa, 2001), which would result in a elasticity will be lower than 1.

corporate income taxes. The estimated coefficients are comparable across the three specifications, significant and have the expected signs. The absence of statistically significant effects of the 1999 and 2002 reforms on total direct tax revenue growth confirms that their costs were fully absorbed by, on the one hand, the progressive nature of the personal income tax in a context of rapid growth of the tax base and, last but not least, by the unprecedented growth of corporate taxes. The error correction terms are significant, negative and lower than one in absolute terms. They are also comparable across the three specifications.

An important difference between the model including the modified GVA, on the one hand, and the models for the standard GVA and GDP, on the other, concerns the way the tax base enters the equation. While the GVA and GDP present a year lag, the modified GVA enters the equation also contemporaneously[30]. This latter model seems consistent with the way government tax receipts are imputed in national accounts in accordance to the Council Regulation No 2516/2000. This makes that direct tax revenues imputed to year t have actually been collected on the income of not only the previous year, but also the current one[31].

Table 5 compares the alternative estimates in table 4 with those released in Bouthevillain et al, 2001, and Girouard and André, 2005 for comparable bases. Overall, the three sets of estimates are comparable, although the estimates in table 4 tend to be on the low side. This may be not surprising in the Spanish case, since, the sample period is characterised by a deep transformation of the tax system in different directions and with different intensity over time. While econometric estimates capture features over the whole sample period, computations by the OECD and ECB would theoretically just reflect the most recent characteristics of the Spanish tax system.

Table 5.- Comparison of estimations of short-term tax elasticities

	In this paper		Bouthevillain et alt. (2001)		Girouard and André (2005)	
	Base	Elasticity	Base	Elasticity	Base	Elasticity
Direct taxes	Modified gross value added (a)	0.9	Compensation of employees and proxy for corporate profits	1.2 - 1.5	Gross domestic product	1.2 - 1.9
	Gross value added	1,3				
	Gross domestic product	1,4				
Indirect taxes	Private consumption + dwellings	0,8	Private consumption	1,0	Total consumption	1,0
	Private consumption	1,2				
Social contributions	Compensation of employees plus imputed compensation of self-employed	1,1	Compensation of employees	0,9	Compensation of employees	0,8
Total fiscal revenues	Gross domestic product	1,0			Gross domestic product	1,1

(a) Calculated as the sum of contemporaneous and one lagged impacts.

[30] Versions of models (7) to (9) including a different lag structure were not superior to those presented in the table. These results are available upon request from the authors.

[31] Although in accordance to ESA95 fiscal revenues should be accounted in accrual terms (i.e. when the activity subject to the tax is carried out, thus in year t), in the specific case of Spain, part of the personal income and corporate taxes (the so-called the differential quota) is paid in function of the income of the precedent year. Although this part has been diminishing in the most recent past, econometric results still reflect the importance of revenues on lagged incomes over the whole period. (see IGAE, Ministerio de Economía y Hacienda: http://www.igae.meh.es/NR/rdonlyres/CA539A9C-963F-4D67-BEA5-362772CFCF71/12068/ManualCCLL1Edici%C3%B3n2007.pdf).

Section 3.4 has provided a first order of magnitude of the part of the increase in government receipts recorded over 1995-2006 and attributable to the changes in composition associated to the asset boom. A figure of about 2¼% of GDP has been advanced. This has been possible within the framework of a relatively restrictive set of conditions. First, following box 2, composition effects have been estimated in a direct way as the difference between the average growth rates of the tax base and the GDP. However, even in the absence of asset booms, GDP composition may change over the cycle, with the concomitant impact on revenues. Consequently, it would be desirable to disentangle composition effects on tax revenues associated to the asset boom from other possible composition effects associated to the expansionary phase of the economic cycle. Second, the asset-boom's composition effects have been circumscribed to VAT on housing and corporate taxes. Nevertheless, other tax bases such as social contributions or personal income taxes have recorded negative composition effects, which might be partially associated to the asset boom. Therefore, it would also be desirable to identify which part of such negative developments in the relative weight of tax bases can be attributed to the asset boom.

Providing unambiguous assessments of these two issues is out of the scope of this paper, since general equilibrium dynamic models of the economy, including the public sector, would be needed. However, model (1) represents a baseline to obtain some tentative estimates of the impact on government receipts of the asset boom in Spain. On the one hand, the model already includes developments in GDP and, thus, growth effects over the cycle. On the other hand, it deals with total tax revenues, and thus with the net impact of the variables in the equation on government receipts.

Columns (1) and (2) present the results of re-specifying the baseline model (1) in table 4 by introducing alternative composition indicators. The first column of table 6 shows that composition effects are absent when represented by the GDP share of typical tax bases, such as private consumption or GVA, which do not reflect the effects of the asset boom. However, the inclusion of spending and income indicators closely related with the asset spending incomes leads to more interesting results. As in section 3, the developments in the housing market are represented by the relative weight of the market value of new dwellings in GDP, thus assuming that developments in secondary housing market follow those of the primary. We represent developments in asset markets through the share of in GDP of the GVA modified in accordance to the PER-based corporate profits. In doing so, we are likely avoiding positive biases in the estimation of the composition effects linked to the asset boom. Therefore, the estimates provided here might be considered as overall conservative. Such estimates of the composition effects are represented by the impact of changes in the shares of the asset boom indicators on total tax revenues. Both indicators of the asset boom are significant and positive[32], while at the by looking at the Box-Pierce-Ljung statistic, no specification errors are apparent.

[32] Note that the indicator of the asset boom enters the equation with a two-year lag. This might reflect the lag between the year the dwelling is built (see box 1) and the year the property is officially registered, and fiscal effects begin to take place.

Table 6. Different econometric approaches to estimate the composition effect

	Modelling fiscal revenues (b)				Modelling tax elasticity
	TOTAL FISCAL REVENUES BASE: GDP	TOTAL FISCAL REVENUES BASE: GDP	INDIRECT TAXES BASE: GDP	DIRECT TAXES BASE: GDP	ELASTICITY OF TOTAL FISCAL REVENUES WRT GDP
	(1)	(2)	(3)	(4)	(5)
Intercept	-0.89 *	-1.31 ***	-1.08 **	-0.63 **	1.26 ***
	(-1.97)	(-3.35)	(-2.36)	(-2.32)	(9.29)
Error correction term (α_1) or Y t-1	-0.37 **	-0.48 ***	-0.22 **	-0.14 **	-0.21 *
	(-2.52)	(-5.69)	(-2.29)	(-2.15)	(-1.88)
Tax base t-1 (level) ($\alpha_1 * \beta$)	0.46 **	0.66 ***	0.35 **	0.18 **	
	(2.23)	(5.40)	(2.50)	(2.20)	
Tax base t (change) (δ1)	1.07 ***	1.01 ***	1.17 **		
	(7.67)	(11.27)	(2.96)		
Tax base t-1 (change) (δ2)				1.43 ***	
				(4.80)	
Trend	-0.004	-0.01 ***	-0.01		-0.01 ***
	(-1.10)	(-3.93)	(-1.25)		(-3.93)
I87	0.04 ***	0.05 ***		0.18 ***	0.69 ***
	(3.02)	(5.24)		(5.16)	(3.61)
I89	0.04 **	0.03 **		0.13 ***	
	(2.78)	(2.41)		(3.54)	
I92	0.04 **	0.05 ***			0.65 ***
	(2.64)	(4.68)			(3.51)
I95	-0.03 **	-0.03 **			-0.60 ***
	(-2.31)	(-3.25)			(-3.24)
I02					0.35 *
					(1.76)
Share consumption to GDP $_t$ (change)	**0.12**				
	(0.37)				
Share GVA to GDP $_t$ (change)	**-0.70**				
	(-1.19)				
Share dwellings to GDP $_{t-2}$ (change)		**0.09** **	**-0.05**		
		(2.17)	(-0.28)		
Share modified GVA to GDP $_t$ (change)		**0.35** ***		**0.62** **	**0.03** **
		(4.74)		(2.51)	(2.14)
Share consumption plus dwellings to GDP $_t$ (change)					**0.13** **
					(2.16)
Cycle GDP (change)					0.02 **
					(2.65)
Adjusted R^2	0.96	0.96	0.52	0.87	0.63
σε (%)	1.67	1.67	4.36	3.64	1.67
DW	2.20	2.13	1.52	2.33	1.67
Q(1)	1.46	0.82	1.92	1.47	0.87
Q(2)	1.63	1.16	3.72	1.63	1.44

(a) R^2 is the adjusted coefficient of determination, DW is the Durbin-Watson residual autocorrelation statistic and Q(k) is the value of the Box-Pierce-Ljung statistic of the k-order correlation of the residuals. ***, ** and * denote the rejection of the null hypothesis at significance levels of 1%, 5% and 10% respectively.

(b) The estimations are made in one stage. The variables are in logarithms.

In order to estimate the impact of such asset-induced composition effects, we have compared the tax revenues estimated directly in column (2) of table 6, with the estimates obtained with the same model assuming no changes in the shares of the market value of new dwellings and corporate profits between 1995 and 2006. In doing so, the year 1995 is arbitrarily set up as the benchmark, which should not be in principle interpreted as something like an equilibrium year. The choice of the base year is justified by the purpose of the paper, namely to disentangle the part of the government receipts increase over the expansion 1995-2006 attributable to the boom in the asset market. Yet it might be interesting to note that the shares in the two asset boom indicators are not that far from

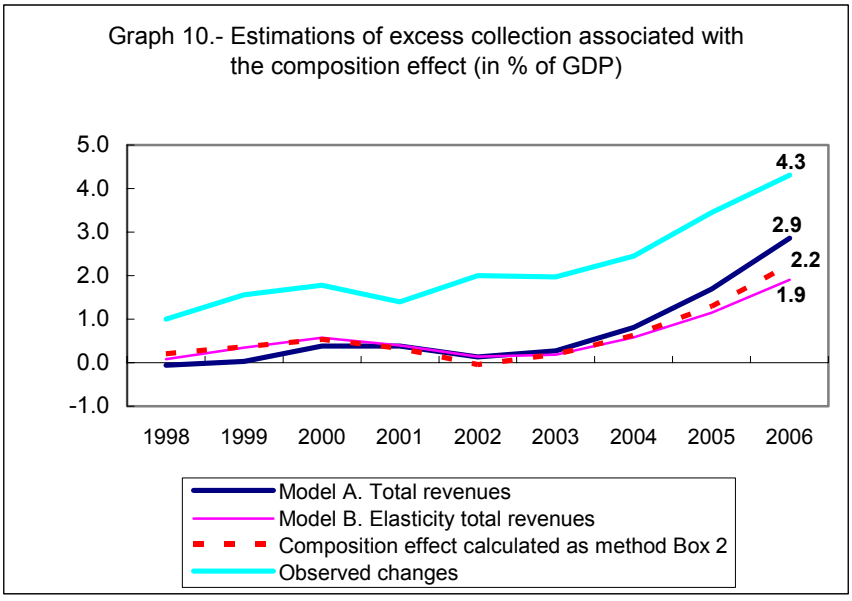
what could be considered as an observable long-run equilibrium. For instance, the number of new houses built in 1995 is pretty close to the average of the period 1980-1995, during which the number of new dwellings hovered around one quarter of a million. Analogously, the figure for our indicator of taxable profits in that year is almost identical to that of the net operating surplus, which is subject to much less cyclical fluctuations.

The result is displayed in the bold line of graph 10. Overall, the estimated impact of the asset boom on tax revenues in 2006 would be close to 3% of GDP. This figure is clearly above the 2¼% estimated in section 3.4 (dotted line in graph 10). Taken at face value, it would suggest that the asset boom would have not affected negatively other tax bases and that about 75% of the increase in tax revenues observed between 1995 and 2006 might be of a transitory nature and would fade out with the asset boom.

For comparative purposes, columns (3) and (4) of table 6 show that similar composition effects can be detected when considering direct taxes, but not in the case of indirect tax revenues. The composition effects induced by the asset boom in direct tax revenues are positive and significant (column (4)). This is consistent with the results in column (2). Unsurprisingly, the composition effect is larger in the model for direct taxes than in that for total taxes. The absence of composition effects in indirect taxes is at odds with the relevance of transactions of new dwellings to explain developments in total taxes. However, this appears to be the result of the inadequacy of ECM models to satisfactorily reflect developments in indirect taxes and should not put into question the estimates in the second column of table 6.

The net composition effect on direct tax revenues can be obtained by comparing the revenues directly estimated in column (4) of table 6, with the estimates obtained with the same model assuming no changes in the share of thee modified GVA between 1995 and 2006. Overall, the estimated impact of the asset boom on direct tax revenues would amount to 0.7% of GDP. This is consistent with the net composition effect calculated in table 2 for direct taxes of 0.8% of GDP (see the cell in the seventh column and third row).

Graph 10.- Estimations of excess collection associated with the composition effect (in % of GDP)



To provide another estimate of composition effects, the last column of table 6 presents the results of a model for the annually recorded elasticity of total taxes.

As a background, graph A4 and tables A6 and A7 have been included in the statistical annex. The four panels of the graph display the observed elasticities of total tax revenues and their three main categories in national accounts (social contributions, and indirect and direct taxes). In line with previous analyses, the elasticity of total tax revenues has been calculated only with respect to the GDP, while those of the three components have been calculated not only with respect to the GDP but also with respect to the most suitable tax bases (labour costs for social contributions, private consumption plus the value of new dwellings for indirect taxes, and the modified gross value added for direct taxes).

Overall, and regardless of the tax base, the series are characterised by a high volatility from year to year, as well as by what appear to be large shocks, some of which might be associated to the economic cycle. The differences between indirect tax elasticities with respect to GDP and to private consumption, plus the market value of new dwellings, seem to point to significant composition effects since the mid-1990s, while, for the rest of the sample, such effects would only be visible, albeit to a much lesser extent, over a short period in the early 1980s. Similarly, the difference between the elasticity with respect to GDP and the base also provides preliminary evidence of composition effects, especially in the most recent past of the sample. Standard unit root tests point to the absence of relevant stochastic trends (the null of a unit root is clearly rejected). Given the low power of the unit root tests, this can be interpreted as reasonable evidence in favour of the stationarity of the series.

According to table A7, the consideration of some tax reforms introduces more or less permanent changes in the mean of the series and unveils some structure in some of the annual tax elasticities, which might be pointing to a more general omitted-variable problem in the models. According to table 6, this seems to be case of the elasticity of total tax revenues with respect to GDP. The last column of the table suggests that changes in composition associated to the asset boom have significant effects on total tax elasticities. By assuming that the shares of new dwellings at market prices and PER-based corporate profits in GDP had remained unchanged since 1995, the estimated impact of composition effects on the total tax burden would amount to about 2% of GDP (see slim line in graph 10). Compared with the estimation of about 2¼% of GDP in section 3.4, this would provide additional evidence against significant negative composition effects associated to the asset boom in Spain, while it would confirm that a large part of increase in the tax burden over the decade might be of a transitory nature.

5. Conclusions

The combination of a steady appreciation of the real effective exchange rate, the reduction of the risk premia and the increase in population in Spain is supportive of a demand-based growth model, highly rich in taxes. While exports, which have low tax content, are not growing as fast as the whole economy, private consumption and the boom in the housing market are pushing VAT revenues up. The economic boom is raising extraordinary profits, especially linked to real state and financial operations, and consequently revenues from corporate taxes. The asset boom has induced significant changes in the composition of GDP and, especially, in the main tax bases.

Within this framework, the paper has discussed and assessed the extent to which the high tax revenues and elasticities recorded in Spain during the last decade can be associated to asset boom-related changes in the composition of GDP.

If so, the increase in government receipts since the mid-1990s might fade out once the current expansion and its associated composition effects taper off. To carry out this assessment, two indicators of the asset boom have been identified and the bases for indirect and direct taxes modified accordingly. The indicator of developments in the housing market has been built on the basis of the market value of new buildings, while corporate profits have been estimated from price-earning ratios (PER) of quoted enterprises in the Spanish stock exchange.

A first assessment, based on a direct decomposition of the changes in tax revenues into composition, discretionary and other effects, leads to composition effects of about 2¼% of GDP. This figure only includes those effects directly associated to VAT on housing and to corporate taxes. It would not therefore take account of possible negative effects induced in other bases, such as labour costs, the weight of which has been falling during the last decade, or additional positive effects induced in others, such as some indirect taxes or certain components of personal incomes. However, this first estimate of composition effects has been confirmed by econometric analyses of the determinants of tax revenues and tax elasticities, which have been used to assess net impacts of the changes in composition on government receipts. According to such models, the net composition effect associated to the current asset boom would situate between 2 and 3 percentage points of GDP, which, when compared with the size of direct effects, would provide evidence against significant negative composition effects of the current asset boom on other bases. Moreover, econometric estimates would suggest that bases determining revenues from other than VAT and corporate taxes, such as other indirect and personal income taxes, might have recorded positive asset-driven composition effects.

Overall, econometric analyses would indicate that about 75% of the increase in tax revenues observed between 1995 and 2006 might be of a transitory nature and would fade out with the asset boom. Consequently, this paper draws the attention to the importance of composition effects in the current economic expansion in Spain, clearly associated to a particular growth model, which might fade out when growth recedes. It therefore seems appropriate for the Spanish policymakers to carefully take account of such transitory composition effects when considering the implementation of unfunded tax cuts and/or expenditure increases, especially those more difficult to revert in bad times.

The paper also represents a contribution to the debate on fiscal surveillance indicators. In particular, it has presented evidence that in the presence of asset booms, and, more generally, when the composition of main tax bases change significantly, tax elasticities with respect to standard bases can lead to misleading conclusions of developments in government receipts. In a context of significant composition biases, and in line with other contributions (viz. Morris and Schuknecht, 2007), this paper warns against using standard tax elasticities for fiscal surveillance purposes because they can lead to an overestimation of structural revenues and, concomitantly, to an incorrect assessment of the fiscal stance. This may be relevant in EMU because, although the current expansion of fiscal revenues in Spain, and likely in other countries, does not seem to be a fully genuine EMU phenomenon, the likelihood of occurrence of asset booms may be relatively high when the monetary-policy stance is far from consistent with the country's inflation.

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ANNEX

Table A1. Social contributions, 1970-2006

	1970-2006	1971-1975	1982-1991	1995-2006
Social contributions(1)	14.0	25.0	12.6	7.5
Contributions as % of GDP(2)	12.1	8.8	12.5	13.0
Constributions base(3)	11.6	19.1	11.4	6.3
Average effective tax rate(4)	19.6	13.1	20.1	22.5
Elasticity wrt GDP(5)	1.2	1.4	1.0	1.0
Elasticity wrt the tax base(6)	1.2	1.3	1.1	1.2

(1) Average annual nominal social contributions growth rate in %
(2) Ratio of nominal social contributions to nominal GDP in %
(3) Average annual nominal labour costs growth rate in %
(4) Ratio of nominal social contributions to nominal total labour costs in %
(5) Elasticity of nominal social contributions with respect to the nominal GDP. See 2nd row in table 1 in the main text.
(6) Elasticity of nominal social contributions with respect to the nominal labour costs
Source: AMECO and own calculations

Table A2. Indirect taxes, 1970-2006

	1970-2006	1971-1975	1982-1991	1995-2006
Indirect tax revenues(1)	13.7	14.8	17.1	9.4
Indirect tax as % of GDP(2)	9.2	7.1	9.3	11.3
Indirect tax base(3)	12.6	18.4	11.5	9.8
Average effective tax rate(4)	13.4	10.2	14.0	16.0
Elasticity wrt GDP(5)	1.1	0.8	1.4	1.3
Elasticity wrt the tax base(6)	1.1	0.8	1.5	1.0

(1) Average annual nominal indirect-tax revenues growth rate in %
(2) Ratio of nominal indirect-tax revenues to nominal GDP in %
(3) Average annual private consumption plus dwellings growth rate in %
(4) Ratio of nominal indirect-tax revenues to nominal private consumption plus dwellings in %
(5) Elasticity of nominal indirect-tax revenues with respect to the nominal GDP. See 2nd row in table 1 in the main text.
(6) Elasticity of nominal indirect-tax revenues with respect to nominal private consumption plus dwellings
Source: AMECO and own calculations

Table A3. Main indirect tax categories , 1995-2006

	VAT housing (a)	VAT other categories (b)	Other indirect taxes (c)	Total (d)
Revenues[(1)]	19.8	9.1	8.9	9.4
Revenues as % of GDP[(2)]	0.5	5.1	5.7	11.3
Tax base[(3)]	22.3	7.0	8.0	9.8
Average effective tax rate[(4)]	7.3	8.6	9.1	16.0
Elasticity wrt GDP[(5)]	2.7	1.2	1.2	1.3
Elasticity wrt the tax base[(6)]	0.9	1.3	1.1	1.0

(1) Average annual nominal tax revenues growth rate in %
(2) Average ratio of nominal tax revenues to nominal GDP in %
(3) Average annual growth rate of the tax base in %. The tax base is the market value of new dwellings (a), private consumption (b), private consumption plus dwellings (c) and (d)
(4) Ratio of nominal indirect-tax revenues to the tax base in %; see (3)
(5) Elasticity of nominal indirect-tax revenues with respect to the nominal GDP. See 2nd row in table 1 in the main text.
(6) Elasticity of nominal indirect-tax revenues with respect to the tax base; see (3)
Source: AMECO, the Spanish Tax Administration Agency (Agencia Tributaria) and own calculations

Table A4. Direct taxes, 1970-2006

	1970-2006	1971-1975	1982-1991	1995-2006
Direct tax revenues[(1)]	16.7	24.0	18.7	8.9
Direct tax as % of GDP[(2)]	8.0	3.5	8.5	10.4
Direct tax base[(3)]	12.5	18.6	12.3	8.5
Average effective tax rate[(4)]	8.7	3.8	9.1	11.2
Elasticity wrt GDP[(5)]	1.4	1.3	1.5	1.2
Elasticity wrt the tax base[(6)]	1.3	1.3	1.5	1.0

(1) Average annual nominal direct-tax revenues growth rate in %
(2) Ratio of nominal direct-tax revenues to nominal GDP in %
(3) Average annual nominal modified gross value added growth rate in %
(4) Ratio of nominal direct-tax revenues to modified nominal gross value added in %
(5) Elasticity of nominal indirect-tax revenues with respect to the nominal GDP. See 2nd row in table 1 in the main text.
(6) Elasticity of nominal indirect-tax revenues with respect to modified nominal gross value added
Source: AMECO, Banco de España, Bolsa de Madrid and own calculations.

Table A5. Direct tax categories, 1995-2006

	Personal income tax (a)	Corporate tax (b)	Total (c)
Revenues[(1)]	6.1	17.4	8.9
Revenues as % of GDP[(2)]	6.9	3.2	10.4
Tax base[(3)]	6.5	14.2	8.5
Average effective tax rate[(4)]	11.3	15.2	11.2
Elasticity wrt GDP[(5)]	0.8	2.4	1.2
Elasticity wrt the tax base[(6)]	0.9	1.2	1.0

(1) Average annual nominal tax revenues growth rate in %
(2) Average ratio of nominal tax revenues to nominal GDP in %
(3) Average annual growth rate of the tax base in %. The tax base is gross disposable income (a), modified net operating surplus (b), modified gross value added (c).
(4) Ratio of nominal indirect-tax revenues to the tax base in %; see (3)
(5) Elasticity of nominal indirect-tax revenues with respect to the nominal GDP
(6) Elasticity of nominal indirect-tax revenues with respect to the tax base; see (3)
Source: AMECO, Banco de España, Bolsa de Madrid and own calculations.

Table A6.- Descriptive statistics for tax elasticities

	Total fiscal revenues	Social contributions		Indirect taxes		Direct taxes	
	to GDP	to tax base: Total labour costs	to GDP	to tax base: Private consumption plus dwellings	to GDP	to tax base: Modified GVA	to GDP
MEAN	1,2	1,2	1,2	1,1	1,1	1,3	1,4
MAXIMUM	1,7	1,7	1,9	2,3	2,2	3,4	3,4
MINIMUM	0,2	0,2	0,1	-1,1	-0,8	-0,4	-0,2
STD. DESV.	0,3	0,3	0,3	0,6	0,5	0,6	0,7
TEST ADF (a)	-6.45 ***	-6.12 ***	-4.68 ***	-5.46 ***	-6.02 ***	-5.84 ***	-5.74 ***
AR MODELS (b) (c)							
Intercept	1.17 ***	1.18 ***	1.08 ***	1.10 ***	1.17 ***	1.24 ***	1.30 ***
	(27.03)	(28.82)	(15.00)	(10.07)	(12.92)	(11.67)	(11.52)
Y_{t-1}	-0,11	-0,05	0.29 *	0,06	-0,03	-0,01	0,00
	(0.64)	(-0.27)	(1.88)	(0.37)	(-0.21)	(-0.04)	(-0.02)
R2	0,00	0,00	0,10	0,00	0,00	0,00	0,00
DW	1,92	1,93	1,92	2,03	1,99	1,99	1,96
Q(1)	0,01	0,02	0,05	0,03	0,00	0,00	0,00

(a) The null hypothesis is the presence of a unit root. ***,**,* denote the rejection of the null hypothesis at significance levels of 1%, 5% and 10% respectively, based on the critical values of Mackinnon (1996). ADF denotes the augmented Dickey-Fuller test (with lags up to and including the highest lag that is statistically significant, at least at the 5% level).

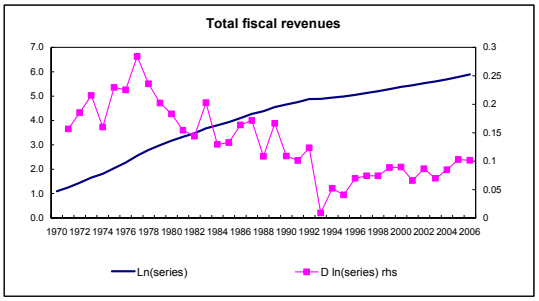
(b) ***, ** and * denote the rejection of the null hypothesis at significance levels of 1%, 5% and 10% respectively.
(c) R2 is the adjusted coefficient of determination, DW is the Durbin-Watson residual autocorrelation statistic and Q(1) is the value of the Box-Pierce-Ljung statistic of the 1-order correlation of the residuals.

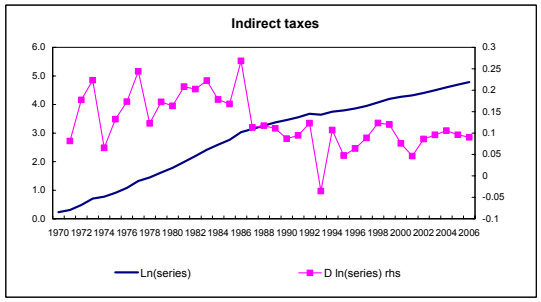
Table A7.- Modelling tax elasticities (a)

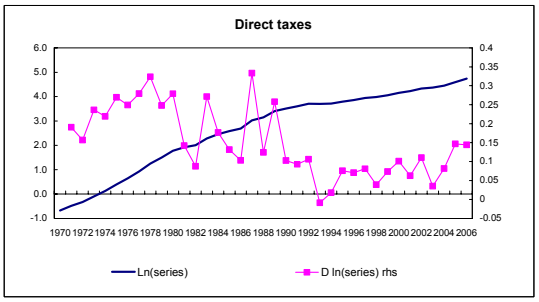
	Total fiscal revenues	Social contributions		Indirect taxes		Direct taxes	
	to GDP	to tax base: Total labour costs	to GDP	to tax base: Private consumption plus dwellings	to GDP	to tax base: Modified GVA	to GDP
Intercept	1.18 ***	1.21 ***	1.11 ***	0.93 ***	1.12 ***	1.17 ***	1.24 ***
	(35.14)	(35.61)	(17.97)	(6.30)	(7.98)	(10.70)	(11.38)
Y_{t-1}	-0.31	0,06	0.28 *	0.50 ***	0.42 **	0,20	0.12
	(-1.68)	(0.37)	(1.76)	(3.06)	(2.48)	(1.17)	(0.65)
I87						2.38 ***	2.22 ***
						(4.58)	(3.89)
I92	0.53 ***						
	(2.74)						
I93	-1.05 ***			-2.68 ***	-2.42 ***		
	(-5.46)			(-7.95)	(-6.54)		
I95	-0.73 ***	-1.07 ***	-0.91 ***				
	(-3.75)	(-5.58)	(-3.49)				
Trendtrunc	0.01			0.06 **	0.03 *		
(1970-1986)	(1.42)			(-2.91)	(1.71)		
R2	0,56	0,45	0,32	0,62	0,48	0,33	0,27
DW	1,93	1,86	1,92	2,10	1,93	1,94	1,92
Q(1)	0,01	0,02	0,05	0,14	0,04	0,01	0,02

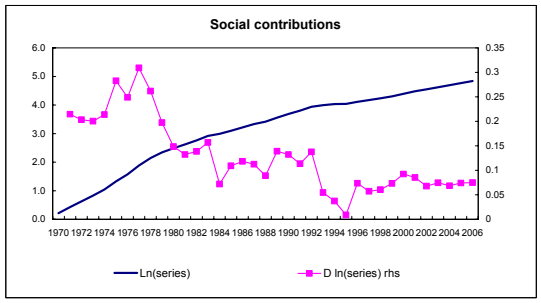
***, ** and * denote the rejection of the null hypothesis at significance levels of 1%, 5% and 10% respectively.
(a) R2 is the adjusted coefficient of determination, DW is the Durbin-Watson residual autocorrelation statistic and Q(1) is the value of the Box-Pierce-Ljung statistic of the 1-order correlation of the residuals.

Graph A1. Series of tax revenues (logarithmic scale)

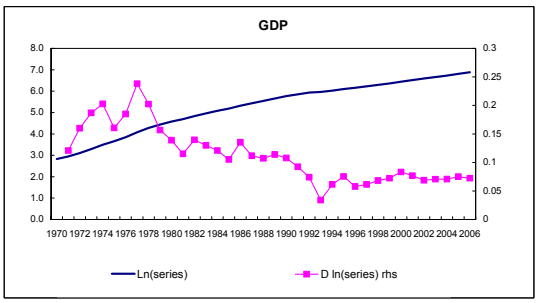


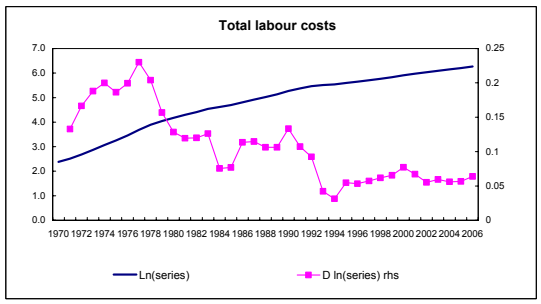


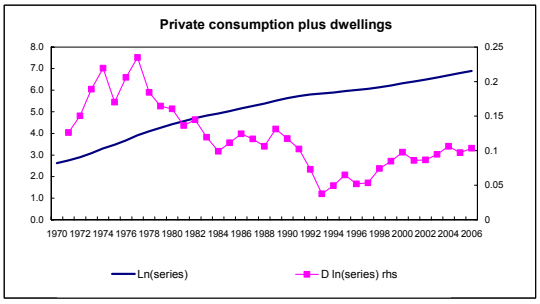


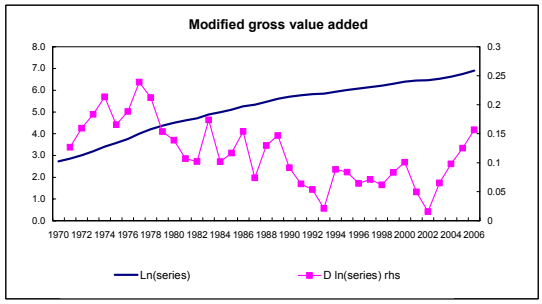


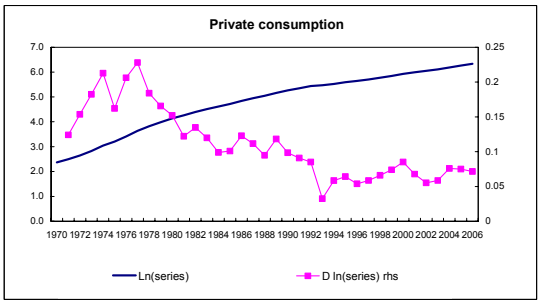
Graph A2. Series of tax bases (logarithmic scale)

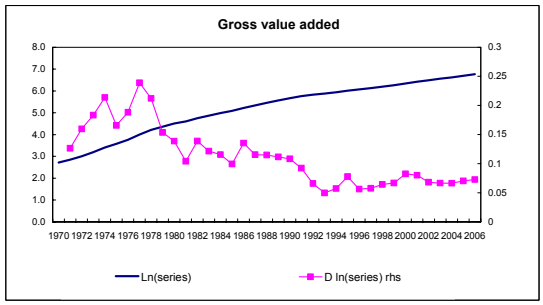






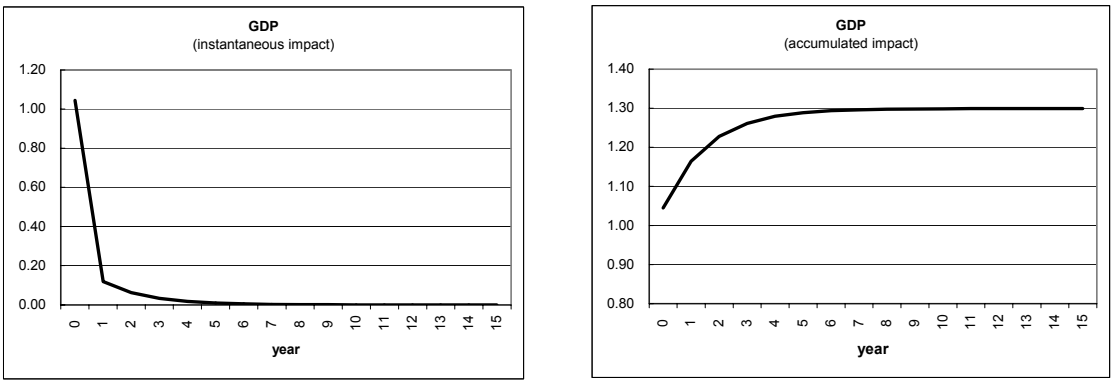




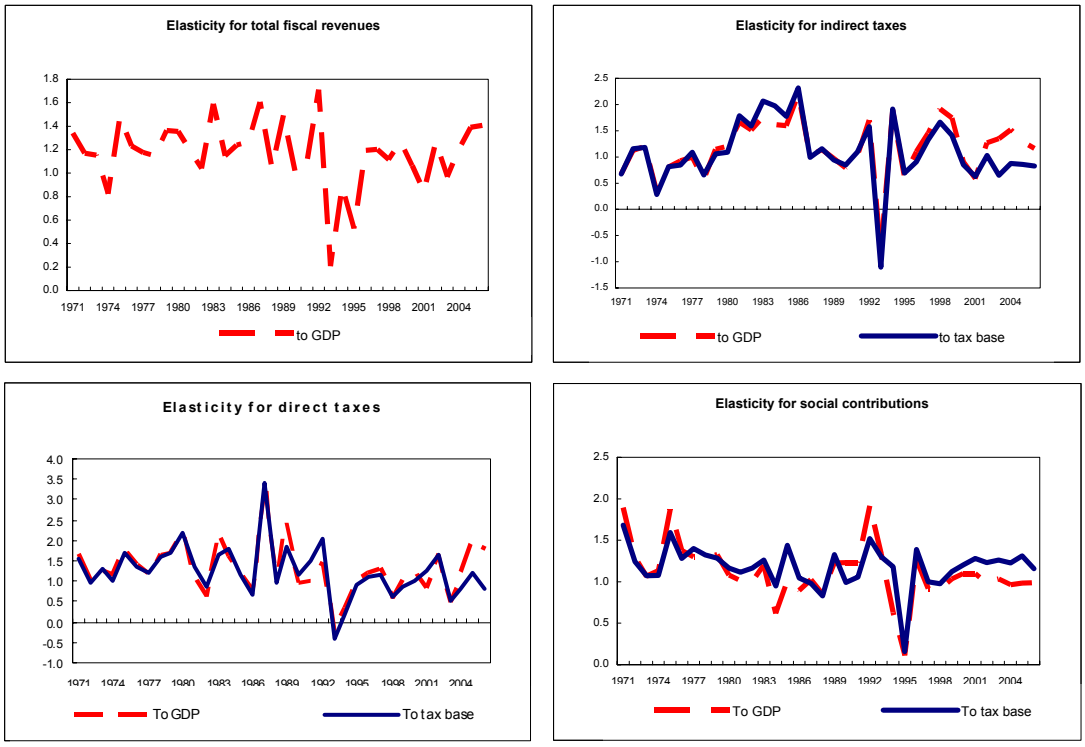


Source: AMECO and own calculations

Graph A3. Instantaneous and accumulated impacts for total tax revenues



Graph A4. Annual tax elasticities, 1970-2006



Source: AMECO and own calculations