Regional Personal Income Tax Revenues in Spain: Evaluating Tax Revenues Elasticities and the Exercise of Fiscal Autonomy[1]

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Abstract

The Personal Income Tax (PIT) is the most relevant revenue source of Spanish Autonomous Communities (ACs) as well as the largest fraction of potential fiscal autonomy. We apply an error correction model to estimate PIT elasticities. The stability of these elasticities is checked and short run asymmetries are identified. A tax overreaction is identified when PIT revenues are above the long run equilibrium while a typical error correction model response is obtained when PIT revenues are below. Some simulations are provided to evaluate the dynamic adjustment between short run and long run elasticities and its consequences on fiscal pressure. It should be noted also some findings regarding cross-sectional variability: short and especially long run elasticities present a decreasing pattern with respect to per capita income. Lastly, an analysis of the exercise of fiscal autonomy in PIT is also provided, but it is limited in scope as fiscal activism in PIT starts with the onset of the crisis. Results suggest that fiscal consolidation purposes were a driver of recent discretionary changes on PIT revenues.

Keywords: tax elasticities, personal income tax, error correction model, asymmetries, fiscal federalism.

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Resumen

El IRPF es la fuente de ingresos más relevante de las Comunidades Autónomas (CCAA) así como la figura más destacable en términos de autonomía fiscal. En el presente trabajo se estiman las elasticidades del IRPF mediante un modelo de corrección del error. Contrastamos la estabilidad de dichas elasticidades, identificando asimetrías a corto plazo. Se identifica una sobrereacción en el impuesto cuando los ingresos por IRPF se sitúan por encima del equilibrio a largo plazo mientras que una respuesta característica de un modelo de corrección del error se obtiene cuando se sitúan por debajo. Se aportan algunas simulaciones para evaluar el ajuste dinámico entre las elasticidades a corto plazo y largo plazo así como las consecuencias en términos de presión fiscal. También debemos destacar algunas fuentes de heterogeneidad regional: las elasticidades a corto y en especial a largo plazo presentan un patrón decreciente con la renta per cápita. Finalmente, se analiza el ejercicio de autonomía fiscal en el IRPF, aunque el análisis tiene un alcance limitado ya que el activismo fiscal en esta figura empieza con el estallido de la crisis. Los resultados obtenidos sugieren que el proceso de consolidación fiscal es un factor explicativo de la variación discrecional de los ingresos por IRPF.

1. Introduction

The global financial crisis that started in 2008 has led to a severe deterioration of Spanish public finances. In Spain, the crisis has also impacted heavily on the fiscal position of the Autonomous Communities (ACs), and as a result, this crisis has placed great challenges on fiscal policies. One of these challenges is the inaccuracy in fiscal forecasting (both at central and subcentral governments), where the analysis of tax elasticities plays an important role. Another challenge in Spanish public finances is the incentives regarding fiscal decentralization, a process which has moved at a fast pace in the past 30 years. In this regard, decentralization of spending responsibilities has moved faster than decentralization of revenues. This partial decentralization process may have softened the regional budget constraint and may have undermined fiscal accountability (Rodden, 2002; Lago Peñas and Martínez-Vázquez, 2015). In fact, despite regional tax powers increase noticeably over the last 20 years, ACs were generally passive in tax matters before 2010 (Solé-Ollé, 2013).

In this work we will focus on the role of Personal Income Tax (PIT) revenues on Spanish common regime ACs, which is the main fiscal resource of these ACs (from then on, ACs refer to common regime ACs). We exclude foral ACs for data availability reasons.

First, we will analyse the stability of personal income tax elasticities in Spain with an error-correction representation of the data that will provide short-run and long-run elasticities. One contribution of our work is the analysis of potential asymmetries in the short-run dynamics. Another contribution is the discussion of the dynamic adjustment between short-run and long-run elasticities and its consequences on fiscal pressure.

Second, we will check not only time variability of tax elasticities but cross-sectional variability. It is worth the assessment of such variability in both dimensions as tax elasticities play an important role in monitoring and forecasting regional public finances. In other words, policymakers need reliable revenue forecasts in order to formulate suitable spending plans, and in particular

to avoid unpleasant revenue surprises. The literature so far has focused especially on the state level, disregarding the regional dimension. To our knowledge, only Sanz et al. (2014) have provided a regional analysis in the Spanish case, but from a different angle. Their work is based on a micro data approach, whereas a time series analysis is used in our work. Despite not being our objective, these elasticities are also an essential ingredient in the estimation of structural budget balances. The current Spanish regulation does not provide for either region-specific elasticities or region-specific cyclical position. This is a strong assumption bearing in mind the results obtained in our work (in particular the ones related to region-specific PIT elasticities).

Third, despite the reaction to the business cycle has been the primary factor behind the evolution of PIT revenues at regional level, we will also examine the role of fiscal autonomy in PIT and its determinants. In our opinion, these issues are essential to assess the incentives of the Spanish decentralized structure (in particular if ACs are facing a hard-budget constraint). Since 1997 ACs are enabled to change elements of PIT, although the effective exercise can be reduced to minor tax deductions and tax credits until the onset of the global crisis. By contrast, since 2010 ACs has been particularly active in modifying PIT schedule. We will analyse several factors that could lie behind this behaviour: the response to the electoral-cycle, to the cyclical conditions as well as to the budget balance situation. As far as we know, the literature has taken a descriptive approach on this issue (see, *e.g.*, Duran and Esteller, 2004; Lago, 2007; Solé-Ollé, 2013; Cuenca, 2014; López Laborda and Zabalza, 2015).

The article is structured as follows. Section 2 provides and empirical review of tax revenues elasticities with a special focus on the Spanish case. Section 3 deals with data issues. In the fourth section we turn to the econometric analysis of PIT elasticities, where we simulate some scenarios to explore the dynamic behaviour of tax elasticities and its incidence on fiscal pressure. Next, in section 5 the role of fiscal autonomy and its determinants are explored. Section 6 concludes.

2. Tax revenues elasticities: an empirical review

The literature on tax elasticities starts with the seminal paper of Groves and Kahn (1952) and from then on there has been an academic discussion that has improved the measurement of these responses. The constant elasticity assumption is a common issue challenged in the recent literature. Sobel and Holcombe (1996) propose an error correction model to deal with non-stationarity of tax revenues and its base. Bruce et al. (2006) consider asymmetric responses to the cycle based on the direction of the underlying equilibrium.

As Dye (2004) points out “researchers face also a choice of which tax measure to use in estimating elasticities: the tax base or tax revenues”. On the one hand, data on tax revenues is much more available, although tax revenues depends on economic activity (our relationship of interest) and policy changes. Therefore it is essential to adjust revenues from policy changes that may be correlated with cyclical conditions. On the other hand, tax base data does not face this limitation, but it is much less available. In this work we are going to analyse the elasticities of personal income tax revenues.

2.1. Personal Income Tax elasticities: the Spanish case

In this section, we will focus on the literature that deals with personal income tax elasticities in the Spanish case. A distinction between the works based on detailed information on tax laws and codes and the ones based on a time series approach should be made. Some of the main objectives of the former ones are the measurement of structural budget balances as well as the analysis of fiscal reforms. The latter group of studies are closer to forecasting goals. Nevertheless, the measurement of the structural budget balances is also covered by this approach.

On the one hand, the first group includes mainly the research of international organizations such as the OECD (Girouard and André, 2005; Price et al., 2014) or the ECB (Bouthevillain et al., 2001). This approach takes advantage of microdata related to income distribution or consumption structure, as well as of

information on tax law and codes. As Martínez-Mongay et al. (2007) point out it is “a time and resource-consuming exercise”, which makes it harder to update. This is an important point if we are interested in forecasting performance. In this branch of research, it should be mentioned also the work of Sanz et al. (2014), the only one to analyse region-specific elasticities. These authors found that PIT elasticities present a decreasing pattern with the level of regional income per capita. In this regard, it is worth noting that PIT elasticities also present a decreasing pattern by income deciles, and more importantly each decile also presents a decreasing pattern with regional income per capita, especially at the bottom of the income distribution. Therefore, the decreasing pattern of PIT elasticities with the level of regional income may reflect higher individual elasticities of poorer taxpayers in less favoured regions.

On the other hand, the macroeconometric approach analyses tax revenues or tax bases as a function of macroeconomic variables. In this regard, the most common approach is the error correction modelling, which is the empirical strategy used in our work as the main focus is centred on forecasting performance. In the Spanish case we should mention the works of Martínez-Mongay et al. (2007), Zack et al. (2014) and Cuerpo and Losada (2015). In the international literature many articles have taken this approach after the work of Sobel and Holcome (1996) (for instance, Bruce et al., 2006; Wolswijk, 2007; Poghosyan, 2011; Koester and Priesmeier, 2012; etc.). State space models are another approach to address non-stationarity issues. Corrales et al. (2002) model tax elasticities using this framework, although their main objective is related to the measurement of structural budget balances.

In the following we will summarise the main results regarding tax elasticites as well as some specification issues. In the Spanish case, the range of personal income tax elasticities is from 0.9 to 2.1. Macroeconometric approaches are on the low band, unlike microdata works. In this range we do not take into account the works of Zack et al. (2014) and Cuerpo and Losada (2015) since they include other macroeconomic variables which would distort the comparison.

Most of the works use tax revenues data, with the exception of Cuerpo and

Losada (2015). Therefore, in the time series approach, it is a common issue the adjustment for tax reform effects. The empirical strategies used in the Spanish case are the inclusion of dummies that represent the impact of specific tax reforms on the growth rate of PIT revenues (Martínez-Mongay et al., 2007) or the inclusion of a variable which control for these reforms, as the average rate of PIT. This is the approach taken by Zack et al. (2014) as well as in our work.

Finally, we will focus on the proxy to the tax base. The literature deals with three main alternatives. The first proxy to the personal income tax base is a broad macroeconomic variable, as the GDP or the Gross Value Added (Martínez-Mongay et al., 2007), which is also our choice. The second option is the compensation of employees in its disaggregated form (employment * average compensation of employees). Finally, the third option relies on other macroeconomic variables (such as gross disposable household income and residential investment, Zack et al. 2014). In this latter approach, we should include the work of Cuerpo and Losada (2015), which present a detailed modelling of different tax bases (labour tax base, capital tax base and economic activity tax base) connected with many macroeconomic variables.

[Table 1]

3. Data

3.1 PIT revenues in the regional financing model

As we can see in Table 2, PIT revenues were the most relevant revenue source in 2012 (33.4 % of overall regional financing resources). In addition, it should be highlighted that PIT is by far the largest fraction of potential fiscal autonomy in the hands of ACs. The next most significant source of fiscal autonomy are traditional ceded taxes, although its relevance is much lower (13.0 % of overall regional financing resources). Therefore, it seems worthy to explore the fiscal autonomy determinants of personal income tax (see section 5).

[Table 2]

3.2 Selecting the proxy for the tax base

Nominal Gross Value Added has been selected as the proxy to our tax base. Our efforts will be addressed more to specification issues, than to a detailed modelling of different tax bases (e.g. Cuerpo and Losada, 2015). In addition, it is difficult to find at regional level enough data to implement such disaggregated framework. Lastly, we rather use GVA, unlike GDP, as the former does not include the value added tax, which presents noticeable changes in recent times.

In Figure 1 we can appreciate the higher volatility of Personal Income Tax revenues with respect to GVA. These differences suggest that the constant elasticity assumption may not be a valid approach.

[Figure 1]

3.3. Adjusting for tax reforms

As we have mentioned previously, we are interested in the relationship between PIT revenues and changes in economic activity. Therefore we should control for tax reforms which may be correlated with the business cycle. On the one hand, we should be especially cautious with central government reforms, since these reforms had the most relevant impact on revenues so far. Accordingly, we should remove the effect of discretionary changes in personal income tax revenues from central government reforms (for instance, change in tax rates, tax bases …). On the other hand, there were also regional tax reforms which should be adjusted. In fact, our focus is centred on the period previous to 2002, as a policy-neutral data is available since then. The autonomic tariff data is available without the incidence of central and regional governments tax reforms.

Box 1 discusses discretionary measures by the central government which have been a relevant source of variation of PIT revenues.

Box 1. Discretionary changes in personal income tax by central government

1988: minimum (top) marginal tax rates were increased (lowered), elimination of the maximum average rate, the obligation of the joint tax declaration for spouses was removed.
1996, 1997 and 2000: deflation of personal income tax rates.
1999: new definition of taxable income, decrease in the number of tax brackets, the maximum and minimum marginal tax rates were lowered (till 18% and 48%).
2003: decrease in the number of tax brackets, the maximum and minimum marginal tax rates were lowered (to 15% and 45%), increase in personal allowance, decrease in tax rates for patrimonial variation.
2007: the maximum and minimum marginal tax rates were lowered (till 0% and 43%), increase in personal allowance.
2008: tax relief for births + 400 € deduction.
2010: elimination of the 400 € deduction.
2011: elimination of tax relief for births. Increase in rates > 120.000€
2012: increase in rates.
2013: elimination of house-purchase deduction for new purchases.

We explored different strategies to deal with the effects of these tax reforms. One option is the inclusion of dummies that represent the impact of specific tax reforms on the growth rate of PIT revenues. This approach may be suitable if there are a limited number of relevant tax reforms. In this connection, the inclusion of dummies not only captures the effects of common tax reforms, but all the factors with a common pattern (including the economic cycle). It is important not to partial out (with the inclusion of dummies) the effects of the economic cycle on tax revenues, as our economic cycle indicator will enable us to make projections according to macroeconomic scenarios. In the Spanish case there have been many reforms in recent times which would suggest introducing a dummy variable almost every year since 2007. Therefore, this option was discarded. Nevertheless, it should be noted that this strategy seems suitable before the onset of the current crisis (see Martínez-Mongay 2007 for an implementation of this strategy).

Another approach consists on controlling for these reforms with the inclusion of a variable such as the average rate of personal income tax. In this regard, Zack et al. (2014) includes the ratio between PIT revenues and the GDP, although this strategy may introduce bias in the estimation of our parameter of interest (PIT revenues elasticity) as a transformation of the dependent variable is included as an explanatory variable. Our approach diverges from Zack et al. (2014) as we take advantage of data on a characteristic taxpayer, thereby avoiding endogeneity problems. We use the average income tax rate of a single person at 100% of average earnings with no child, that is, the income tax as a % of gross earnings (before 1996 the income tax is normalized by gross wages instead of gross earnings). This data comes from OECD's Taxing Wages report. For details on data sources, have a look at Appendix 3.

Figure 2 show the connection between the evolution of personal income tax revenues and the changes in the average rate of personal income tax, which is very strong until 2009. The decoupling of both variables may be due to the different evolution of the fiscal pressure of our characteristic taxpayer (which has increased) and the downward trend of capital tax bases and economic activity tax bases. Considering these caveats and regarding our analysis, this indicator is the best proxy to control for these discretionary measures for the period previous to 2002. From then on we keep this variable constant as our data is policy neutral.

[Figure 2]

3.4. Available sample and personal income tax data.

Before turning to the econometric analysis we point out that the available sample is 1987-2013. Our dependent variable (personal income tax revenues) is measured in accrual terms since what is ceded to the regions of Personal Income Tax (PIT) in a given year is not really a fixed fraction of the collection of

the fiscal period (PIT cash) but the yield of the autonomic tariff (PIT accrual), which is collected along two periods (the current, through monthly withholdings, excluding that of December, and the following one, when the declaration of the tax settlement and withholdings corresponding to December is carried out). Despite the fact that PIT was not been partially devolved until 1994, we found statistical information for each ACs dating from 1987.

Homogeneous data on autonomic tariff is available since 2002. We found data for the period 1997-2001, although it was not homogeneous as the percentage of cession depended on assumed responsibilities, which differed across common regime ACs. Therefore, we assumed the levels of the autonomic tariff since 2009. We extended our data backwards base on autonomic tariff data for the period 2002-2008. In this procedure, we adapted the PIT % of cession to 50 %. Then, we extended our data for the period 1987-2001 by means of total PIT revenues in accrual terms, that is, the sum of regional and central PIT revenues (we used the year-on-year changes in these series to extrapolate backwards our dependent variable). This historical data comes from AEAT.

4. Econometric analysis of Personal Income Tax elasticities

4.1. Modelling of Personal Income Tax elasticities and results

The time series approach to PIT revenues elasticities consists on modelling tax revenues in function of macroeconomic proxies that capture the dynamic of its tax bases. In this modelling we should explore the presence of a cointegration relationship between tax revenues and its tax bases, that is, the presence of a long-run relationship. If this is the case "*there exists an error-correction model that describes the short-run dynamics consistently with the long-run relationship, i.e. the Granger representation theorem which states that if a set of variables are integrated of the same order and cointegrated, then there exists a valid error-correction representation of the data*" (Verbeek, 2004, p.318).[2] Long run

[2] Some authors refine their strategy by estimating the long–run elasticity using dynamic ordinary least squares (DOLS) proposed by Stock and Watson (1993), which consists on adding leads and lags of the change of the explanatory variable in order to adjust for possible endogeneity and autocorrelation. In this empirical strategy one should be careful about overparameterization.

tax revenue elasticities reflects the progressivity of the PIT with respect to its base and other long run trends as tax fraud or tax evasion (Koester and Priesmeier, 2012), whereas short run elasticities capture the impact on PIT revenues of short run fluctuations in the tax bases. Institutional factors related to the regulation of the labour market or imperfect information issues regarding tax reforms may also contribute to the differences between short and long run reactions. Our dataset rejected the null hypothesis of no cointegration. Accordingly, we have adopted an error-correction representation of the data.

The approach of the most recent literature to the short run fluctuations of tax elasticities (since Bruce et al., 2006) also considers potential asymmetries. In this regard, results lead us to specify an asymmetry in the proxy to the tax base (and its lag), but not in the error correction term. A lag of our tax base variable is also included to capture the dynamic relationship between tax revenues and economic activity.

At this point we present our empirical framework. It should be noted that our equations include the average rate of PIT in order to control for the incidence of discretionary changes. As we mentioned previously, we avoid potential endogenity by including information of our characteristical taxpayer, independent from our dependent variable. This control variable is introduced in additive form as we rejected the multiplicative specification. Equation (1) and (2) are the long run equations in its multiplicative and additive form. Accordingly, we rejected in equation (2) the hypothesis $\beta = \gamma$. Equation (3) is our short term symmetric specification and equations (4) our short run asymmetric specification, where *F* is a dummy that takes 1 in below equilibrium years and 0 otherwise.

$$(1)\ lnPIT_{it} = \delta_i + \beta \ln(average\ rate_t * GVA_{it}) + \varepsilon_{it}$$

$$(2)\ lnPIT_{it} = \delta_i + \beta \ln(average\ rate_t) + \gamma \ln(GVA_{it}) + \varepsilon_{it}$$

$$(3)\ \Delta(lnPIT_{it}) = \alpha + \beta \Delta(\ln average\ rate_t) + \gamma_1 \Delta(\ln GVA_{it}) + \gamma_2 \Delta(\ln GVA_{it-1}) + \\ + \lambda \varepsilon_{it-1} + \upsilon_{it}$$

$$(4)\ \Delta(lnPIT_{it}) = \alpha + \beta \Delta(\ln average\ rate_t) + \gamma_1 F \Delta(\ln GVA_{it}) + \gamma_2 (1-F) \Delta(\ln GVA_{it}) + \\ + \gamma_3 F \Delta(\ln GVA_{it-1}) + \gamma_4 (1-F) \Delta(\ln GVA_{it-1}) + \lambda \varepsilon_{it-1} + \upsilon_{it}$$

Our symmetric specification (regression (1) in Table 3) enables us to compare our short and long run tax elasticities (1.18 [3] and 1.07 respectively) with the ones obtained in the Spanish empirical literature (see Table 1). Our estimates are in the low-band, very close to Martínez-Mongay et al. (2007) who also used GVA as a proxy to the tax base. Regression (ii) presents a full specification of the potential asymmetries which can be restricted to regression (iii) where we consider and asymmetry on our tax base variable (and its lag). A first check on fiscal forecasting performance indicates that the asymmetric specification outperforms its rival. The root mean squared error (RMSE) and the mean absolute error (MAE) statistics in Table 3 display the results for the *ex post* forecast period 2009-2011, where lower values indicates better accuracy. Furthermore, the dynamics that lies behind equation (3) is much more complex than equation (2), a simple error correction model. Thus, we provide some simulations in next section to assess the significance of our results.

[Table 3]

Regarding cross-sectional variability our data required fixed effects in the long run equations as well as region-specific tax elasticities both in the short and the long run. Equation (5) and (8) deal with long run and short run region-specific tax elasticities.[4] Our data rejected the equality constraint for tax elasticities and suggest considering its dependency on income per capita (see regression (iv) in Table 4, regression (vi) in Table 5 and Figure 3). Thus we allowed our tax base parameter to depend on income per capita in equation (6). Equation (7) presents the long run specification used in our empirical work (see reg. (v) in Table 4). From Figure 3 we expect γ_1 to be significant and negative, reflecting a decreasing pattern of regional tax elasticities with respect to per capita income (see reg. (v) in Table 4 for the long run estimates and reg. (vii) in Table 5 for the short run estimates), which is consistent with the pattern obtained by Sanz et al. (2014). In addition, this relationship is stronger in the long run, as it can be checked in Figure 3.

[3] That is, the sum of the contemporaneous and the lagged coefficient.
[4] We did not include a lag in the tax base variable to avoid overparameterization.

(5) $lnPIT_{it} = \delta_i + \beta \ln(average\ rate_t) + \gamma_i \ln(GVA_{it}) + \varepsilon_{it}$

(6) $lnPIT_{it} = \delta_i + \beta \ln(average\ rate_t) + \gamma_r \ln(GVA_{it}) + \varepsilon_{it}$,

where $\gamma_r = \gamma_0 + \gamma_1 \ln\left(\frac{GVA_{it}}{POP_{it}}\right)$

(7) $lnPIT_{it} = \delta_i + \beta \ln(average\ rate_t) + \gamma_0 \ln(GVA_{it}) + \gamma_1 \ln(GVA_{it}) * \ln\left(\frac{GVA_{it}}{POP_{it}}\right) + \varepsilon_{it}$

(8) $\Delta(lnPIT_{it}) = \alpha + \beta\Delta(\ln average\ rate_t) + \gamma_i \Delta(\ln GVA_{it}) + \lambda\varepsilon_{it-1} + \upsilon_{it}$

[Table 4]

[Table 5]

[Figure 3]

4.2 Dynamic adjustment between short-run and long-run elasticities: simulated elasticities and fiscal pressure scenarios

The empirical literature on Spanish PIT elasticities deals with either short-run or long-run elasticities. To our knowledge, there is no discussion of the dynamic adjustment between the two (see a discussion of the German case in Koester and Priesmeier, 2012).

As mentioned previously, to assess the dynamics of the asymmetric specification (regression (iii)) it is convenient to provide some simulations as it is very hard to derive analytically its properties. Two groups of simulations are provided. To start with we assess the dynamic adjustment between short run and long run elasticities when we are above or below the long run equilibrium. We have simulated the impact of a 10% increase and a 10% decrease of GVA on PIT revenues. Results are displayed in Figure 4. When PIT revenues are above the long run equilibrium the impact leads to an overreaction effect, that gets corrected until the long run value is achieved. When PIT revenues are below, a typical error correction model response is obtained, with a mean delay of 0.49. The ratio PIT revenues over GVA (see Figure 5) displays the implications in terms of fiscal pressure. In this regard it is interesting to check the progressivity nature of PIT. The fiscal pressure increases or decreases depending on the sign of the shock.

[Figure 4]

[Figure 5]

The second group of simulations considers only the above equilibrium scenarios. We provide 4 scenarios to evaluate the outcomes of these overreaction effects on simulated elasticities and fiscal pressure. This scenarios consist on sustained trajectories of GVA growth of 2%, 3%, 4% and 5% respectively.

Long term simulation elasticities increase with higher sustained GVA growth rates (see Figure 6). One possible explanation of this behaviour is the tax overreaction in the above equilibrium situation. The overreaction with respect to the first GVA growth is added to the overreaction with respect to the second GVA growth, and so forth, and since the income is always increasing, the dynamic elasticity ends up above the static elasticity obtained from the long term equilibrium solution. These results are somehow consistent with the progressive nature of PIT and one of its consequences is the increasing fiscal pressure in higher sustained GVA growth environments (see Figure 7).

[Figure 6]

[Figure 7]

5. Evaluation of fiscal autonomy in regional Personal Income Tax

In this section, we will examine the role of regional fiscal autonomy in PIT and its determinants. As far as we know, the literature has taken a descriptive approach on this issue (see, e.g., Duran and Esteller, 2004; Lago, 2007; Solé-Ollé, 2013; Cuenca, 2014; Laborda and Zabalza, 2015). Therefore, in addition to a descriptive analysis, it would be of special interest to provide an econometric approach. In this regard, we will analyse several factors that could lie behind the discretionary fiscal policy regarding PIT: the response to the electoral-cycle, to the cyclical conditions as well as to the budget balance situation.

5.1 Descriptive analysis

Since 1997 ACs are enabled to change elements of PIT, although the effective exercise can be reduced to minor tax deductions and tax credits until the onset of the global crisis. By contrast, since 2011 ACs has been particularly active in modifying PIT schedule. In Box 2 we present the evolution of fiscal autonomy concerning PIT, while Figure 8 summarizes the main discretionary changes in PIT regional rates.

Box 2. Tax autonomy of regional government concerning Personal Income Tax

Before 1994: no tax autonomy in PIT.
1994 -1996: no tax autonomy in PIT. 15% tax sharing.
1997-2001: Increase of tax autonomy (power over tax credits, tax deductions and tax rates). ACs were entitled to 30% of PIT when education responsibilities were transferred, but they were only enabled to modify 15% (although some ACs didn't accept this new agreement).
2002-2008: Increase of tax autonomy. The share of PIT rises to 33%. Increase of tax autonomy.
2009: Increase of tax autonomy (more power over tax rates, personal and family allowances with +- 10% band). The share of PIT rises from 33 to 50%.

According to PIT rates we can group ACs in the ones with a lower rate than the central government (La Rioja and Madrid), the ones which have always applied the central government rate (Galicia, Aragon, Castile-La Mancha, Balearic Islands, and Castile and Leon) and the ones which have increased its rate. In fact, most of the increases took place since 2011.

[Figure 8]

PIT discretionary revenues had been always negative, although before 2009 regional governments presented a looser fiscal policy (see Figure 9). Since 2009

ACs reduced partly the fiscal benefits given in good times, to the extent that some of them have increased their tax rate. At first sight, from Figure 9, it seems that ACs PIT policy has contributed to the stability of public finances but at the cost of being procyclical. The following econometric analysis tries to identify these issues.

[Figure 9]

5.2. An econometric approach to the determinants of discretionary Personal Income Tax Revenues: some results and limitations

In this section we analyse several factors that could lie behind the change of PIT discretionary revenues over PIT revenues ($\Delta DR\_PIT/PIT$): the response to the electoral-cycle (*ECYCLE*, a dummy that takes value 1 in election years and zero otherwise), to the cyclical conditions (*ΔlnGVA*) as well as to the primary budget balance situation (*PBB*).[5] Appendix 3 provides details on data sources.

The estimated equation presents a specification very similar to a fiscal reaction function (see for instance Galí and Perotti, 2003):

$$(9)\ \Delta\frac{DR\_PIT_{it}}{PIT_{it}} = \gamma_1 + \gamma_2\Delta(lnGVA_{it}) + \gamma_3 PBB_{it-1} + \gamma_4 ECYCLE_{it} + u_{it}$$

Results are displayed on Table 6. The estimated model presents a low R-squared value (0.08) and only the primary budget balance situation is significant. This poor result reflects a short-sample (2003-2013), but more

[5] Primary budget balance of each AC is computed according to budgetary criteria both regarding to the institutional scope covered as well as to the accounting rules. This data relates to all the public units included in the consolidated budget of each AC. In addition, we adjust the dependent variable according to de la Fuente (2013) and Lago and Fernández (2013). On the one hand, we make corrections for the negative settlements from the funding system (for years 2008 and 2009), whose payments were deferred. We do as if these negative results were cancelled in 2010 and 2011 respectively (as provided initially by law), and accordingly we do not apply revenue withholdings in 2011, 2012 and 2013 (to give back those deferred payments). On the other hand, we do adjustments related to outstanding invoices (misplaced public expenditure), which are captured by annual changes in accounts payable for accrued liabilities. After these adjustments our data is very close to national accounts criteria. In addition, as in Lago and Fernández (2013), we present the primary budget balance normalized by non-financial revenues (adjusted by FEOGA revenues and local fund revenues).

importantly a lack of variability on our dependent variable. In fact, fiscal activism in personal income taxation starts with the onset of the crisis, and in particular for fiscal consolidation purposes. In fact, this is what the estimated model reflects. Nevertheless, all the variables take the expected sign as we expected a procyclical behaviour of PIT discretionary revenues, a negative reaction of the primary budget balance, a negative reaction of the electoral cycle and a positive effect of the % of left-wing seats.

[Table 6]

6. Conclusions

The instability of public finances of public finances since the onset of the last global crisis has placed more attention to tax elasticities as a tool for guiding revenue forecasting. PIT is the most relevant revenue source of ACs and it could in fact gain relevance in the next reform of the regional financing model, as some authors (Cuenca, 2014; Lago Peñas and Martínez Vázquez, 2015) have claimed a full cession of PIT.

PIT tax elasticities are used for cyclical adjustment methods as well as for revenue forecasting purposes. The common PIT elasticity assumption may be suitable concerning cyclical adjustment methods (used to obtain structural budget balances) but fails if our purposes focus on forecasting. In this work we obtain short and long run elasticities taking into account potential asymmetries. It is important to identify the relative position with respect to long run trajectories as different dynamic processes drive PIT revenues behaviour. The dynamic adjustment between short and long run elasticities illustrates the different patterns involved in above and below equilibrium environments. In addition, our results allow the progressivity nature of PIT to be contrasted in different scenarios.

The common PIT elasticity assumption also fails when considering the regional dimension. Our analysis identifies a decreasing pattern of short and especially

long run elasticities with respect to per capita income. Thus, this cross-sectional variability may be valuable for tax revenues forecasting. Furthermore, it may be worth considering these region-specific elasticities when measuring structural budget balances.

The analysis of fiscal autonomy in regional PIT, the most important tax in terms of ACs potential fiscal autonomy, suggest that the effective exercise can be reduced to minor tax deductions and tax credits until the onset of the global crisis. Results suggest that AC budget constraint is strengthening as PIT discretionary revenues have reacted to the recent budget imbalances.

In near future it would interesting to extend the analysis of tax elasticities to other regional tax figures such as the taxes on financial and capital transactions which have challenged regional public finances in Spain as a result of the real state cycle.

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Appendix 1. Tables

Table 1. Empirical works on personal income tax elasticities in Spain

	Dataset	Dependent variable	Adjustment for tax reform effects	Method	Proxy to tax base	Elasticity	
						short-term	long-term
Bouthevillain et al. (2001)	1970-1998	nominal tax revenues (labour component)	dummies	OLS & ECM & tax laws and detailed revenue data	employment private sector, compensation per private sector worker	1,0 1,5	
Corrales et al. (2002)	1970-2001	nominal direct taxation (deviation from potential values)		Unobserved Components Model	output gap	1.5	
Girouard & André (2005)	2003	nominal tax revenues (labour component)		tax laws and detailed revenue data	gross income	2.1	
Martínez-Mongay et al. (2007)	1975-2006	nominal tax revenues	dummies	ECM	modified GVA[1] GVA GDP	0.9 1.3 1.4	1.2 1.3 1.3
Sanz Sanz et al. (2014)	2008	nominal tax revenues		tax laws and detailed revenue data	gross income	1.5	
Price et al. (2014)[2]	2010	nominal tax revenues		tax laws and detailed revenue data	gross income	1.9	
Zack et al. (2014)	1986-2010	nominal tax revenues	inclusion of average tax rate	ECM & DOLS	gross disposable household income, average tax rate, nominal residential investment	0.43 0.18 0,20	0.90 0.14 0.14
Cuerpo & Losada (2015)	1995-2013	labour tax base, capital tax base and economic activity tax base		ECM Detailed modelization of different tax bases	macroeconomic variables	-	-

Notes:

wrt (with respect to), GVA (Gross Value Added), ECM (Error Correction Model), DOLS (Dynamic OLS).

[1] modified GVA: Modified according to PER-based profits. Calculated as the sum of contemporaneous and one lagged impacts.

[2] wrt Girouard & André (2005), inclusion of other personal income components (self-employment and capital incomes in addition to earnings).

Table 2. Regional revenue sources in Spain, 2012
billion €

Personal Income Tax	33.4
VAT	25.2
Other indirect taxes	12.3
Traditional ceded taxes[1]	13.0
Tax revenues	84.0
Transfers[2]	16.1
Non-earmarked revenues (regional financing model)[2]	100.0

Source: own elaboration from Generalitat de Catalunya.
Notes: tax revenues in normative terms.

[1] Traditional ceded taxes are assigned fully to ACs, which include inheritance and gift taxes, taxes on financial and capital transactions, recurrent taxes on net wealth until 2008 (at the moment there is a 100% tax benefit and taxes on betting and gambling).

[2] Transfers and non-earmarked revenues include specific responsabilities.

Table 3. Asymmetric modeling of regional Personal Income Tax elasticities
common regime ACs

	(i)	(ii)	(iii)
Long run. Dependent variable = Personal Income Tax revenues			
Constant	-5.04	-5.04	-5.04
	(-33,06)***	(-33,06)***	(-33,06)***
Nominal Gross Value Added (GVA)	1.07	1.07	1.07
	(109,12)***	(109,12)***	(109,12)***
Average rate of Personal Income Tax	0.38	0.38	0.38
	(5,66)***	(5,66)***	(5,66)***
Short run. Dependent variable = Δ Personal Income Tax revenues			
Constant	0.00	0.00	0.00
	(-0.24)	(-0.53)	(-0.34)
Δ GVA	1.02		
	(23.97)***		
Δ GVA * F		0.83	0.80
		(14.59)***	(14.37)***
Δ GVA * (1-F)		1.16	1.14
		(22.96)***	(22.73)***
Δ GVA (-1)	0.16		
	(3.77)***		
Δ GVA (-1) * F		0.01	0.02
		(0.22)	(0.31)
Δ GVA (-1) * (1-F)		0.26	0.27
		(5.22)***	(5.39)***
Δ Average rate of Personal Income Tax	0.83		0.71
	(12.41)***		(13.24)***
Δ Average rate of Personal Income Tax * F		0.75	
		(13.75)***	
Δ Average rate of Personal Income Tax * (1-F)		0.51	
		(7.53)***	
Error correction term	0.30		0.49
	(11.51)***		(16.61)***
Error correction term * F		0.49	
		(12.42)***	
Error correction term * (1-F)		0.45	
		(10.03)***	
Short run statistics			
Number of observations	390	390	390
Sample	1987-2013	1987-2013	1987-2013
Adjusted R2	0.72	0.79	0.78
RMSE 2009-2011[1]	0.073	-	0.057
MAE 2009 2011[1]	0.057	-	0.044

Notes: short run regressions are estimated by Panel EGLS (Cross-section SUR weights).
*** signification at 99% & ** 95% & * 90%. t-statistics are reported between parentheses.
[1] Estimation sample 1987-2008. *Ex post* forecasts 2009-2011.
Long run regressions are estimated by Panel Least Squares including Fixed Effects.
F is a dummy that signals below equilibrium scenario.
Error correction term = long run value of Personal Income Tax Revenues (t-1) - Personal Income Tax Revenues (t-1).
All variables expressed in logs.

Table 4. Long run regional Personal Income Tax elasticies
common regime ACs

	(iv)		(v)	
Dependent variable = Personal Income Tax revenues				
Constant	-5.04	(-35.23)***	-6.86	(-11.48)***
Nominal Gross Value Added (GVA)			1.45	(11.99)***
GVA * (GVA per capita)			-0.02	(-3.14)***
Average rate of Personal Income Tax	0.37	(5.97)***	0.39	(5.91)***
GVA				
Andalusia	1.10	(35.53)***		
Aragon	1.00	(30.81)***		
Asturias	1.09	(28.92)***		
Balearic Islands	1.03	(36.6)***		
Canary Islands	1.00	(33.42)***		
Cantabria	1.07	(32.21)***		
Catalonia	1.00	(32.67)***		
Castile and León	1.09	(30.17)***		
Castile–La Mancha	1.18	(38.7)***		
Extremadura	1.16	(35.36)***		
Galicia	1.10	(32.9)***		
Madrid	0.96	(34.13)***		
Murcia	1.15	(39.58)***		
La Rioja	1.09	(34.67)***		
Valencian Community	1.11	(35.46)***		
Long run statistics				
Number of observations	405		405	
Sample	1987-2013		1987-2013	
Adjusted R2	0.99		0.99	

Notes: long run regressions are estimated by Panel Least Squares including Fixed Effects.

*** signification at 99% & ** 95% & * 90%. t-statistics are reported between parentheses.

All variables expressed in logs.

Table 5. Short run regional Personal Income Tax elasticies
common regime ACs

	(vi)		(vii)	
Dependent variable = Δ Personal Income Tax revenues				
Constant	-0.01	(-1.54)	0.00	(0.28)
Δ Nominal Gross Value Added (GVA)			3.24	(7.14)***
Δ GVA * (GVA per capita)			-0.23	(-4.74)***
Δ Average rate of Personal Income Tax	0.83	(12.53)***	0.89	(15.05)***
Error correction term	0.39	(11.58)***	0.41	(12.05)***
Δ GVA				
Andalusia	1.10	(19.44)***		
Aragon	0.97	(14.66)***		
Asturias	1.00	(14.82)***		
Balearic Islands	1.00	(14.32)***		
Canary Islands	0.99	(15.63)***		
Cantabria	0.92	(14.33)***		
Catalonia	1.06	(19.68)***		
Castile and León	0.96	(12.64)***		
Castile–La Mancha	1.09	(14.18)***		
Extremadura	1.07	(13.43)***		
Galicia	1.05	(16.08)***		
Madrid	0.97	(13.97)***		
Murcia	1.11	(14.66)***		
La Rioja	1.07	(11.21)***		
Valencian Community	1.17	(16.07)***		
Short run statistics				
Number of observations	390		390	
Sample	1987-2013		1987-2013	
Adjusted R2	0.70		0.73	

Notes: all regressions are estimated by Panel EGLS (Cross-section SUR weights).
*** signification at 99% & ** 95% & * 90%. t-statistics are reported between parentheses.
F (dummy that signals below equilibrium scenario).
Error correction term = long run value of Personal Income Tax Revenues (t-1) - Personal Income Tax Revenues (t-1)
Look at Table 4 for long run estimates.
All variables expressed in logs.

Table 6. Fiscal autonomy determinants in regional Personal Income Tax

common regime ACs

Dependent variable: Δ (Personal Income Tax Discretionary revenues / Personal Income Tax revenues)

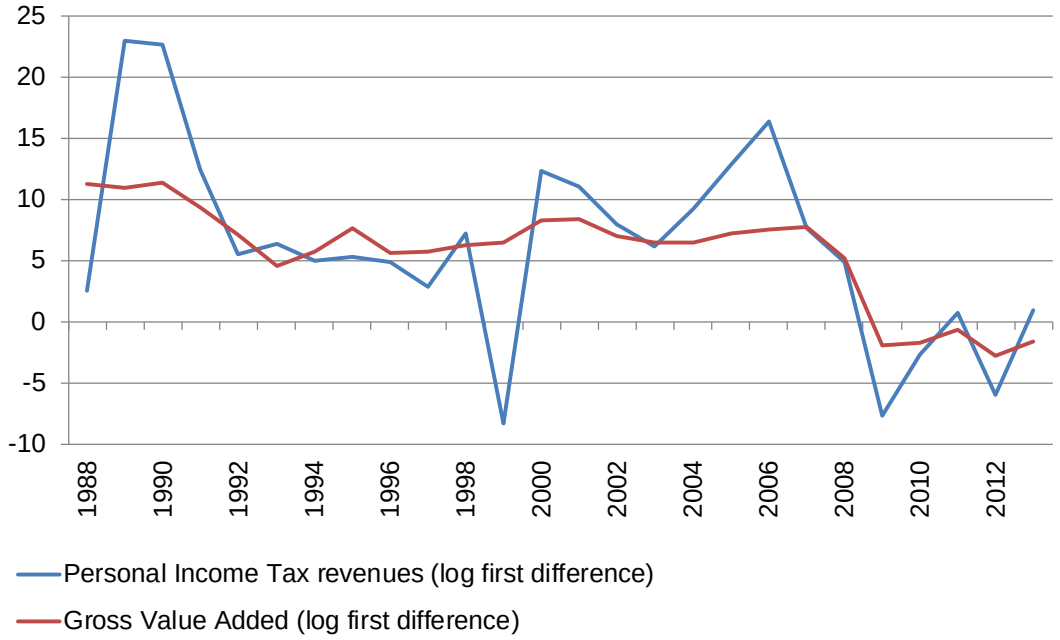
	(viii)
Constant term (x1000)	-0.57
	(-0.59)
Δ Nominal Gross Value Added (x1000)	-6.38
	(-1.18)
Primary budget balance / non financial revenues (-1) (x1000)	-3.75
	(-2.04)**
Electoral cycle (dummy) (x1000)	-0.21
	(-0.58)
% of left-wings seats (x1000)	1.20
	(0.66)
Number of observations	165
Sample	2003-2013
Adjusted R2	0.08
F-statistic (p-value)	4.60 (0.00)

Notes: regressions are estimated by Panel EGLS (Cross-section weights).

*** signification at 99% & ** 95% & * 90%. t-statistics are reported between parentheses.

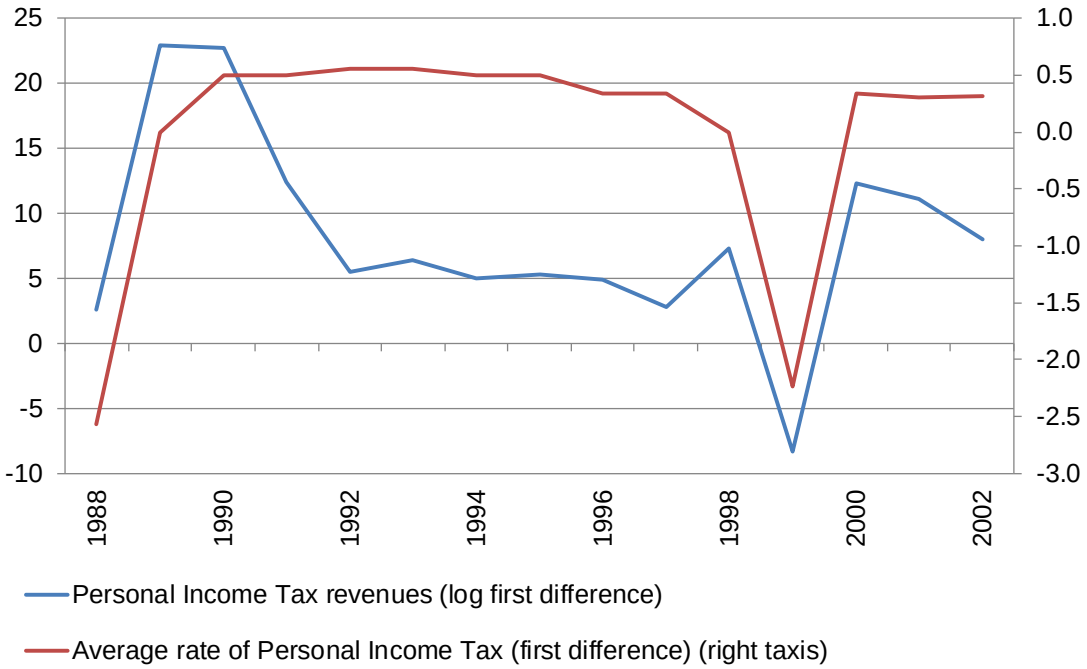
Appendix 2. Figures

Figure 1. Personal Income Tax revenues and Gross Value Added
common regime ACs



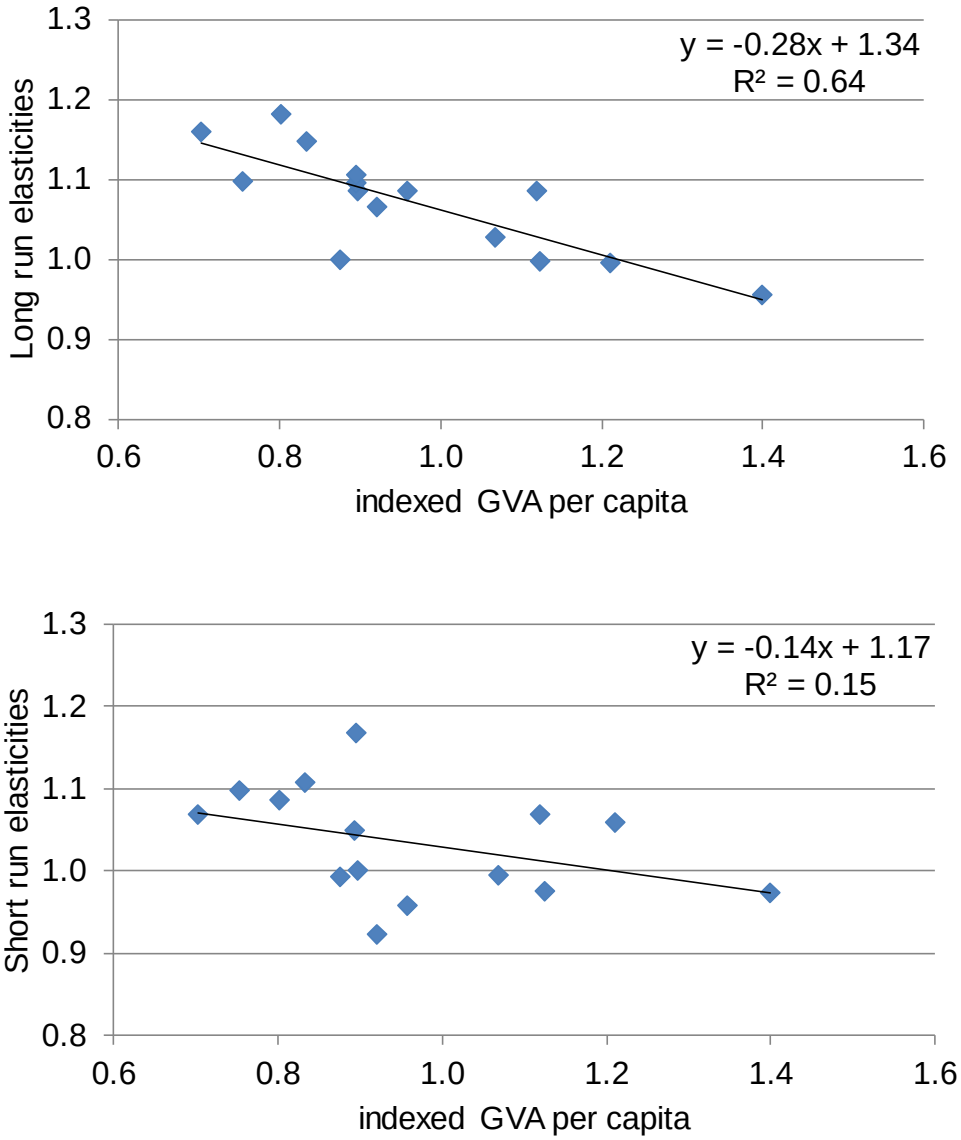
Sources: AEAT, Ministerio de Hacienda, BDMORES and INE.

Figure 2. Personal Income Tax revenues and average rate of Personal Income Tax



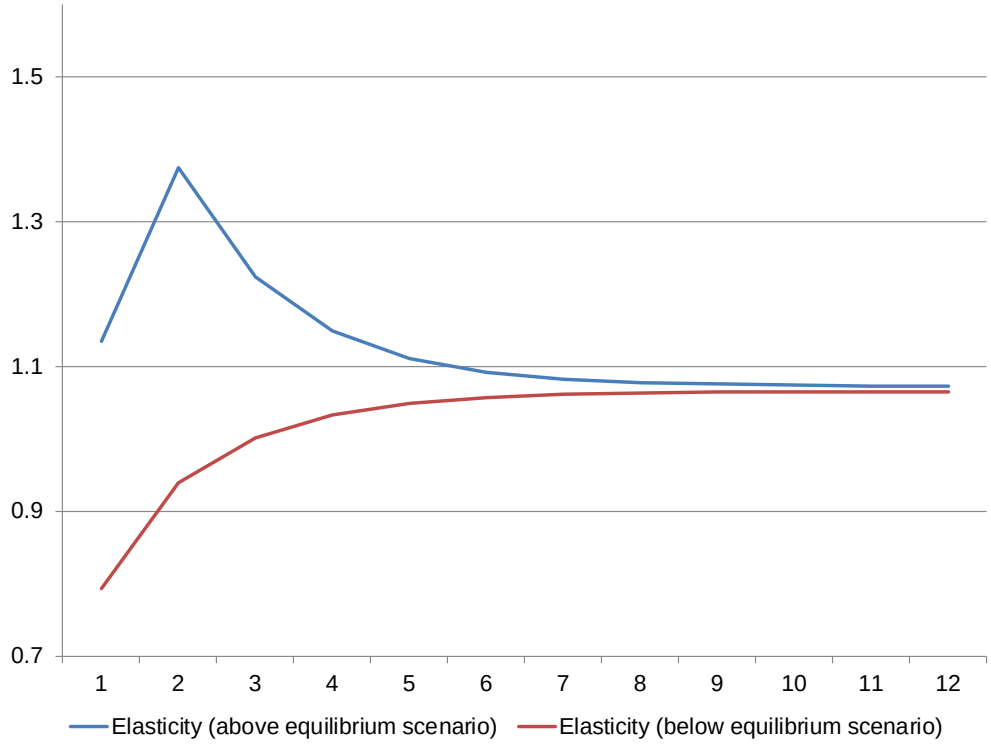
Notes:
Personal Income Tax revenues of common regime ACs.
Average rate of Personal Income Tax (General Government statistics).
Sources: AEAT, Ministerio de Hacienda and OECD.

Figure 3. A decreasing pattern of regional Personal Income Tax elasticities wrt per capita income



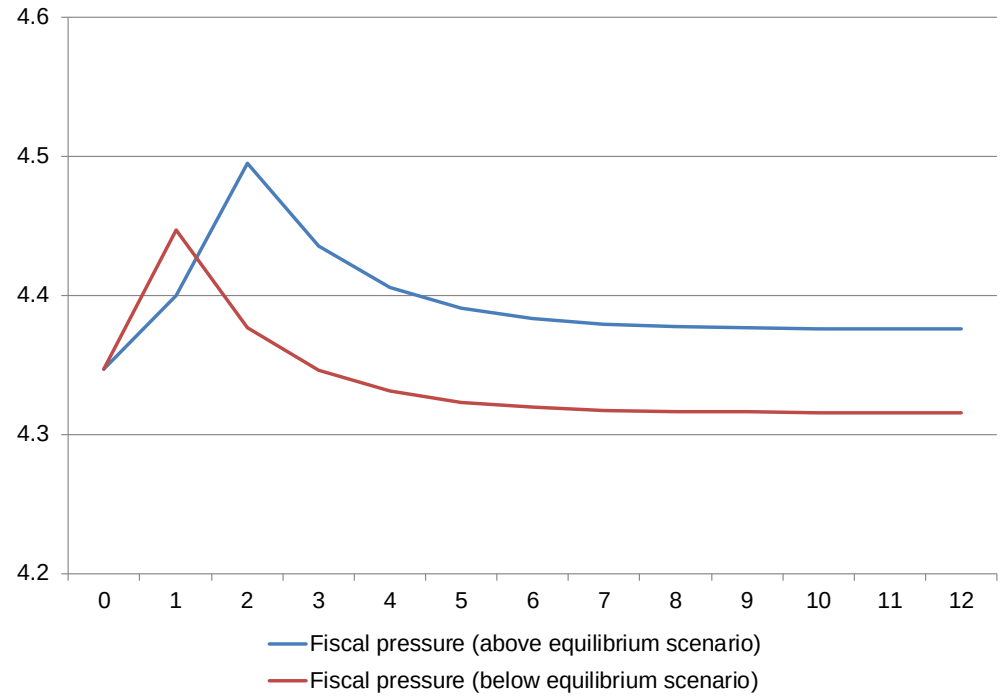
Notes: short and long run estimates from Table 4 and 5.
Indexed GVA per capita (common regime ACs =1.00)

Figure 4. Simulated elasticities. Above and below equilibrium scenarios



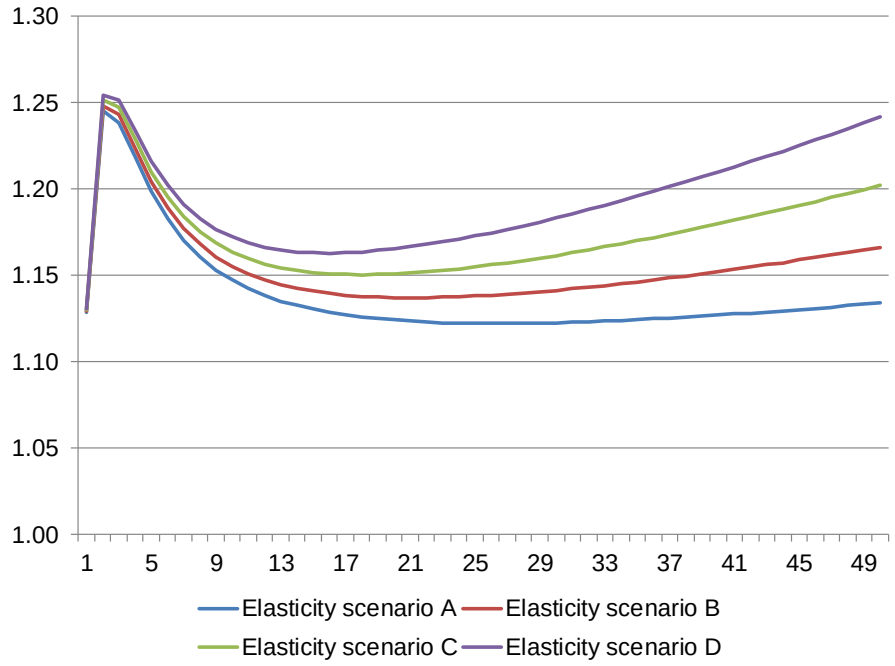
Notes:
Above equilibrium scenario: a 10 percent increase in Gross Value Added.
Below equilibrium scenario: a 10 percent decline in Gross Value Added.
Simulated elasticities are obtained from regression (3).

Figure 5. Simulated fiscal pressure. Above and below equilibrium scenarios



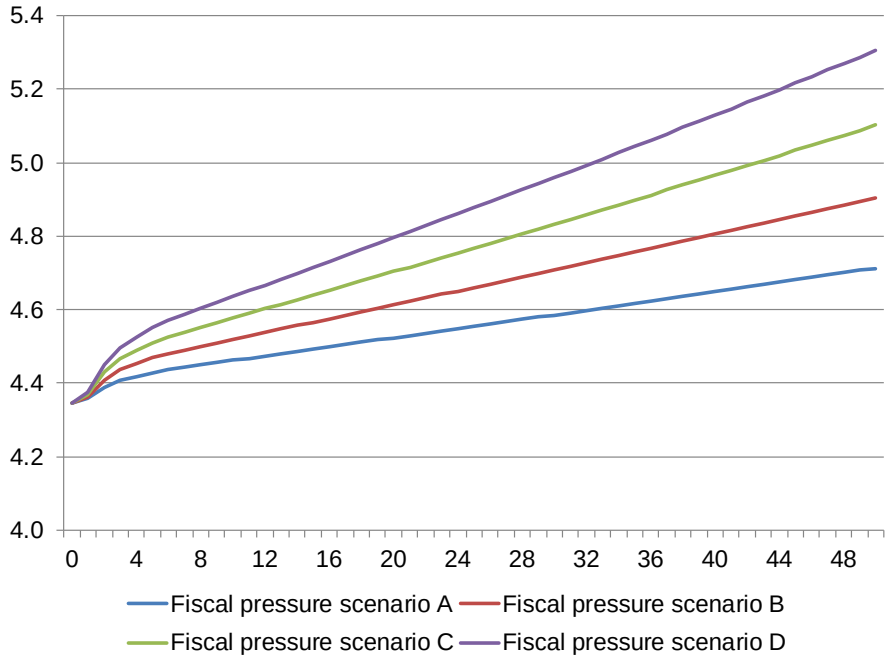
Notes: idem as the previous Figure.
Fiscal pressure: PIT revenues as a % of GVA.

Figure 6. Simulated elasticites in a sustained economic growth environment
Above equilibrium scenarios



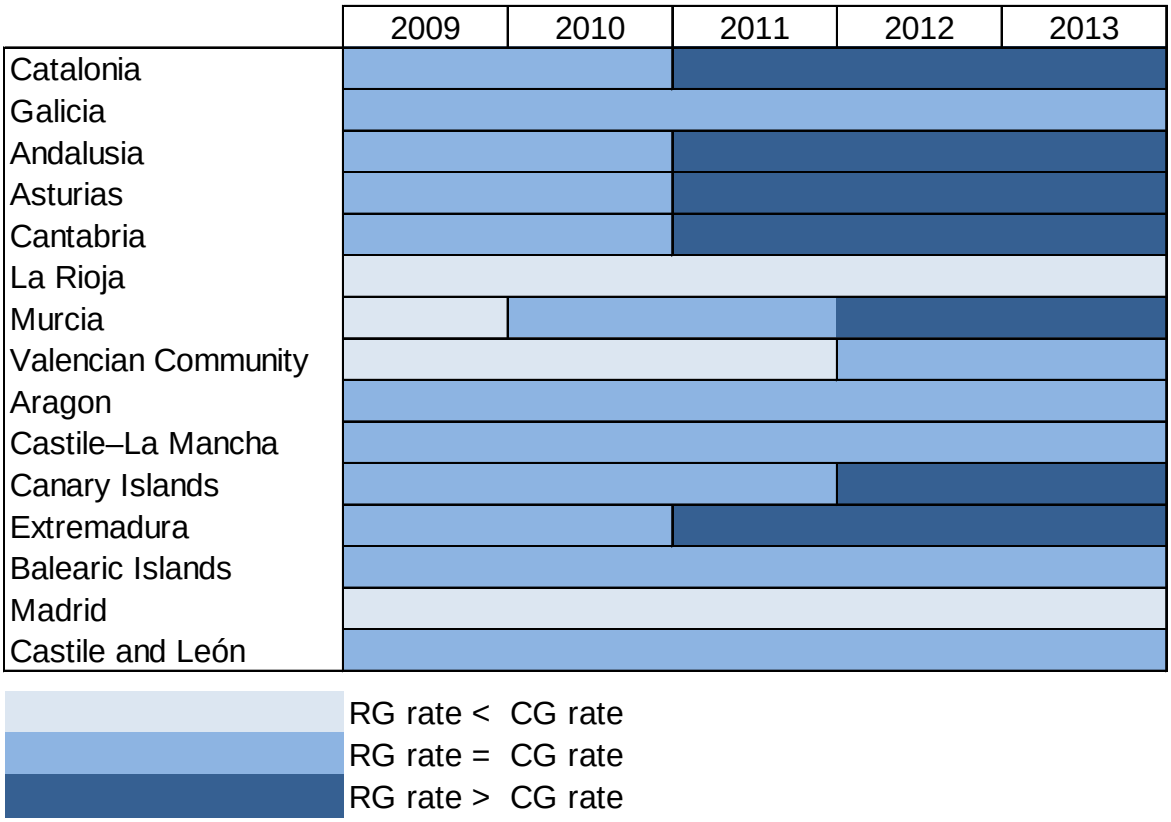
Notes:
Scenario A: 2 % growth of Gross Value Added (GVA).
Scenario B: 3 % growth of GVA.
Scenario C: 4 % growth of GVA.
Scenario D: 5 % growth of GVA.
Simulated elasticities are obtained from regression (3).

Figure 7. Simulated fiscal pressure in a sustained economic growth environment
Above equilibrium scenarios



Notes: idem as the previous Figure.
Fiscal pressure: PIT revenues as a % of GVA.

Figure 8. Discretionary changes in Personal Income Tax rates by regional governments

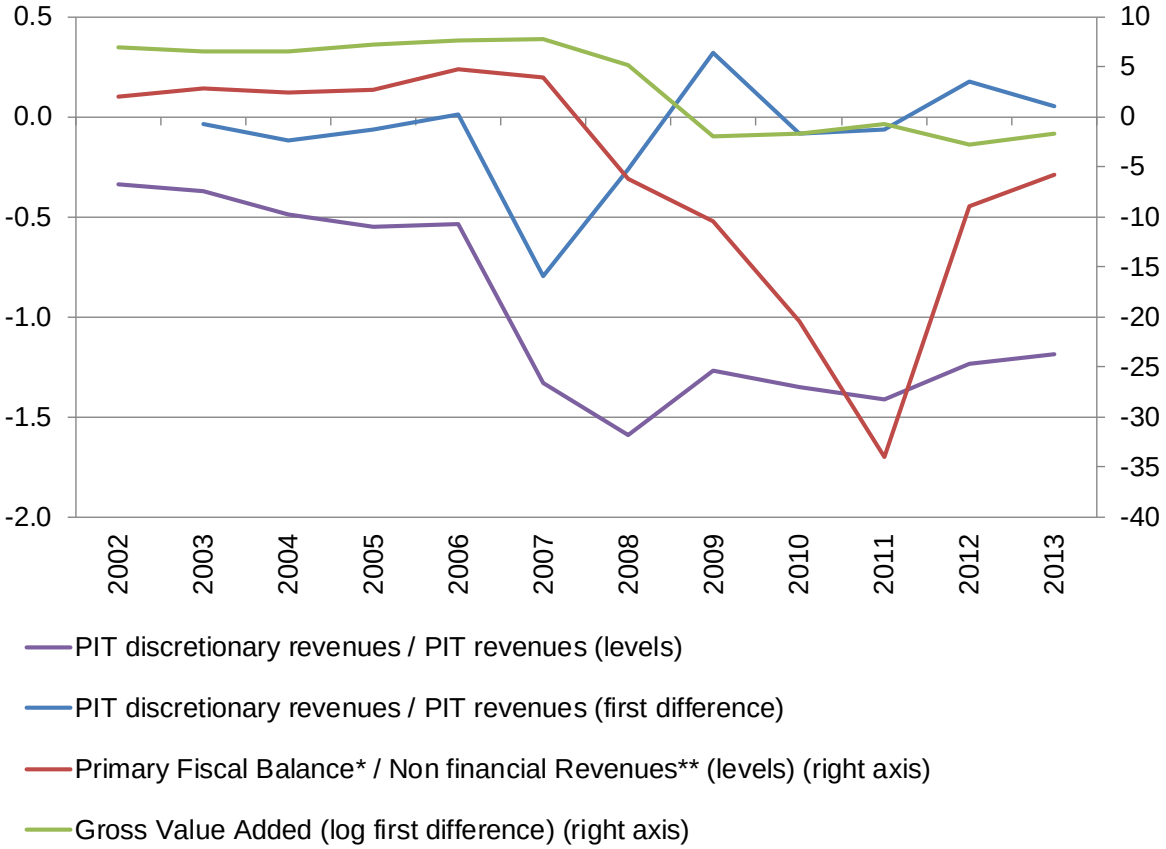


Source: Generalitat de Catalunya (2014).

Notes: CG (RG) stands for central (regional) government.

Figure 9. PIT discretionary revenues / PIT revenues, Gross Value Added and primary fiscal balance* / non financial revenues**

common regime ACs



Notes: * adjusted by 2008, 2009 negative settlements and misplaced public expenditure.
** adjusted by FEOGA revenues and local fund revenues.
Sources: AEAT, Ministerio de Hacienda y Administraciones Públicas, BDMORES and INE.

Appendix 3. Data sources

Average rate of Personal Income Tax: OECD. Taxing Wages.

Personal Income Tax discretionary revenues / PIT revenues: Ministerio de Hacienda y Administraciones Públicas. For further details see section 3.4.

Electoral $cycle_{it}$: own elaboration from Ministerio del Interior.
http://www.infoelectoral.mir.es/

Gross Value Added and population: BDMORES for the period 1987-2000 (Ministerio de Hacienda y Administraciones Públicas) and INE for the period 2000-2014.

Left-wing seats: own elaboration based on
http://www.argos.gva.es/ahe/indexv.html

Personal Income Tax revenues: AEAT and Ministerio de Hacienda y Administraciones Públicas. For further details see section 3.4.

Primary budget $balance_{it}$ / non-financial revenues : Liquidación de Presupuestos de las Comunidades y Ciudades Autónomas. Ministerio de Hacienda y Administraciones Públicas. For further details see footnote 5.