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Subnational Taxation and Public Indebtedness in Contemporary Spain

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Abstract

This study assesses fiscal sustainability in contemporary Spain at the regional level. Spain consists of 17 autonomous regions, two fiscal regimes differing in taxing autonomy, and two path-dependent types of communities with more and less legislatively recognized autonomy. Three of the 17 autonomies do neither have any fiscal power over ceded taxes nor the option to grant tax credits. This structure allows us to apply panel unit root and stationarity tests to sub-samples of autonomies to check for fiscal sustainability in the sense of adhering to an intertemporal budget constraint. Only for the clear-cut fiscally autonomous regimes of Navarro and Basque Country, endowed with ample statutory privileges in the collection of taxes, time series properties accord with the notion of sustainability based on expected-value budget constraints.

JEL-Code: H600, H710, C220, C230.

Keywords: decentralization, public debt, primary surplus, taxation, unit root.

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1 Introduction

This study seeks to assess fiscal sustainability, in the sense of intertemporally balanced budgets, by examining unit root and panel stationarity properties of central fiscal variables for panels consisting of differently defined entities in Spain. To this end, we rely on quarterly and annual series that range, at least, from the 1990s to the 2010s. The cross-section dimensions are given by Spanish institutional idiosyncrasies that allow us to relate the panels to different hypotheses regarding fiscal autonomy and decentralization. Since the late 1970s, contemporary Spain consists of 17 autonomous communities (*Communidades Autónomas*),[1] two fiscal regimes differing in taxing autonomy through statutory privileges across major tax categories levied on their territory (*Régimen Foral* and *Régimen Común*), and two path-dependent types of communities –some with more and some with less legislatively recognized autonomy– due to a distinct historical and cultural identity (*Nacionalidades*). Additionally, there are three exceptional cases of autonomous regions (*Communidades Especiales*) that are especially restricted in terms of fiscal power as regards configurational rights in the territorial collection of ceded taxes and in the granting of tax credits within the territorial collection of personal income tax (PIT). In fact, they do not have any power with regard to both. The possibility to structure the economy along the sketched four dimensions allows us to apply panel unit root and panel stationarity tests, respectively. Only for the regimes of Navarro and Basque Country that operate under the *Régimen Foral*, which allows them to autonomously collect all taxes levied on their territory and to relatively freely set their tax structure, time series properties fulfill sustainability conditions based on expected-value budget constraints (Trehan and Walsh, 1988; Bohn, 1998, 2005).

We interpret our findings as evidence for the strand of literature stressing the role of taxing autonomy and regional tax competition for fiscal sustainability. In contrast, our results do not speak in favor of a historically grown legitimacy, in the sense of intra-

[1] Since 1995 the two Spanish cities Ceuta and Melilla in Northern Africa officially became two autonomous cities (*Ciudades Autónomas*). Due to data limitations we exclude them from our analysis.

and inter-jurisdictional administrative and political standing, of the subnational entity playing a crucial role for the sustainability of fiscal policy at the regional level.

Longitudinal and time series analysis test results suggest other channels through which decentralization might impact on fiscal variables and sustainability rather not to matter in the case of Spain. This includes prominent routes of explanation such as enhanced preference matching or local needs responsiveness through decentralization (Oates, 1999; Faguet, 2004). In these approaches, decentralization mainly refers to decentralized task assignment in a rather broad sense as in the case of the *Communidades Autónomas* in general or more extended in the case of the *Nacionalidades* in particular. It does not refer to actual taxing autonomy as in the case of the *Régimen Foral*. The same applies to approaches of enhanced accountability and political participation as well as reduced rent seeking and informal market activity through decentralization (Seabright, 1996). Similarly, the positive link between tax decentralization and public deficits predicted by the literature suggesting a softening of subnational budgets through the reliance on bailouts and corresponding strategic behavior (Wildasin, 1997; De Mello, 2000; Goodspeed, 2002) as well as by the literature stressing the impediments of coordinating budget consolidations induced by decentralization (Tsebelis, 1995; Wibbels, 2000) is not confirmed.

The remainder of the paper is organized as follows. Section 2 gives an overview of theoretical work related to our study. In Section 3 we outline the concept of sustainability based on intertemporal budget constraints that is used in the proceeding empirical analysis set out in Section 4 and Section 5. Section 6 concludes.

2 Theoretical considerations

In the following we focus on works considering different shades of fiscal autonomy against the backdrop of analyzing the link between different degrees of autonomy and intertemporally balanced budgets. Thus, we abstract from discussing more general approaches that compare polar systems (e.g. Goodspeed, 2002) or that analyze the relationship between decentralization and productivity-enhancing policies (Weingast, 2009) which might

indirectly impact on the sustainability of fiscal policy, for example, through arguments of dynamic efficiency (Blanachard and Weil, 2002).

Studies analyzing the relationship between public indebtedness and decentralization at the subnational level within a particular country habitually aim to deal with a relatively stable and comparable cultural and historical environment (Baskaran, 2012). Notably, for Spain this is not the case: The Spanish federal system is characterized by quite some variation among its federal entities, i.e. its autonomous communities. It concerns, in particular, the two central dimensions: historically grown legitimacy (*Nacionalidades*), in the sense of intra- and inter-jurisdictional administrative and political standing, and taxing autonomy (*Régimen Foral*). These two dimensions are also key concepts in the theoretical literature that relates different shades of fiscal decentralization and fiscal autonomy to the intertemporal fiscal stability of the public sector.

First, historical legitimacy, for example, allows a community to oppose more effectively the imposition of additional spending responsibilities by the central government on the subnational level (Baskaran, 2012). This legitimacy might originate from some legislatively recognized administrative rights and competencies. In general, the higher this political standing, fostered by the backing of a population aware of its distinct historical and cultural roots (Rodriguez-Pose and Gill, 2003), the lower is the propensity to run excessive public deficits at the subnational level. This relationship turns out to be U-shaped if some subnational entities are so politically powerful as to force the federal government to bail them out from time to time.[2]

Secondly, in the public choice tradition (Hayek, 1948, p. 258-260; Tiebout, 1956; Brennan and Buchanan, 1980; Baskaran, 2010) taxing autonomy and implied tax competition[3] among subnational entities is seen as taming Leviathan governments by forcing them to refrain from inefficient expropriatory taxation as taxpayers can simply migrate

[2]For example, Rodriguez-Pose and Gill (2004) suggest the U-shape hypothesis to apply to the tradition of politically powerful Brazlian states.

[3]For a general model and a comprehensive overview of tax competition against the backdrop of public policy see Keen and Marchand (1997) and Bénassy-Quéré, Gobalraja, and Trannoy (2007), respectively.

to another region. It is argued that tax competition ultimately forces local governments to implement optimal policies both in terms of technical and allocative efficiency: Increases in the efficiency of the public sector might lead to lower deficits and ultimately lower levels of public indebtedness over time if efficiency gains imply, for example, that a given amount of public goods can be provided with fewer resources (Baskaran, 2012). Additionally, the regional tax competition argument has an important intertemporal dimension. Regions that maximize their present value of revenue flows are inclined to accumulate debt at a lower level in order to motivate citizens to move into their region, as low levels of indebtedness signal –other things equal– low future taxes. This incentive for intertemporally conservative fiscal policy might be even strengthened by the intention to signal attractive business conditions in a particular region, for example, by lower public deficits signaling a higher scope to grant tax privileges to firms (Martinez-Vazquez and McNab, 2003).

Other prominent strands of the theoretical literature come to the opposite conclusion, that is, to a positive relationship between subnational taxing autonomy and public deficits. In particular, this concerns the strand of literature suggesting a softening of subnational budgets through the reliance on bailouts and corresponding strategic behavior. See Wildasin (1997) and Goodspeed (2002) and some corresponding evidence by De Mello (2000). Similarly, a positive link is predicted by approaches that stress the impediments of coordinating budget consolidations induced by decentralization, for example, through an increased number of veto-players or political actors in general (Tsebelis, 1995; Wibbels, 2000).

3 Budget constraints based sustainability

This section briefly outlines the notion of fiscal sustainability that we use in the proceeding analysis. It relies on conditions based on expected-value budget constraints as originally set up in the seminal study by Trehan and Walsh (1988). Our argumentation and notation widely follows Bohn (2005).

Consider a one-period budget constraint of regional government i

$$G_{i,t} + (1 + i_{i,t})D_{i,t-1} = T_{i,t} + D_{i,t}, \tag{1}$$

where $D_{i,t}$ denotes stock of debt, $G_{i,t}$ public expenditure exclusive of interest payments, $T_{i,t}$ public revenue, and $i_{i,t}$ the rate of interest of of region i in period t, respectively. This budget constraint is similar to an individual's budget constraint, where the left hand side represents all expenditures, here public expenditures $G_{i,t}$ and the payback of bonds plus interest on it. For simplicity, we assume all government bonds to have a one-period maturity. Additionally, let government i show strict convexity in utility, implying that (1) is binding.

Reformulating (1), the following expression needs to hold for the public deficit DEF of region i in period t in nominal terms

$$DEF_{i,t} \equiv \Delta D_{i,t} = D_{i,t} - D_{i,t-1} = G_{i,t} - T_{i,t} + i_{i,t}D_{i,t-1}. \tag{2}$$

If expressed in real quantities, it is

$$\Delta \left(\frac{D}{P}\right)_{i,t} = \frac{D_{i,t}}{P_{i,t}} - \frac{D_{i,t-1}}{P_{i,t-1}} = \frac{DEF_{i,t}}{P_{i,t}} - \frac{D_{i,t-1}}{P_{i,t-1}}\frac{\pi_{i,t}}{\pi_{i,t}+1}, \tag{3}$$

where $\pi_{i,t} \equiv \frac{P_{i,t}-P_{i,t-1}}{P_{i,t-1}}$ denotes the rate of inflation of region i in period t. This can be easily seen by extending the first difference in (3) using definition (2)

$$\Delta \left(\frac{D}{P}\right)_{i,t} = \frac{D_{i,t}}{P_{i,t}} - \frac{D_{i,t-1}}{P_{i,t-1}} - \frac{D_{i,t-1}}{P_{i,t}} + \frac{D_{i,t-1}}{P_{i,t}} = \frac{DEF_{i,t}}{P_{i,t}} - \frac{D_{i,t-1}}{P_{i,t-1}} + \frac{D_{i,t-1}}{P_{i,t}} \Leftrightarrow$$
$$\Delta \left(\frac{D}{P}\right)_{i,t} = \frac{DEF_{i,t}}{P_{i,t}} - \frac{D_{i,t-1}}{P_{i,t-1}}\frac{(P_{i,t} - P_{i,t-1})}{P_{i,t}}.$$

The last multiplicative term in the latter expression is equivalent to $\frac{\pi_{i,t}}{\pi_{i,t}+1}$ as by definition $\frac{\pi_{i,t}}{\pi_{i,t}+1} \equiv \frac{(P_{i,t}-P_{i,t-1})}{P_{i,t-1}}\frac{P_{i,t-1}}{(P_{i,t-1}+P_{i,t}-P_{i,t-1})} = \frac{(P_{i,t}-P_{i,t-1})}{P_{i,t}}$.

At the heart of the sustainability conditions based on expected-value budget constraints lies real debt rather than real deficit. It can be derived by defining the primary

deficit $DEF^0_{i,t}$ in a first step as

$$DEF^0_{i,t} \equiv G_{i,t} - T_{i,t}. \tag{4}$$

Hence, by (2) nominal debt is given by

$$D_{i,t} = DEF^0_{i,t} + (1 + i_{i,t}) D_{i,t-1}. \tag{5}$$

Dividing (5) through $P_{i,t}$ and using the extension $P_{i,t-1}/P_{i,t-1}$ on its right hand side renders real debt as

$$\frac{D_{i,t}}{P_{i,t}} = \frac{DEF^0_{i,t}}{P_{i,t}} + (1 + i_{i,t}) \frac{D_{i,t-1}}{P_{i,t-1}} \frac{P_{i,t-1}}{P_{i,t}} = \frac{DEF^0_{i,t}}{P_{i,t}} + \frac{1 + i_{i,t}}{1 + \pi_{i,t}} \frac{D_{i,t-1}}{P_{i,t-1}}, \tag{6}$$

where $(1 + \pi_{i,t})^{-1}$ in the last additive part of (6) is equivalent to $\frac{P_{i,t-1}}{P_{i,t}}$ (from the preceding equality) as by definition $(1 + \pi_{i,t})^{-1} = \left(1 + \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}}\right)^{-1} = \left(\frac{P_{i,t}}{P_{i,t-1}}\right)^{-1} = \frac{P_{i,t-1}}{P_{i,t}}$.

For notational ease, let us introduce the following set of lower-case parameters, where $d_{i,t}$ denotes debt, $s_{i,t}$ the primary surplus scaled by the contemporaneous price level, respectively, and $r_{i,t}$ corresponds to the real return on debt:

$$d_{i,t} \equiv \frac{D_{i,t}}{P_{i,t}}; \quad s_{i,t} \equiv -\frac{DEF^0_{i,t}}{P_{i,t}}; \quad r_{i,t} \equiv \frac{1 + i_{i,t}}{1 + \pi_{i,t}} - 1 \Leftrightarrow 1 + r_{i,t} = \frac{1 + i_{i,t}}{1 + \pi_{i,t}}.$$

Using these definitions, (5) can be expressed in real terms as

$$d_{i,t} = (1 + r_{i,t})\, d_{i,t-1} - s_{i,t}. \tag{7}$$

Basic forward-iteration thus allows us to write an n-period future stream of real debt as

$$\begin{aligned}
d_{i,t} &= (1 + r_{i,t})\, d_{i,t-1} - s_{i,t} \\
d_{i,t+1} &= (1 + r_{i,t+1})\,(1 + r_{i,t})\, d_{i,t-1} - (1 + r_{i,t+1})\, s_{i,t} - s_{i,t+1} \\
&\dots \\
d_{i,t+n} &= \left[\prod_{k=0}^{n} (1 + r_{i,t+k})\right] d_{i,t-1} - \sum_{n}^{j=0} \left[\prod_{k=j+1}^{n} (1 + r_{t+k})\right] s_{i,t+j}.
\end{aligned} \tag{8}$$

Taking conditional expectations $E[\cdot]$ of (8), for $E[r_{i,t}] = r_i$, results in

$$E_t\left[d_{i,t+n}\right] = (1 + r_i)^n\, d^*_{i,t} - \sum_{j=0}^{n} (1 + r_i)^{n-j}\, E_t\left[s_{i,t+j}\right], \tag{9}$$

where $d^*_{i,t} = (1 + r_{i,t})d_{t-1}$ is the debt at the start of period t. Dividing by $(1 + r_i)^n$ and rearranging yields

$$d^*_{i,t} = \sum_{j=0}^{n} \frac{1}{(1 + r_i)^j} E_t \left[s_{i,t+j}\right] + \frac{1}{(1 + r_i)^n} E_t \left[d_{i,t+n}\right]. \tag{10}$$

Finally, taking the limit $n \to \infty$ of (10), we are given

$$d^*_{i,t} = \sum_{j=0}^{\infty} \frac{1}{(1 + r_i)^j} E_t[s_{i,t+j}] \tag{IBC}$$

$$+ \lim_{n\to\infty} \frac{1}{(1 + r_i)^n} E_t[d_{i,t+n}], \tag{TC}$$

where (IBC) represents the intertemporal budget constraint and (TC) the transversality condition, respectively. Hence, sustainability fulfilling (ICB) and (TC), i.e. initial debt equalling the expected present value of future primary surpluses, is given if and only if discounted future debt converges to zero. That is,

$$d^*_{i,t} = \sum_{j=0}^{\infty} \frac{1}{(1 + r_i)^j} E_t[s_{i,t+j}] \tag{11}$$

is equivalent to

$$\lim_{n\to\infty} \frac{1}{(1 + r_i)^n} E_t[d_{i,t+n}] = 0. \tag{12}$$

Condition 1 *In the expected present value of future primary surpluses sense (Trehan and Walsh, 1988), fiscal policy is sustainable if equations* (11) *and* (12) *hold, fulfilling both the intertemporal budget constraint and the transversality condition. This is the case*

(a) *for real debt following a stationary process, i.e.* $d_{i,t} \sim I(0)$, *or*

(b) *for real debt being at most I(1), i.e.* $d_{i,t} \sim I(\delta)$, *where* δ *being either 0 or 1, and real total revenues and real total expenditures being integrated of the same order* δ *as the real debt series* $d_{i,t}$, *implying that in either case* $\delta \in \{0, 1\}$ *the real deficit is* $I(0)$, *i.e.* $\Delta d_{i,t} \sim I(0)$. *For* $d_{i,t} \sim I(1)$, $\Delta d_{i,t} \sim I(0)$, *and stationary real interest rate dynamics,* $s_{i,t} \sim I(1)$ *follows from equation* (7).

Condition 2 *For fiscal sustainability in the sense of Trehan and Walsh (1988) and for* $d_{i,t} \sim I(\delta)$ *with* $\delta \in \{0, 1\}$, *the following implications for* $s_{i,t}$ *result*

(b1) *for* $\delta = 0$ *sustainability is achieved if* $\Delta d_{i,t} \sim I(0)$ *and* $s_{i,t} \sim I(0)$

(b2) *for* $\delta = 1$ *sustainability is achieved if* $\Delta d_{i,t} \sim I(0)$ *and* $s_{i,t} \sim I(1)$.

According to Condition 2 (b2), fiscal sustainability can be achieved if real revenues and real expenditures —and linear combinations like the real primary surplus— as well as the real debt series are integrated of order one (i.e. contain a unit root in their levels), while at the same time the real deficit series follows a stationary process.

Note, as shown in Trehan and Walsh (1988) and illustrated in Bohn (2005), the strategy to test real revenues, real spending, and real debt series to have a unit root and the real (with-interest) deficit to be stationary is equivalent to the strategy to either test the real primary surplus (i.e. real revenues and real total expenditures, including interest payments) and the real debt series to be co-integrated with a co-integrating vector $(1, -r)$, invoking the budget identity with fixed interest r, or to test real revenues, real non-interest spending, and real debt to be co-integrated with vector $(1, -1, -r)$. The latter strategy based on co-integration properties is followed, for example, by Mahdavi and Westerlund (2011). Here, we exclusively follow the equivalent first strategy by examining Conditions 1, 2, and in particular Condition 2 (b2) using adequate tests.

4 Data and methodology

Our empirical strategy to test for fiscal sustainability against the backdrop of fiscal autonomy consists in two central steps. First, we test real revenues, real spending, and real debt series for having a unit root at the level of autonomous communities. In a second step, we group the community-level series into four different subgroups according to different shades of (institutional) fiscal autonomy. Each of these subgroups consists of two longitudinal data sets, where by definition one entity can only belong to one such set of each paired up subgroup, respectively. The cross section dimensions range from two (*Régimen Foral*) to 17 communities (total number of *Communidades Autónomas*). They are outlined in the following. Subsequently, we describe the construction of time

series before sketching the testing strategy.

4.1 Definition of cross sections

Communidades. Contemporary Spain is federally structured into 17 political entities referred to as autonomous communities.[4] These communities, in general, have control over their budget. They also issue debt on credit markets. In total, they manage more than half of Spanish total public expenditures – mostly for education and health care (Prieto and Manzano, 2004). This is mainly due to a prolonged period of fiscal decentralization. However, since Spain is struggling at the center stage of the recent sovereign debt crisis in the aftermath of what has to become known as the Great Recession, a decade of substantial growth as well as the process of decentralization seem to have come to a halt.[5] In the wake of the sovereign debt crisis, the Spanish government passed the so-called Immediate Action Plan in 2010 and the Austerity Plan 2011-2013, which endows the central government with the right to intervene in budget formation and budgetary planning of the *Communidades Autónomas*. In particular, the plans cut down on the fiscal autonomy of communities by freezing the hiring of new civil servants and the compensation of public employees since 2011. For detail see Di Mascio and Natalini (2014). As regards taxation (see OECD, 1999, p. 65-66, for detail), the autonomous regions can, in general, not impose a tax on a tax base that is already controlled by the central

[4]Before Spain approved its current democratic constitution in 1978, the Spanish governmental structure at the subnational level was made of a two-tiered local administration consisting of 50 provinces and 8,116 municipalities. This deeper organization of territories in municipalities ("first level" of subnational governement system) and provinces ("second level") was adopted and exists to the present. While the number of municipalities has not changed, the number of provinces increased by two to a total of 52 (Nam, 2013). For reasons of data availability, we exclusively focus on the third level of the Spanish subnational government system, that is on its 17 autonomous communities.

[5]In this context, Di Mascio and Natalini (2014, p. 15) note: "The Zapatero government streamlined the wider public sector ... Two Framework Agreements between the state and the autonomous communities and local governments were also adopted to stablilize public expenditure across levels of government. The Rajoy government held the same course, imposing to the reluctant communities to sign particularly restricting plans of fiscal retrenchment in October 2012."

government. The Constitution also sets a broadly defined limit to taxing powers by prohibiting autonomous communities from imposing barriers to the functioning of internal (national) markets. The revenue sources of the *Communidades Autónomas* are proceeds from fees for services provided to taxpayers and from loans as well as revenues from ceded taxes, from a share in the central government revenue from PIT and from a share in the rest of the state general tax revenues. Regarding the PIT revenues shares, all regions are entitled to a block grant equal to 15 percent of the PIT collected in the respective territory. In those autonomous communities, where regional expenditures planned to be financed by this 15 percent PIT revenues share do not absorb this share, the share is reduced to 10 or 5 percent.

Communidades Autónomas are (in alphabetical order): Andalusia, Aragon, Asturias, Balearic Islands, Basque Country, Canary Islands, Cantabria, Castile – La Mancha, Castile and Leon, Catalonia, Extremadura, Galicia, La Rioja, Madrid, Murcia, Navarre, and the Valencian Community.

Nacionalidades. Due to a distinct historical and cultural identity, the Spanish basic institutional legislation recognizes a sub-set of the autonomous communities as representing so-called *Nacionalidades*. The scope of fiscal autonomy for this group of communities is, in practice, relatively narrow (with the exception of the *Régimen Foral*; see below). It concerns basic tasks of public administration and legislative competencies. Article 143 of the Spanish Constitution is concerned with the seven *Nacionalidades*, while Article 151 covers the remaining 10 communities (Alegre, 2010).

Nacionalidades are: Andalusia, Basque Country, Canary Islands, Catalonia, Galicia, Navarre, and the Valencian Community.

Regímenes. In general, Spanish regional governments enjoy more autonomy in deciding over expenditures than over revenues. Revenues are mostly transferred from the national government. An exception is made for two autonomous communities representing the so-called *Régimen Foral*. These two communities collect all taxes levied on their territory, including corporate income tax (CIT), special excises, value added tax (VAT),[6]

[6]The Canary Islands know an own indirect tax similar to VAT. It is referred to as Indirect

and PIT and have also several rights in defining tax structures; for detail see Lago-Peñas (2005). The remaining 15 autonomous communities represent the *Régimen Común*. They finance their spending mainly from central government transfers. In 1998, for example, 70 percent of total public spending across these communities was financed by central government transfers, stemming in the majority from collections of taxes from the territory of communities by national agencies that redistribute revenues (Prieto and Manzano, 2004; Lago-Peñas, 2005).

Régimen Foral are: the Basque Country and Navarre.

Communidades Especiales. Three of the autonomous communities represent in terms of fiscal power exceptional cases; see OECD (1999) for detail. We refer to them as *Communidades Especiales*. As noted above, one of the revenue sources of the autonomous regions is given by ceded taxes. Ceded taxes comprise wealth tax, inheritance and gift taxes, transfer tax and stamp tax, and duties on gambling. For all but not for the exceptional cases of the autonomous communities some decision power over these taxes and duties, e.g., the setting of rates of the transfer tax which is due on the transfer of immovable properties, is delegated from the central government to the community level. The exceptional cases have no fiscal power over the ceded taxes at all. They are also restricted as regards the other central revenue source, that is, the share in the central government revenue from PIT: While all other autonomous regions have the option to receive beside the aforementioned 15 percent share another 15 percent share in PIT collected in their territory, the special cases do not have this option. For this additional share, the non-special regions can modify rates and introduce tax credits. The latter can be granted for special personal or family circumstances and for qualifying non-enterprise expenses. Hence, apart from the exceptional cases, autonomous communities might introduce a complementary or "autonomous" rate within the PIT (OECD, 1999, p. 66) through these specific tax credits.

The *Communidades Especiales*, that is the exceptional cases that are, in particular, con-

General Tax of Canaries (IGTC). They are also entitled to set special incentives as regards CIT; see OECD (1999). However, compared to the foral autonomies, the fiscal scope due to these priviliges seems rather narrow and, hence, not to justify a separate treatment.

stitutionally constrained to zero fiscal power over ceded taxes and without the right to introduce tax credits in the PIT, are Andalusia, Castile-La Mancha, and Extremadura.

4.2 Construction of time series

We use time series at the autonomous community-level from two central sources. The first is the *Ministry of Finance and Public Administations* of Spain, from which we draw community-level series of total revenues and total outlays, and construct our total deficit series including interest payments (i.e. "with interest deficits"). The series are in annual frequency and cover the period from 1984 to 2010 ($T = 27$) for the $N = 17$ communities. Hence, for our baseline panel the total number of observations is $N \times T = 459$. Our second central data source is the *Bank of Spain* that publishes debt level series for the autonomous communities in quarterly frequency ranging from the third quarter of 1994 to the fourth quarter of 2012 ($T = 74$; $N \times T = 1,258$).

Original series are nominal. We transfer each of them into real quantities by using a regional community-level CPI that we obtain from the *National Statistics Institute* of Spain with base year 1992 (1992 = 100).[7]

Summary statistics of series is given in Table A.1 in the Appendix.

4.3 Testing strategy

Given our prior of non-stationary real debt series, which is drawn from a mere eyeballing of the community-level series, we are after testing Condition 2 (b2) for fiscal sustainability as outlined in detail at the end of Section 3 above. For this purpose, we require to test the real revenues and real expenditures series as well as the real debt series to be integrated of order one (i.e. to contain a unit root in their levels and no unit root in their first differences), while at the same time we require to test wether the real deficit series follow

[7] In the case of the debt series in quarterly frequency, we have to resort to the annual CPI as a proxy to construct the real series.

a stationary process.

For both requirements, that is (i) the I(1) properties of real debt, revenues, and spending series as well as (ii) the stationarity property of the real deficit series, we follow rather conservative testing strategies. For (i) we do not only rely on standard ADF and KPSS (Kwiatkowski, Phillips, Schmidt, and Shin, 1992) tests in levels and first differences of the series but also consider the respective panel unit root (UR) and stationarity tests. For the panel UR-tests, we consider the IPS-test (Im, Pesaran, and Shin, 2003), which represents a UR-test for balanced panels, extending the standard panel UR-tests with unit-specific fixed effects and time trends:

$$\Delta y_{it} = a_i + \rho_i y_{it-1} + \sum\nolimits_{k=1}^{n} \phi_k \Delta y_{it-k} + \eta_i t + \theta_t + \epsilon_{it}, \tag{13}$$

where the null and alternative hypotheses are $H_0 : \rho_i = 0$ for all i and $H_1 : \rho_i < 0$ for at least one i, respectively.

For checking (ii) the stationarity property of the real deficit series, we follow a particularly conservative strategy in relying on a test that has been shown to over-reject its null of stationarity, i.e., the Hadri panel stationarity test (Hadri, 2000). As demonstrated in Hlouskova and Wagner (2006, p. 112), the Hadri test experiences some distortion in the presence of serial correlation when there is no unit root.[8] As a consequence, the Hadri test, in practice, appears to over-reject the null of stationarity. The time series building block of the Hadri test is the KPSS test. Hence, its null hypothesis is stationarity for any of the series in the panel. As in the case of he KPSS test, the Hadri test is based on residuals from individual OLS regressions of $\Delta d_{i,t}$ on either a constant or a constant and a trend. In the latter case, estimates are obtained from

$$\Delta d_{it} = a_i + \eta_i t + \epsilon_{it}. \tag{14}$$

From the corresponding residual estimates $\widehat{\epsilon}_{it}$, the following heteroskedasticity consistent LM test statistics is computed

$$LM = \frac{1}{N} \left(\sum\nolimits_{i=1}^{N} \frac{1}{f_{i0}} \left(\sum\nolimits_{t=1}^{T} \frac{{S_{it}}^2}{T^2} \right) \right),$$

[8] This is, in particular, the case for small T (Hlouskova and Wagner, 2006) that we also face in the present study.

where S_{it} denote partial sums, i.e., $S_{it} = \sum_{j=1}^{t} \widehat{\epsilon}_{ij}$, and f_{i0} are the individual estimators of the residual spectrum at zero frequency. Hadri (2000) shows that under mild assumptions

$$LM_m = \frac{\sqrt{N}\left(LM_m - \xi_m\right)}{\zeta_m} \text{ with } m = 1, 2 \rightarrow N\left(0, 1\right),$$

where $m = 1$ refers to the general test equation (14), while $m = 2$ to the model including constants only, i.e. $\eta_i = 0$ for all i in (14), and $\xi_1 = 1/6$, $\zeta_1 = \sqrt{1/45}$ and $\xi_2 = 1/15$, $\zeta_2 = \sqrt{11/6300}$, respectively. High p-values (> 10 percent) corresponding to this test statistics indicate that (the notoriously over-rejected) null of stationarity cannot be rejected.

5 Findings

Results from standard ADF and KPSS tests for series in levels and first differences are shown in the following seven tables (Tables 1 to 7). Subsequently, the central panel test results are given (Tables 8 to 11). Note that we allowed for a constant in all ADF tests but did not include a deterministic trend. Our results are not sensitive to this choice.[9] For the KPSS tests we used the Parzen kernel spectral estimation method with automatic Newey-West bandwidth selection. In line with Condition 2 (b2), findings based on univariate tests indicate fiscal sustainability only for the region of Navarre, that is, for one of the two autonomies of the *Régimen Foral*, at the 10 percentage level. See the framed row in Table 3. In Tables 8 to 11, "Non-exceptional" denotes the subgroup of autonomies with, at least, some fiscal power over ceded taxes and in granting tax credits within the on-territory levied PIT, i.e. all regions except Andalusia, Castile-La Mancha, and Extremadura that are subsampled and denoted as "Exceptional" in the tables.

Figure 1 summarizes the panel unit root tests results based on IPS test p-values (in percent) of the real deficit series. Figure 2 shows the graphical summary of the panel stationarity tests results based on Hadri tests p-values (in percent) of the real deficits series.

[9] Results of tests including a deterministic trend are available on request from the authors.

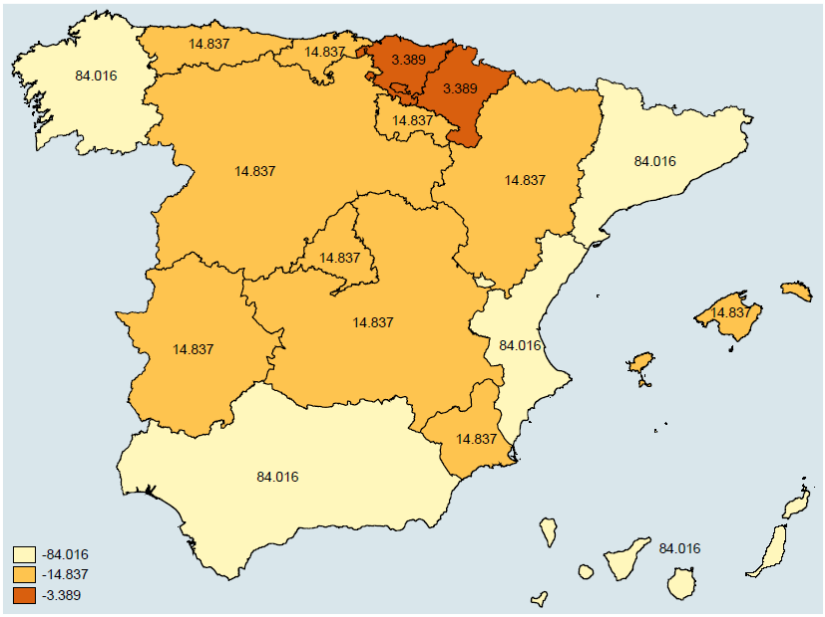

Figure 1. Graphical summary of panel unit root tests results

Figure 2. Graphical summary of panel stationarity tests results

In line with Condition 2 (b2), our findings indicate fiscal sustainability only for the two autonomies of the *Régimen Foral*. For these two regions, real revenues and real expenditures series as well as the real debt series are integrated of order one (i.e. contain

a unit root in their levels and no unit root in their first differences), while at the same time the real deficit series follow stationary processes. For detail on the latter fact see, in particular, the framed entries of Table 9. Accordingly, the deficit series of the two autonomies Navarre and Basque Country are found to be I(0) at the 5 percentage level and to be stationary in case of the Hadri test at all conventional levels of significance (p-values $>$ 10 percent).

As summarized in Figure 1 and Figure 2, only for the truly autonomous –in particular, autonomous as regards taxing– regimes of Navarro and Basque Country, time series properties of the real deficit series accord with the notion of sustainability based on expected-value budget constraints.

[Tables 1 to 11 about here]

6 Conclusion

This study assessed fiscal sustainability in contemporary Spain at the regional level. We find that only for the in terms of taxing widely autonomous regimes of Navarro and Basque Country time series properties accord with the notion of sustainability based on expected-value budget constraints. We interpret this finding as evidence for the strand of literature stressing the role of taxing autonomy and regional tax competition for fiscal sustainability. In contrast, our results do not speak in favor of a historically grown legitimacy, in the sense of intra- and inter-jurisdictional administrative and political standing, of the subnational entity playing a crucial role for the sustainability of fiscal policy at the regional level. Overall, our results suggest that indeed taxing autonomy plays the most decisive role in accounting for differences in fiscal sustainability. Taxing autonomy is, according to our findings, key to warrant fiscal sustainability in the sense of Trehan and Walsh (1988). Our applied time series insights can be seen as confirming theoretical approaches that predict a negative link between tax decentralization and public deficits and entertain taxing autonomy as the central driver behind fiscal sustainability. This

concerns, in particular, the public choice tradition of local tax competition (Hayek, 1948; Tiebout, 1956; Brennan and Buchanan, 1980; Baskaran, 2010). In contrast, we find no evidence both for the softening of subnational budgets hypothesis (Wildasin, 1997; De Mello, 2000; Goodspeed, 2002) and for the complicating subnational budget consolidations hypothesis (Tsebelis, 1995; Wibbels, 2000) that both predict a positive link between subnational taxing autonomy and public deficits.

Although the Spanish federal system might not know as much heterogeneity as the cantonal Swiss system, there can be drawn some policy implication from our findings in the sense of laboratory federalism (Oates, 1999; Feld and Kirchgässner, 2008). Following this line of reasoning, if fiscal sustainability at the regional level is aimed at and given our findings that more degrees of freedom regarding subnational taxation turn out to be associated with sustainable fiscal policies, the *Régimen Foral* of Navarro and Basque Country can act as a role model for the other autonomous communities of Spain. In a first step, the *Régimen Foral* might be gradually extended to more than two already "foral" *Communidades Autónomas*.

Table 1. Standard ADF and KPSS tests: real debt series

	ADF (AIC)	ADF (BIC)	KPSS	Implication
Andalusia	-0.655	4.238	0.624**	non-stationary
Aragon	4.589	4.589	0.766***	non-stationary
Principality of Austurias	-1.996	2.846	0.724**	non-stationary
Balearic Islands	3.404	2.756	1.017***	non-stationary
Basque Country	-1.903	1.185	0.262	inconclusive
Canary Islands	1.563	1.819	0.792***	non-stationary
Cantabria	1.138	4.384	0.789***	non-stationary
Castile-La Mancha	2.987	2.987	0.874***	non-stationary
Castile and Leon	0.548	5.782	0.795***	non-stationary
Catalonia	3.741	3.741	0.885***	non-stationary
Extremadura	0.750	0.699	0.738**	non-stationary
Galicia	2.412	2.152	0.753***	non-stationary
La Rioja	-0.310	0.601	0.892***	non-stationary
Community of Madrid	2.630	2.630	1.104***	non-stationary
Murcia	-4.552***	3.758	0.635**	inconclusive
Navarre	-2.399	3.131	0.444*	non-stationary
Valencian Community	1.700	4.322	1.091***	non-stationary

*/**/*** denotes rejection of null at 10/5/1 percent level of significance, respectively.

Note: Used information criterion to determine lag order given in parentheses; maximum lag order set to 19.

Table 2. Standard ADF and KPSS tests: real debt series (first differences)

	ADF (AIC)	ADF (BIC)	KPSS	Implication
Andalusia	-1.887	-3.187**	0.470**	inconclusive
Aragon	-1.226	-1.226	0.679**	non-stationary
Principality of Austurias	-2.816*	-1.736	0.420*	inconclusive
Balearic Islands	-8.987***	-8.987***	0.365**	inconclusive
Basque Country	-0.942	-5.285***	0.502**	inconclusive
Canary Islands	-3.283**	-10.666***	0.665**	inconclusive
Cantabria	0.129	0.139	0.652**	non-stationary
Castile-La Mancha	0.211	-9.411***	0.374*	inconclusive
Castile and Leon	0.087	-1.566	0.514**	non-stationary
Catalonia	-1.923	-6.457***	0.684**	inconclusive
Extremadura	-2.423	-3.117**	0.446*	inconclusive
Galicia	-1.181	-1.181	0.482**	non-stationary
La Rioja	-1.766	-2.319	0.647**	non-stationary
Community of Madrid	-1.038	-7.153***	0.364*	inconclusive
Murcia	-2.998**	-6.772***	0.656**	inconclusive
Navarre	0.337	-6.856***	0.770***	inconclusive
Valencian Community	2.186	-4.563***	0.521**	inconclusive

*/**/*** denotes rejection of null at 10/5/1 percent level of significance, respectively.

Note: Used information criterion to determine lag order given in parentheses; maximum lag order set to 19.

Table 3. Standard ADF and KPSS tests: real deficit series

	ADF (AIC)	ADF (BIC)	KPSS	Implication
Andalusia	-2.178	-1.869	0.221	inconclusive
Aragon	-0.033	-0.033	0.461*	non-stationary
Principality of Austurias	-1.780	-1.780	0.231	inconclusive
Balearic Islands	0.130	0.130	0.384*	non-stationary
Basque Country	-2.343	-1.986	0.202	inconclusive
Canary Islands	-0.323	-2.228	0.474**	non-stationary
Cantabria	-1.995	-2.173	0.208	inconclusive
Castile-La Mancha	1.969	3.743	0.467**	non-stationary
Castile and Leon	-1.492	-1.492	0.390*	non-stationary
Catalonia	0.865	0.865	0.380*	non-stationary
Extremadura	-0.209	-0.209	0.313	inconclusive
Galicia	-1.976	-1.976	0.321	inconclusive
La Rioja	-0.528	-0.528	0.505**	non-stationary
Community of Madrid	-1.232	-1.224	0.340	inconclusive
Murcia	-2.784*	0.447	0.250	inconclusive
Navarre	-2.589*	-2.589*	0.140	stationary
Valencian Community	-1.711	-1.711	0.314	inconclusive

*/**/*** denotes rejection of null at 10/5/1 percent level of significance, respectively.

Note: Used information criterion to determine lag order given in parentheses; maximum lag order set to 7.

Table 4. Standard ADF and KPSS tests: real deficit series (first differences)

	ADF (AIC)	ADF (BIC)	KPSS	Implication
Andalusia	-4.027***	-4.027***	0.141	stationary
Aragon	-2.274	-4.946***	0.214	inconclusive
Principality of Austurias	-1.729	-4.269***	0.167	inconclusive
Balearic Islands	-8.412***	-8.412***	0.235	stationary
Basque Country	-4.285***	-4.454***	0.161	stationary
Canary Islands	-7.559***	-7.559***	0.060	stationary
Cantabria	-3.024**	-7.248***	0.180	stationary
Castile-La Mancha	1.621	0.745	0.381*	non-stationary
Castile and Leon	-1.490	-4.937***	0.172	inconclusive
Catalonia	-4.237***	-4.237***	0.267	stationary
Extremadura	-4.364***	-4.364***	0.216	stationary
Galicia	-6.473***	-6.473***	0.090	stationary
La Rioja	-7.495***	-7.495***	0.065	stationary
Community of Madrid	-3.849***	-5.281***	0.152	stationary
Murcia	-8.023***	-8.023***	0.219	stationary
Navarre	-5.547***	-5.547***	0.122	stationary
Valencian Community	-3.079**	-3.079**	0.200	stationary

*/**/*** denotes rejection of null at 10/5/1 percent level of significance, respectively.

Note: Used information criterion to determine lag order given in parentheses; maximum lag order set to 7.

Table 4. Standard ADF and KPSS tests: real spending series

	ADF (AIC)	ADF (BIC)	KPSS	Implication
Andalusia	-1.687	-1.687	0.654**	non-stationary
Aragon	-0.106	-0.106	0.632**	non-stationary
Principality of Austurias	-0.292	-0.292	0.616**	non-stationary
Balearic Islands	-0.085	-0.085	0.596**	non-stationary
Basque Country	-1.384	-1.384	0.656**	non-stationary
Canary Islands	-1.016	-1.362	0.658**	non-stationary
Cantabria	-0.466	-0.466	0.588**	non-stationary
Castile-La Mancha	0.533	0.533	0.635**	non-stationary
Castile and Leon	-0.760	-0.760	0.622**	non-stationary
Catalonia	-0.043	-0.043	0.641**	non-stationary
Extremadura	-0.314	-0.314	0.628**	non-stationary
Galicia	-2.001	-1.957	0.627**	non-stationary
La Rioja	-1.596	-0.157	0.609**	non-stationary
Community of Madrid	-2.331	-2.331	0.607**	non-stationary
Murcia	-1.722	0.131	0.601**	non-stationary
Navarre	0.267	-1.188	0.639**	non-stationary
Valencian Community	-1.624	-1.624	0.656**	non-stationary

*/**/*** denotes rejection of null at 10/5/1 percent level of significance, respectively.

Note: Used information criterion to determine lag order given in parentheses; maximum lag order set to 7.

Table 5. Standard ADF and KPSS tests: real spending series (first differences)

	ADF (AIC)	ADF (BIC)	KPSS	Implication
Andalusia	-2.702*	-2.702*	0.172	stationary
Aragon	-4.560***	-4.560***	0.146	stationary
Principality of Austurias	-1.938	-5.462***	0.126	inconclusive
Balearic Islands	-3.380**	-3.380**	0.157	stationary
Basque Country	-3.421**	-3.421**	0.140	stationary
Canary Islands	-1.299	-4.467***	0.230	inconclusive
Cantabria	-4.096***	-4.096***	0.114	stationary
Castile-La Mancha	-5.897***	-5.897***	0.241	stationary
Castile and Leon	-3.071**	-3.071***	0.144	stationary
Catalonia	-6.396***	-6.396***	0.132	stationary
Extremadura	-1.906	-3.907***	0.138	inconclusive
Galicia	-1.649	-1.649	0.285	inconclusive
La Rioja	-3.174**	-3.174**	0.155	stationary
Community of Madrid	-2.605*	-2.605*	0.138	stationary
Murcia	-3.772***	-3.772***	0.171	stationary
Navarre	-1.685	-1.685***	0.100	inconclusive
Valencian Community	-4.355***	-4.355***	0.172	stationary

*/**/*** denotes rejection of null at 10/5/1 percent level of significance, respectively.

Note: Used information criterion to determine lag order given in parentheses; maximum lag order set to 7.

Table 6. Standard ADF and KPSS tests: real revenue series

	ADF (AIC)	ADF (BIC)	KPSS	Implication
Andalusia	-1.737	-1.737	0.636**	non-stationary
Aragon	-2.858*	-2.101	0.609**	inconclusive
Principality of Austurias	-1.556	-0.547	0.587**	non-stationary
Balearic Islands	-1.046	-0.738	0.578**	non-stationary
Basque Country	-1.733	-1.733	0.647**	non-stationary
Canary Islands	-1.497	-1.497	0.646**	non-stationary
Cantabria	-0.667	-0.667	0.583**	non-stationary
Castile-La Mancha	-1.979	-1.979	0.606**	non-stationary
Castile and Leon	-1.824	-1.824	0.609**	non-stationary
Catalonia	-0.687	-0.687	0.639**	non-stationary
Extremadura	-1.690	-1.690	0.605**	non-stationary
Galicia	-1.963	-1.963	0.620**	non-stationary
La Rioja	-0.280	-0.280	0.602**	non-stationary
Community of Madrid	-2.337	-2.337	0.592**	non-stationary
Murcia	-0.879	-3.655***	0.583**	inconclusive
Navarre	-1.431	-1.431	0.636**	non-stationary
Valencian Community	-2.130	-2.130	0.625**	non-stationary

*/**/*** denotes rejection of null at 10/5/1 percent level of significance, respectively.

Note: Used information criterion to determine lag order given in parentheses; maximum lag order set to 7.

Table 7. Standard ADF and KPSS tests: real revenue series (first differences)

	ADF (AIC)	ADF (BIC)	KPSS	Implication
Andalusia	-2.797*	-2.797*	0.218	stationary
Aragon	-2.999**	-2.999**	0.154	stationary
Principality of Austurias	-1.300	-3.853***	0.126	inconclusive
Balearic Islands	-3.245**	-3.245**	0.131	stationary
Basque Country	-4.711***	-4.711***	0.290	stationary
Canary Islands	-5.727***	-5.727***	0.245	stationary
Cantabria	-3.752***	-3.752***	0.122	stationary
Castile-La Mancha	-0.657	-3.232**	0.136	inconclusive
Castile and Leon	-0.703	-0.703	0.153	inconclusive
Catalonia	-3.364**	-3.364**	0.160	stationary
Extremadura	-2.160	-2.624*	0.142	inconclusive
Galicia	-1.736	-1.736	0.309	inconclusive
La Rioja	-2.997**	-4.484***	0.133	stationary
Community of Madrid	-2.363	-4.143***	0.126	inconclusive
Murcia	-2.464	-2.477	0.125	inconclusive
Navarre	-4.195***	-4.680***	0.262	stationary
Valencian Community	-2.435	-2.435	0.254	inconclusive

*/**/*** denotes rejection of null at 10/5/1 percent level of significance, respectively.

Note: Used information criterion to determine lag order given in parentheses; maximum lag order set to 7.

Table 8. Panel UR and stationarity tests: real debt series

				First differences		
	IPS	Hadri	Implication	IPS	Hadri	Implication
Total	19.532	35.149***	non-stationary	-20.955***	13.876***	inconclusive
Exceptional	7.151	12.350***	non-stationary	-6.889***	6.765***	inconclusive
Non-exceptional	17.483	32.748***	non-stationary	-18.052***	13.301***	inconclusive
Historical	11.360	25.074***	non-stationary	-13.261***	10.185***	inconclusive
Non-Historical	11.525	31.305***	non-stationary	-16.554***	6.530***	inconclusive
Foral	2.347	2.903***	non-stationary	-3.345***	5.781***	inconclusive
Non-Foral	18.540	33.002***	non-stationary	-19.500***	13.493***	inconclusive

*/**/*** denotes rejection of null at 10/5/1 percent level of significance, respectively.

Table 9. Panel UR and stationarity tests: real deficit series

				First differences		
	IPS	Hadri	Implication	IPS	Hadri	Implication
Total	1.735	5.111***	non-stationary	-15.863***	3.587***	inconclusive
Exceptional	-0.100	1.570*	non-stationary	-3.419***	0.756	stationary
Non-exceptional	0.046	5.690***	non-stationary	-15.979***	3.825***	inconclusive
Historical	0.995	4.394***	non-stationary	-10.330***	3.129***	inconclusive
Non-Historical	-1.043	5.602***	non-stationary	-15.200***	3.161***	inconclusive
Foral	-1.827**	1.203	stationary	-5.909***	-0.258	stationary
Non-Foral	3.498	5.403***	non-stationary	-15.020***	3.666***	inconclusive

*/**/*** denotes rejection of null at 10/5/1 percent level of significance, respectively.

Table 10. Panel UR and stationarity tests: real spending series

				First differences		
	IPS	Hadri	Implication	IPS	Hadri	Implication
Total	1.917	13.543***	non-stationary	-12.823***	1.269	stationary
Exceptional	-1.409*	8.724***	inconclusive	-2.009**	1.539*	inconclusive
Non-exceptional	2.021	13.067***	non-stationary	-12.894***	1.034	stationary
Historical	1.986	10.610***	non-stationary	-8.564***	1.554*	inconclusive
Non-Historical	3.935	11.802***	non-stationary	-12.572***	0.244	stationary
Foral	0.504	7.968***	non-stationary	-3.723***	0.158	stationary
Non-Foral	1.554	13.885***	non-stationary	-12.019***	1.311*	inconclusive

*/**/*** denotes rejection of null at 10/5/1 percent level of significance, respectively.

Table 11. Panel UR and stationarity tests: real revenue series

				First differences		
	IPS	Hadri	Implication	IPS	Hadri	Implication
Total	-1.107	13.364***	non-stationary	-9.369***	1.260	stationary
Exceptional	-0.939	8.596***	non-stationary	-3.619***	1.572*	inconclusive
Non-exceptional	-0.316	12.890***	non-stationary	-8.907***	0.928	stationary
Historical	0.193	10.645***	non-stationary	-5.424***	0.605	stationary
Non-Historical	0.552	11.446***	non-stationary	-9.420***	-0.183	stationary
Foral	-0.429	8.024***	non-stationary	-6.730***	1.239	stationary
Non-Foral	-0.630	13.743***	non-stationary	-8.523***	1.351*	inconclusive

*/**/*** denotes rejection of null at 10/5/1 percent level of significance, respectively.

Appendix

Table A.1 Summary statistics of central series

Time series	Mean	Std. Dev.	Min	Max	N obs	Periodicity	Period
Debt[a]	3840.495	6087.198	106.763	52554.74	1275	quarterly	1994q4-2013q2
Deficit[b]	408.136	1015.11	-712.918	12573.928	476	yearly	1984-2011
Total expenditures[b]	4755.709	6269.994	31.715	35294.184	476	yearly	1984-2011
Total revenues[b]	4347.572	5605.208	29.389	31518.854	476	yearly	1984-2011
Real debt[a]	32.951	46.963	1.142	370.858	1275	quarterly	1994q4-2013q2
Real total deficit	2.872	6.183	-4.479	70.351	476	yearly	1984-2011
Real expenditures	34.208	39.711	0.508	207.173	476	yearly	1984-2011
Real revenues	31.336	35.789	0.471	184.429	476	yearly	1984-2011
CPI (annual)[c]	114.336	42.85	35.505	183.884	561	yearly	1980-2012
CPI (quarterly)[c]	81.588	33.969	18.181	142.049	2414	quarterly	1978:q1 - 2013q2

Sources: [a] Banco de España, [b] Ministerio de Hacienda y Administraciones Públicas (MINHAP), [c] Spanish Statistical Office

Notes: First four series are in million Euros. Base year of CPI is 2001.

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