Regional Studies

ISSN: 0034-3404 (Print) 1360-0591 (Online) Journal homepage: http://rsa.tandfonline.com/loi/cres20

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To cite this article: Raffaele Lagravinese, Paolo Liberati & Agnese Sacchi (2017): The growth and variability of regional taxes: an application to Italy, Regional Studies, DOI: 10.1080/00343404.2017.1313400

To link to this article: http://dx.doi.org/10.1080/00343404.2017.1313400

REGIONAL STUDIES, 2017
https://doi.org/10.1080/00343404.2017.1313400

The growth and variability of regional taxes: an application to Italy

Raffaele Lagravinese[a], Paolo Liberati[b] and Agnese Sacchi[c]

ABSTRACT

The growth and variability of regional taxes: an application to Italy. *Regional Studies*. This paper investigates the potential long-term growth and short-term cyclical stability of the Italian regional tax system. Short- and long-run elasticities with respect to regional gross domestic product (GDP) are estimated between 2001 and 2012 for the surtax on central personal income tax (RPIT) and for the regional tax on productive activities (RTPA). Cyclical reactions are more marked for the RTPA and higher in the southern regions. Significant long-run growth of the RPIT and RTPA, on the other hand, is found only in the northern regions. The results suggest that the behaviour of regional taxes may increase the Italian north–south gap and cast some doubt on these taxes in financing essential public services, such as health, in each region.

KEYWORDS

income elasticity; regional tax bases; error correction model; regional gross domestic product (GDP); Italy

摘要

区域税收的成长与变化: 意大利的应用。*Regional Studies*. 本文探讨意大利区域税收系统的潜在长期成长与短期週期性稳定。本文为中央个人所得税（RPIT）的附加税与生产活动的区域税收（RTPA），评估2001年至2012年间有关区域的国内生产毛额（GDP）的短期与长期弹性。週期性反应对RTPA来说更为显着，并且在南部区域中更高。此外，RPIT与RTPA显着的长期成长，只有在北方区域中发现。研究结果显示，区域税收的行为，可能会增加意大利的南北差距，并对于在各区域中以这些税收支持诸如健康等公共服务产生若干质疑。

关键词

所得弹性; 区域税收基础; 误差修正模型; 区域的国内生产总值（GDP）; 意大利

RÉSUMÉ

Expansion et variabilité des impôts locaux: une application à l'Italie. *Regional Studies*. La présente communication se penche sur l'expansion potentielle à long terme et la stabilité cyclique à court terme du régime fiscal régional en Italie. On y procède à une estimation des élasticités à court et long terme relativement au produit intérieur brut (PIB) de 2001 à 2012 pour la surtaxe sur l'impôt centralisé sur les revenus personnels (RPIT), et pour l'impôt régional sur les activités productives (RTPA). Les réactions cycliques sont plus prononcées pour le RTPA, et plus élevées dans les régions méridionales. Par contre, on ne relève une croissance significative à long terme des RPIT et RPTA que dans les régions septentrionales. Les résultats indiquent que l'évolution des impôts régionaux est susceptible de renforcer l'écart entre le nord et le sud du pays, et mettent en doute la capacité de financement, dans chaque région, de certains services publics essentiels, par exemple la santé publique, avec ces impôts.

MOTS-CLÉS

élasticité des revenus; bases fiscales régionales; modèle de rectification des erreurs; produit intérieur brut (PIB) régional; Italie

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This article was originally published with errors. This version has been corrected. Please see Erratum (https://doi.org/10.1080/00343404.2017.1329187)

ZUSAMMENFASSUNG
Wachstum und Variabilität von Regionalsteuern: eine Anwendung auf Italien. *Regional Studies*. In diesem Beitrag untersuchen wir das potenzielle langfristige Wachstum und die kurzfristige zyklische Stabilität des regionalen Steuersystems in Italien. Hierfür schätzen wir die kurz- und langfristige Elastizität hinsichtlich des regionalen Bruttoinlandsprodukts (BIP) im Zeitraum von 2001 bis 2012 für die Zusatzsteuer zur zentralen persönlichen Einkommensteuer (RPIT) sowie für die Regionalsteuer auf Produktionstätigkeiten (RTPA). Zyklische Reaktionen fallen für die RTPA ausgeprägter und in den südlichen Regionen höher aus. Ein signifikantes langfristiges Wachstum der RPIT und RTPA ist wiederum nur in den nördlichen Regionen zu finden. Die Ergebnisse weisen darauf hin, dass das Verhalten der Regionalsteuern das Nord-Süd-Gefälle Italiens vertiefen kann, und lassen Zweifel an der Eignung dieser Steuern zur Finanzierung von wesentlichen staatlichen Leistungen wie dem Gesundheitswesen in den einzelnen Regionen aufkommen.

SCHLÜSSELWÖRTER
Einkommenselastizität; regionale Steuerbemessungsgrundlagen; Fehlerkorrekturmodell; regionales Bruttoinlandsprodukt (BIP); Italien

RESUMEN
Crecimiento y variabilidad de los impuestos regionales: una aplicación en Italia. *Regional Studies*. En este artículo analizamos el posible crecimiento a largo plazo y la estabilidad cíclica a corto plazo del sistema fiscal regional en Italia. Para ello calculamos las elasticidades a corto y largo plazo con respecto al producto interno bruto (PIB) regional entre 2001 y 2012 para el recargo regional en el impuesto central sobre la renta de las personas físicas (IRPF) y para el impuesto regional sobre las actividades productivas (IRAP). Las reacciones cíclicas están más marcadas por el IRAP y son más altas en las regiones del sur. Por otra parte, observamos que un crecimiento significativo a largo plazo del IRPF y las IRAP ocurre solamente en las regiones del norte. Los resultados indican que el comportamiento de los impuestos regionales puede aumentar las diferencias entre el norte y el sur de Italia, y ponen en entredicho que estos impuestos puedan financiar los servicios públicos esenciales, tales como sanidad, en cada región.

PALABRAS CLAVES
elasticidad de ingresos; bases impositivas regionales; modelo de corrección de errores; producto interno bruto (PIB) regional; Italia

JEL H24, H25, H77, R50
HISTORY Received 22 March 2016; in revised form 26 March 2017

INTRODUCTION

The recent sovereign debt crisis combined with a downturn in economic activity in many developed countries has contributed to increasing interest in how subnational governments behave when facing the business cycle in a framework characterized by strong intergovernmental relationships. To this purpose, this paper investigates the role that two Italian regional taxes – the surtax on personal income tax (RPIT) and the regional tax on productive activities (RTPA) – may have in ensuring adequate cyclical stability and significant long-term growth.

Even though most parameters for these taxes are centrally set and regional governments cannot exploit full autonomy in changing them, the RPIT and RTPA are extremely important in the regional budget since most of their revenues are used to finance an essential public service such as health whose responsibility of provision ultimately falls on regions. Thus, while cyclical stability and long-term growth are certainly two extremely important characteristics of any regional financing source, it is especially true that without proper tax assignment, subnational essential public services may be more at risk than national ones.[1]

This argument is strengthened by the observation that – based on the recent second-generation theory of fiscal federalism (Oates, 2005; Weingast, 2009) – an increase in the taxing power of local governments should be supported to ensure closer correspondence between those who benefit from regional spending and those who finance them, which increases the need to understand how regional taxes behave in the short and the long runs. From a short-run perspective, a good strategy would be to decentralize less cyclically sensitive taxes. From a long-run perspective, taxes should also guarantee at least moderate growth to face increasing local needs properly. Again, this is especially relevant when local spending is aimed at achieving social purposes that may have strong countercyclical behaviour (Fricke & Süssmuth, 2014; Sobel & Holcombe, 1996; Sobel & Wagner, 2003).

In order to investigate this issue properly, some indicators are needed to measure each characteristic and the corresponding dynamics. To this purpose, the paper provides estimations of the elasticities of the regional tax bases of the RPIT and RTPA with regard to regional gross domestic product (GDP) over the period 2001–12. In particular, short-run elasticities will be used to measure cyclical stability, whereas long-run elasticities will be used to measure long-term growth.

With regard to growth, comparing long-run income elasticities of regional taxes would help us define which of them performs better in terms of financing long-lasting public services.[2] As in the case of Italy, this is particularly important for territories that have different levels of per-capita income, income growth rates and composition of

the tax burden (i.e., direct versus indirect taxes), but where essential public services should in principle be provided at some standard in all regions.

As far as stability is concerned, on the other hand, short-run income elasticities would provide information to policy-makers on how taxes react to economic downturns or boom episodes, allowing more informed decisions to be made on whether the structure of local taxation should be highly concentrated on a few large tax bases or spread over many taxes and a choice to be made from different levels of progressivity.

It is worth noting that notwithstanding this potential interest, testing the growth and variability of subnational taxes is a relatively uncommon empirical task compared with other dimensions of decentralization.[3] To this purpose, the estimation of short- and long-run income elasticities of the Italian regional tax bases (RPIT and RTPA) is carried out using an error correction model (ECM) and taking into account socio-economic and geographical differences.[4] This analysis allows us to draw some policy implications for a sustainable intergovernmental tax structure and, consequently, for a consistent spending task assignment across tiers of government. The results show that cyclical stability is lower for the RTPA and even lower in the southern regions. A significant long-run growth of the RPIT and RTPA, on the other hand, is found only in the northern regions. Such findings seem to reflect the north–south gap that characterizes the Italian economy and cast some doubt on the role of these taxes as adequate tools for financing essential public services, such as health, in each region.[5]

The paper is organized as follows. After a review of the essential empirical literature on the topic in the next section, the main characteristics of the tax structure in Italian regions are described in the third section. The fourth section explains the empirical strategy, data and variables. The fifth section discusses the results. Finally, the sixth section concludes with some policy recommendations.

REVIEW OF EMPIRICAL STUDIES

The economic literature often considers the properties of growth and stability of taxes as inversely related (Dye, 2004; Groves & Kahn, 1952; Ladd & Weist, 1991; White, 1983), suggesting that taxes with higher cyclical variability are also taxes with lower growth. However, it has been also demonstrated (e.g., Bruce, Fox, & Tuttle, 2006; Dye & McGuire, 1991) that such a correlation could basically depend on different institutional settings in which the degree of decentralization plays an important role.

On the one hand, decentralization may favour uncoordinated and procyclical subnational tax and spending policies (Hines, 2010; Rodden & Wibbels, 2010), in this way jeopardizing national fiscal policies and endangering the country's macroeconomic stability (Ter-Minassian, 1997). On the other hand, subnational taxes are basically used to finance public services whose provision is mostly independent of the business cycle and may require a growing amount of resources over time, like those for health, education, environment etc.

In this framework, the elasticity of tax revenues plays a crucial role in monitoring and forecasting public finances. It also helps to predict to what extent tax resources are able to react to expansionary or contractionary stages of the economic cycle. At a central level, this information is particularly important for implementing countercyclical or – more generally – stabilization policies. In recent years, the elasticity of tax revenues has also assumed importance at a subnational level, especially when tax resources are devoted to finance social expenditures and the debt-financing channel is ruled out.

Three different concepts of tax elasticities can be identified. The first is tax base elasticity (TBE), which measures the relationship between changes in tax bases and some macroeconomic variables such as GDP (Bruce et al., 2006). The second is tax revenue elasticity (TRE), which directly measures the relationship between tax revenues and a measure of aggregate income (e.g., Acquaah & Gelardi, 2008). The third is adjusted tax revenue elasticity (ATRE), where tax changes are measured in relation to changes in the corresponding tax bases (Bouthevillain et al., 2001).

These concepts are adopted differently in the literature according to the specific approach used. In any case, these elasticities have been employed to measure the reaction of taxes that subnational governments *actually* apply.

An attempt to move the analysis towards *normative* ground is represented by the application of the portfolio theory (Markowitz, 1952) to the variability of subnational taxes. The idea is that subnational governments should choose from a set of tax instruments (e.g., general sales taxes, excise taxes, personal or corporate income taxes, property taxes) to minimize the impact of economic up- or downturns. Accordingly, the growth and volatility of subnational taxes would depend on the composition of the portfolio suggesting that an *optimal* differentiation, which better cushions the fluctuations of the business cycle, may exist. Garrett (2009) evaluates how a subnational tax portfolio should be built to minimize the overall variability in total state tax revenues in the United States. From another perspective, Cornia and Nelson (2010) suggest that the measure of tax elasticities would be useful for subnational governments in order optimally to choose the composition of their tax portfolios, especially in the short run.

Although appealing, the application of this theory to subnational financing issues is less helpful in practice. Indeed, subnational governments are often severely constrained in the choice of their tax instruments. Given such constraints, the measurement of tax elasticities should refer to taxes that local governments can actually apply.

To this purpose, regression analyses are widely used to investigate tax revenue variability (Sobel & Holcombe, 1996; Williams, Anderson, Froehle, & Lamb, 1973). Dye and McGuire (1991) examine, for instance, the elasticity and stability of both personal income taxes and sales taxes, concluding that both taxes vary significantly

over the business cycle. However, Dye (2004) highlights that the excessive cross-state variation in economic cycles and tax structures does not allow any stable conclusion to be drawn in terms of short-run elasticity for the United States.

Other studies have analysed the relationship between tax elasticities and variables other than the business cycle. Wolswijk (2009) examined the short- and long-run behaviours of tax receipts in the Netherlands in 1971–2005 in relation to their corresponding tax bases. He found that short-term elasticities may deviate from long-term ones (with large differences especially in 'bad times') and that significant differences in the elasticities of the value-added tax and the corporate income tax may occur. Tosun and Abizadeh (2005) provide evidence that different taxes (on property, payroll, goods and services) respond differently to per-capita GDP growth in some Organisation for Economic Co-operation and Development (OECD) countries over the period 1980–99.

The recent global economic crisis has encouraged an analysis of tax revenue volatility in downturn periods and how this would affect different government levels. Hines (2010) studies the effects of state, local and federal taxes in the United States during 1947–2010, finding that per-capita federal tax collections tend to decline when the economy performs poorly, whereas state and local tax collections are much more stable. More recently, Fricke and Süssmuth (2014) analyse the trade-off between growth and volatility of tax revenues in Latin America in 1990–2010. They suggest that tax revenues above (below) the long-run equilibrium may react stronger (weaker) to business cycle dynamics.

There are no studies analysing the impact of the economic cycle on the variability and stability of subnational taxes in Italy. There are at least three good reasons to perform this analysis. First, Italy has a dual economy with very different patterns of growth across northern and southern regions. Consequently, the same stage of the economic cycle may cause asymmetrical effects in different areas. Second, Italy is a country that has significantly suffered from the recent economic crisis. This provides a good laboratory for testing the performance of the main regional taxes. Third, Italian regions have a constrained set of tax instruments – whose parameters are mostly determined centrally – that might be suboptimal for limiting variability in the short run and enhancing growth in the long run.

REGIONAL TAXES IN ITALY: NORMATIVE FEATURES AND TRENDS

The main taxes applied by the Italian regions are the regional tax on productive activities (RTPA) and the regional personal income tax (RPIT).[6] The RTPA is applied to all taxpayers engaging in productive or professional activities.[7] Its tax base is determined by the net value of local production where the deduction of both financial costs (interest payments) and labour costs (wages, social contributions) is not allowed, even though capital and labour are used as inputs in the production process.[8] The RPIT, on the other hand, is a surtax on personal incomes levied at the regional level and applied to all taxpayers who pay the central personal income tax.

Both taxes were introduced in January 1998, with some autonomy left to regions to set tax rates. In 2009 (according to the latest data available from the Institute for the Study of Regionalism, Federalism and Self-Government – ISSiRFA), ordinary statutory regions (OSRs)[9] have collected more than €46 billion, representing 42% of the current total tax revenues. Among them, the RTPA is the most important tax source since it provides more than €32 billion, which represents about 70% of the total regional taxation.[10] The RPIT provides €6.8 billion, representing 15% of the total regional taxation From this picture, a fairly rigid tax structure emerges at the regional level.

As for the current handling of such taxes, it is worth recalling that regional governments have limited fiscal autonomy since they can vary only the tax rates of the RTPA and RPIT within narrower bounds and without any power to determine their tax bases. In our period, regions have to apply the taxes and can choose to vary the base tax rate by 1 percentage point in both directions in the case of the RTPA (giving a minimum tax rate of 2.98% and a maximum of 4.82%)[11] and by 0.5 percentage points upwards for the RPIT.[12]

For the part of the RTPA that falls on the private sector, regions can vary the tax rate for specific categories of taxpayers (e.g., non-profit organizations, social cooperatives, agricultural firms) and make decisions on other aspects of tax administration.

However, even though a certain degree of autonomy has been granted to regions by a number of federalist reforms, the effective power and control that regional governments exercise over their tax revenues is severely limited, also according to international standards (Blöchliger & Nettley, 2015). As highlighted by the OECD (1999), tax autonomy is the greatest if subcentral governments are free to determine both the tax base and the tax rates, without any limits on revenues, bases or rates by the central government. It is clear that neither the RTPA nor the RPIT fulfil these conditions. Changes of the regional tax burden may not be wholly due to discretionary tax policies by subcentral governments, but to automatic increases in tax rates of the RTPA and RPIT imposed by the central government to satisfy central needs. In fact, both taxes are strictly linked to financing of the National Health Service (NHS), which means that the central government can impose the maximum tax rate for both taxes in any region in the case of health deficits (as in Lazio, Liguria, Campania, Abruzzi and Molise in 2007).

Negative implications for the distribution of tax resources may also derive from the rather unequal distribution of tax bases across regions. The tax base of the RTPA is unequally distributed among regions reflecting the high concentration of industries and productive activities in the northern part of the country. This issue is clearly documented in Figure 1, where the distributions of per-capita tax bases of both the RTPA and RPIT are reported by region. The picture supports the view that Italy is traditionally divided between

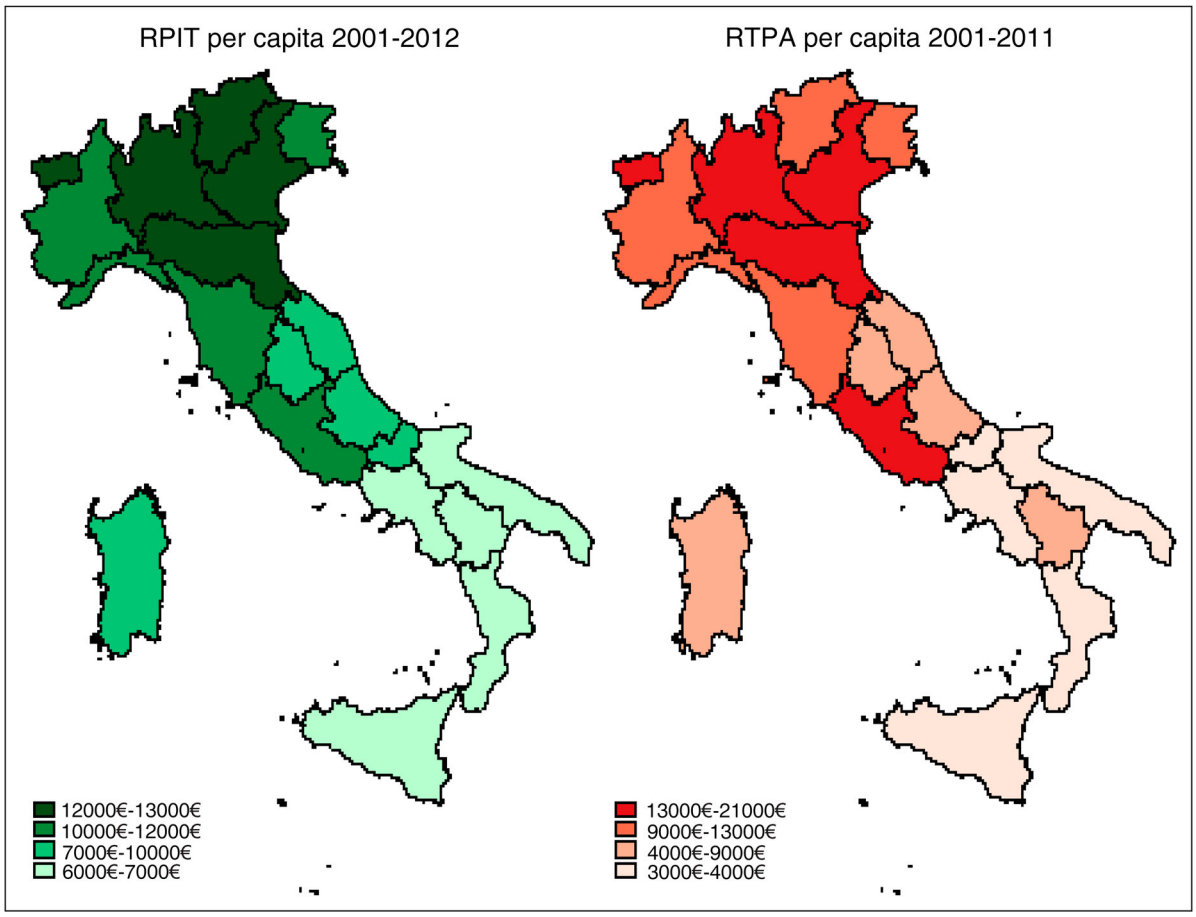

Figure 1. Tax bases by region (average in euros per capita).

the core (mass) industrial north (regions of the north-west, north-east and, to a less extent, the centre) and a sluggish, more agricultural south (including the isles). Consequently, the rigidity of the structure of subnational taxes, mostly based on incomes, introduces some significant asymmetries in the ability of different regions to finance an adequate level of services in both good and bad times. Indeed, in terms of per-capita tax revenues, the richest region collects about four times more resources than the poorest one. A similar trend – even though on a reduced scale – emerges also for the RPIT, which only partly depends on the different tax effort provided by regions.

EMPIRICAL ANALYSIS

Model specification

The empirical analysis employs a balanced panel of 20 Italian regions over the period 2001–12. To estimate both short- and long-run responses of the tax bases of the RTPA and RPIT to regional GDP, an ECM is used. This has been widely applied in the literature to calculate the income elasticity of tax revenue (e.g., Wolswijk, 2009). The model considers both levels and changes of the relevant variables in order to identify both the long-run growth and short-run cyclical variability of a tax base through a single equation (for a similar application of the ECM on Italian regional data and short time span, see Grisorio & Prota, 2015). The use of both levels and changes is driven by the fact that if income and tax bases are non-stationary in their levels – as usually happens – the estimated coefficients of variables in levels would provide information only on the long-run relationships between variables (Sobel & Holcombe, 1996). Thus, a second regression based on stationary versions of the same variables should be implemented to obtain the short-run relationship. It is important to highlight that in short-run estimations, elasticities can be biased by the presence of an error correction (Engle & Granger, 1987) due to the fact that two non-stationary variables, with a long-run relationship, will tend to move back together whenever they get too far apart.[13] To overcome this issue, the Akaike information criterion (AIC) selection procedure is applied and it suggests using one lag as the appropriate timing of adjustment. Furthermore, a disequilibrium relationship is assumed involving first-order lags of both endogenous and exogenous variables in order to give the following ECM model for a cross-section ($i = 1$–20) time-series ($t = 2001$–12) analysis:[14]

$$\Delta \ln (TB_{it}) = \theta \cdot \ln (TB_{it-1}) + \delta \cdot \Delta \ln (Y_{it}) + \lambda \cdot \ln (Y_{it-1}) + \sum_{j=1}^{s} (\gamma_j \cdot \Delta Z_{jit}) + \sum_{j=1}^{s} (\omega_j \cdot Z_{jit-1}) + \alpha_i + \tau_t + \varepsilon_{it} \quad (1)$$

where TB_{it} is the regional per-capita tax base in logarithmic form; Y_{it} is the per-capita regional GDP in log-form; Z_{it} includes a set of control variables (described below); α_i and τ_t capture, respectively, region- and time-fixed effects; and ε_{it} is the error term.[15]

As suggested by Wickens and Breusch (1988) for small samples and by Banerjee, Dolado, Hendry, and Smith (1986) for multivariate models, the $\hat{\delta}$ estimated coefficient from equation (1) directly provides the short-run responses. Thus, the short-run income elasticity of a regional tax base can be defined as:

$$\eta_{\text{short}} = \hat{\delta} \tag{2}$$

Equation (2) measures the cyclical component of the tax base variability as the average income elasticity across regions. A $\eta_{\text{short}} > 1$ indicates that the tax base fluctuates more than regional income over the business cycle, indicating a potential greater sensitivity of the corresponding tax revenues. The opposite holds when $\eta_{\text{short}} < 1$.

The estimation of the long-run income elasticity can be recovered by:

$$\eta_{\text{long}} = -\left[\frac{\hat{\lambda}}{\hat{\theta}}\right] \tag{3}$$

where both $\hat{\lambda}$ and $\hat{\theta}$ are obtained from equation (1), and with the latter representing the speed of adjustment towards the long-run equilibrium. A $\eta_{\text{long}} > 1$ means that the tax base grows faster than the regional income, suggesting a more rapid convergence towards the long-run equilibrium.

Data and variables

In equation (1), the dependent variable (TB_{it}) is alternatively expressed as the per-capita tax base of the RTPA falling on the private sector and as the per-capita tax base of the RPIT. Some choices made in equation (1) are not uncontroversial, in particular the use of both per-capita tax bases, and tax bases instead of tax revenues. With regard to the former, borrowing an argument used in the literature on economic growth (Glaeser, Scheinkman, & Shleifer, 1995; Stansel, 2005), per-capita tax bases may be considered a less appropriate measure for investigating the growth and stability of tax resources at the subnational level because the high mobility of factors may cause changes in the level of per-capita tax bases that do not depend on productivity, but on changes in the general attractiveness of a particular area. In this case, alternative measures are suggested, such as the share of tax bases on GDP. While this may be more true for the municipal level and metropolitan areas, mobility among Italian regions is rather low. Thus, one of the fundamental shortcoming of this measure does not apply to our analysis. But even if it did, the fact that per-capita tax bases could capture the impact of mobility may not necessarily be a shortcoming of the approach since the availability of tax resources at the subnational level also depends on how attractive that particular area is and, thus, on how the structure of subnational taxes contributes to either reducing or increasing the mobility of factors.

Furthermore, to the extent that the analysis is based on tax resources as a proxy of the level of public services that subnational governments may provide, the estimation of the reaction of per-capita tax bases is more informative. Indeed, with regard to cyclical stability, the change in per-capita tax bases expresses how much of the potential public spending every citizen would gain or lose in expansionary or contractionary stages of the economic cycle. Analogously, with regard to long-term growth, using per-capita tax bases would provide information on the long-term level of public services that every subnational government could actually provide. When using GDP at the denominator of the tax base, on the other hand, the information would conflate the changes in tax bases – determined by GDP – and the changes in GDP that may alter the ratio without changing the potential level of tax resources and public services. Last, but not least, in equation (1), GDP is used as an explanatory variable; for the sake of clarity, this choice has been made to avoid the use of GDP in the left side of the equation.[16]

With regard to the second issue – the choice between tax bases and tax revenues – a general agreement has emerged on using tax bases to deal with the growth and variability of subnational tax instruments (e.g., Bruce et al., 2006; Groves & Kahn, 1952; Mikesell, 1977; Sobel & Holcombe, 1996; Wilford, 1965). This is especially due to the non-negligible advantage of eliminating the distortions linked to the measurement of effective tax rates and their changes when using tax revenues. When tax revenues are used as a dependent variable, on the other hand, tax bases are often included among the explanatory variables (Cornia & Nelson, 2010; Dye & McGuire, 1991; Fox & Campbell, 1984).

Data on tax bases come from the Italian Revenue Agency (they are available until 2011 for the RTPA and until 2012 for the RPIT), whereas data on regional population used for the per-capita normalization come from the Italian National Institute of Statistics. It is worth noting that since a number of transitory factors (e.g., financial variables, unemployment rate, terms of trade, commodity price, asset price and credit cycles) can systematically affect tax bases, cyclically adjusted tax bases could be used with the aim of factoring out such cyclical effects. However, in our case, the movements in variables other than regional GDP, such as those in commodity and asset prices as well as in export or import prices, are likely to be less relevant with regard to estimating short- and long-run fiscal elasticities in a cross-country analysis (e.g., Price & Dang, 2011). For this reason, adjustments to tax bases at the regional level are not needed, assuming that there will be no other significant co-movements between the cyclical components of the tax base and the cyclical component of other macroeconomic factors beyond regional GDP.

With regard to the explanatory variables, we include the log of per-capita regional GDP (Y_{it}) in the level. Subnational income is included rather than national income, with the aim of capturing potential deviations of regional

business cycles from the national one. Data on regional GDP come from the Italian National Institute of Statistics.

Finally, a set of control variables (Z_{it}) takes into account the external factors potentially affecting the RTPA and RPIT tax bases. First, particularly important for the dynamic of the RPIT that mainly falls on labour incomes, an indicator of participation in the labour market at the regional level is introduced, namely working population (measured by the share of population actually working over total population). As a byproduct, this measure also controls for the characteristics of the socio-economic context. Second, for the RTPA, the share of self-employees over total population is considered. The reason is that the RTPA is directly paid by self-employed and entrepreneurial incomes and not by dependent workers. Since the distribution of self-employed people and productive activities is rather unequal across regions, this variable indirectly controls for the influence of the composition of the working population. Third – and because of the characteristics of the RTPA – the regression also controls for the number of firms normalized on total working population in each region (namely, number of firms). The very unequal distribution of productive activities between the north and south may in principle affect the estimated elasticities. Finally, a dummy to include the central government's discretionary interventions in the case of the RTPA and RPIT is also introduced to isolate the factors that are not under direct control of regional governments. It is worth recalling that both the RTPA and RPIT are set by the central government and that regional governments are left limited autonomy.

All these variables are expressed in logarithmic form and are delivered by the Italian National Institute of Statistics. In addition, region-specific time-invariant effects (λ_i) are also included to catch unobservable regional-specific patterns and mostly to control for time-fixed determinants of such tax bases (e.g., institutional factors). More specifically, time-fixed effects (τ_t) are used to control for national shocks that may affect more than one region at the same time. Finally, since the error term (ε_{it}) is likely to be serially correlated as well as showing cross-sectional correlation, we use a fixed-effect estimator that is robust to heteroskedasticity, cross-sectional dependence and autocorrelation up to some lags. Table A1 in Appendix A in the supplemental data online reports the descriptive statistics of the variables.

RESULTS AND DISCUSSION

The empirical assessment of short- and long-run responses of the RTPA and RPIT to regional GDP consists of four steps. First, we test the presence of cross-sectional dependence in the data (Pesaran, 2015). Second, we control for stationarity in order to apply the ECM correctly (Hadri & Kurozumi, 2012). Third, we investigate the co-integration between regional GDP and the two tax bases using the Westerlund test (Westerlund, 2007), which is recommended especially in the case of cross-sectional correlations. Fourth, we provide the ECM estimates. The results of diagnostic tests are reported, respectively, in Tables A2–A4 in Appendix A in the supplemental data online.

Results of the error-correction model

This section reports the long- and short-run income elasticities of the RPIT and RTPA over 2001–12 by estimating equation (1) after taking into account the outcome of the diagnostic tests. We use the fixed-effect estimator with the Driscoll and Kraay (DK) corrected standard errors, which is robust to heteroskedasticity, cross-sectional dependence and autocorrelation (Driscoll & Kraay, 1998).[17]

However, given that our sample include regions with very different per-capita tax bases and economic characteristics, we expect large heterogeneity in income elasticities in different areas of the country. Ignoring it may lead to biased estimates. Indeed, either weak or strong forms of correlation across regional panel units are likely to arise because regions react in a similar manner – although with different intensity – to external forces and unanticipated events such as an economic recession. To address this issue, we also estimate equation (1) by a mean group estimator in a dynamic panel with dependence across regions. We use the dynamic common correlated effects estimator (DCCE), which controls for dependence by adding cross-sectional means and lags (Chudik & Pesaran, 2015; Everaert & De Groote, 2016; Pesaran, 2006; Pesaran & Tosetti, 2011) and by testing, at the same time, for cross-sectional dependence in the error terms. Finally, the procedure implemented by Ditzen (2016) allows one to correct for small sample time-series bias (Chudik & Pesaran, 2015).[18]

Tables 1 and 2 show, respectively, the ECM estimations for the RPIT in Italy and the macro north–south regions. Columns (1) and (2) report coefficients using the DK estimator, with the difference that column (2) includes control variables. Columns (3) and (4) present coefficients using the DCCE, without and with controls respectively.

We first consider the case of the RPIT in Italy as a whole (Table 1). According to equation (3), a necessary condition for the long-run elasticity is the significance of the coefficients of the lagged per-capita regional GDP (i.e., Y_{it-1}). In all cases, with the exception of Driscoll and Kraay fixed effects (DK-FE) with controls (column 2), this coefficient is statistically significant, implying that the tax base of the regional income tax shows some potential growth over the long run. However, since the long-run coefficients – as calculated from equation (3) – are less than 1, the RPIT tax base grows slower than the regional GDP. The same is true when measuring elasticities with the DCCE, even though in this case coefficients are closer to 1 than those estimated by DK-FE. To some extent – even though debatable under other perspectives – the personal income tax at the subnational level could be a satisfactory tool for providing an increasing flow of resources to regions.

Table 1. Error correction model (ECM) estimations for the regional personal income tax (RPIT).

	$\Delta \ln (RPIT_{i,t})$			
Dependent variable	**DK-FE (1)**	**DK-FE (2)**	**DCCE (3)**	**DCCE (4)**
$RPIT_{i,t-1}$	–0.42**	–0.45***	–0.44***	–0.55***
	(0.15)	(0.15)	(0.037)	(0.093)
$\Delta Y_{i,t}$	0.21**	0.18*	0.52***	0.69***
	(0.085)	(0.096)	(0.13)	(0.12)
$Y_{i,t-1}$	0.35**	0.36*	0.41***	0.51***
	(0.15)	(0.18)	(0.035)	(0.088)
$\Delta Working\ population_{i,t}$		0.089		0.072
		(0.073)		(0.15)
$Working\ population_{i,t-1}$		–0.053		–0.26*
		(0.11)		(0.14)
$Discretionary\ CG\ on\ RPIT_{i,t}$		0.012**		0.032**
		(0.0048)		(0.013)
Regional fixed effects	Yes	Yes		
Time fixed effects	Yes	Yes		
t-test for $\Delta Y_{i,t}$ coefficient = 1	–9.20	–8.54	–3.69	–2.58
R^2			0.410	0.659
Observations	220	220	220	220
Groups	20	20	20	20

Notes: Values are regression coefficients (associated robust standard errors). The constant is included but not reported. DCCE, dynamic common correlated effects estimator; DK-FE, Driscoll and Kraay fixed effects; CG, central government.
*Significant at 10%; **significant at 5%; ***significant at 1%.

Given the strong dualism of the Italian regions, with the north on average richer than the south, investigating whether long-run elasticities differ between geographical areas is in itself of interest. The available data did not allow us to perform a region-by-region analysis, but we were able to split the sample into two and repeat the analysis for northern and southern regions separately in Table 2. As in the previous case, the coefficients of lagged regional GDP are always statistically significant (at least at the 10% level in southern regions when using DK-FE). The estimated long-run elasticities show – as expected – that the personal income tax base grows faster in the north than in the south for all specifications. This would give northern regions a competitive advantage in terms of potential tax resources to be spent on public services for their citizens. This is partially due to the initial conditions in which the north and south operate, with a large concentration of incomes in the north as well as a higher per-capita level of income. If the personal income tax base seems to serve the scope of assuring at least some long-run growth, the higher elasticities in the north would mean that such tax would, ultimately, amplify the differences in resources and public services endowments compared with those in the south. In a highly decentralized setting, this could call for a higher use of equalization transfers from the centre. This is especially true if a certain level of fundamental public services has to be levelled over the whole territory, as in the case of the NHS.

With regard to short-run elasticities, on the other hand, the relevant information is captured by the coefficient of the changes of regional GDP (i.e., ΔY_{it}). In Table 1, this coefficient is always statistically significant and always smaller than 1. This means that the regional tax base of the personal income tax fluctuates over the business cycle (in a procyclical way), but less than the regional GDP which may be thought of as a good property of a subnational tax base. It is, however, worth noting that in this case the size of the short-run elasticity depends more on the specific model used, with the DCCE estimating significantly higher elasticities, a feature that also persists when the sample is split between northern and southern regions (Table 2).[19]

Moving on to the RTPA (Tables 3 and 4), things are slightly different and we expect them to reflect more strongly the dualism of Italy. Considering first long-run growth, Table 3 shows that the presence of controls weakens the statistical significance of the coefficients of interest. Notwithstanding these less stable results, some estimations give indications that the RTPA also shows some potential long-run growth which is again higher when estimated with the DCCE.

However, the most interesting result is captured by Table 4 where the sample is split between north and south. It is evident that some possibilities of a long-run growth of the RTPA would be a characteristic of northern regions only, while in the south this tax seems to be

Table 2. Error correction model (ECM) estimations for the regional personal income tax (RPIT) for northern and southern regions.

	Δln ($RPIT_{i,t}$) in northern regions				Δln ($RPIT_{i,t}$) in southern regions			
Dependent variable	**DK-FE (1)**	**DK-FE (2)**	**DCCE (3)**	**DCCE (4)**	**DK-FE (5)**	**DK-FE (6)**	**DCCE (7)**	**DCCE (8)**
$RPIT_{i,t-1}$	–0.42**	–0.44**	–0.39**	–0.48***	–0.41**	–0.43**	–0.41***	–0.66***
	(0.13)	(0.14)	(0.15)	(0.047)	(0.14)	(0.14)	(0.053)	(0.11)
$\Delta Y_{i,t}$	0.27*	0.27	0.69***	0.47***	0.24***	0.18	0.56**	0.69***
	(0.13)	(0.15)	(0.12)	(0.043)	(0.044)	(0.11)	(0.22)	(0.20)
$Y_{i,t-1}$	0.37**	0.41**	0.49***	0.45***	0.29**	0.35*	0.38***	0.52***
	(0.14)	(0.17)	(0.12)	(0.044)	(0.12)	(0.17)	(0.050)	(0.13)
$\Delta Working\ population_{i,t}$		0.083		0.51**		0.093		–0.22
		(0.080)		(0.24)		(0.11)		(0.15)
$Working\ population_{i,t-1}$		–0.043		0.12		–0.085		–0.51**
		(0.066)		(0.11)		(0.099)		(0.19)
$Discretionary\ CG\ on\ RPIT_{i,t}$		0.00038		–0.00041		0.0046*		0.053**
		(0.0016)		(0.0016)		(0.0023)		(0.020)
Regional fixed effects	Yes	Yes			Yes	Yes		
Time fixed effects	Yes	Yes			Yes	Yes		
t-test for $\Delta Y_{i,t}$ coefficient = 1	–5.61	–4.86	–2.58	–12.00	–17.27	–7.45	–2.00	–1.55
R^2			0.486	0.731			0.397	0.642
Observations	88	88	88	88	132	132	132	132
Groups	8	8	8	8	12	12	12	12

Notes: Values are regression coefficients (associated robust standard errors). The constant is included but not reported. DCCE, dynamic common correlated effects estimator; DK-FE, Driscoll and Kraay fixed effects; CG, central government.
*Significant at 10%; **significant at 5%; ***significant at 1%.

Table 3. Error correction model (ECM) estimations for the regional tax on productive activities (RTPA).

	$\Delta \ln (RTPA_{i,t})$			
Dependent variable	**DK-FE (1)**	**DK-FE (2)**	**DCCE (3)**	**DCCE (4)**
$RTPA_{i,t-1}$	–0.39***	–0.38***	–0.49***	–0.70**
	(0.062)	(0.064)	(0.052)	(0.32)
$\Delta Y_{i,t}$	0.40*	0.48**	1.31***	1.83**
	(0.19)	(0.17)	(0.13)	(0.74)
$Y_{i,t-1}$	0.23**	0.17	0.45***	0.67*
	(0.087)	(0.12)	(0.046)	(0.34)
$\Delta Self\text{-}employees_{i,t}$		0.034		–1.08**
		(0.024)		(0.51)
$Self\text{-}employees_{i,t-1}$		0.049		–1.39
		(0.053)		(0.83)
$\Delta N\ firms_{i,t}$		0.28*		0.12
		(0.13)		(0.56)
$N\ firms_{i,t-1}$		0.048		0.99
		(0.080)		(1.06)
$Discretionary\ CG\ on\ RTPA_{i,t}$		–0.0030		–0.041
		(0.0044)		(0.030)
Regional fixed effects	Yes	Yes		
Time fixed effects	Yes	Yes		
t-test for $\Delta Y_{i,t}$ coefficient = 1	–3.15	–3.05	2.38	1.12
R^2			0.491	0.927
Observations	200	200	200	200
Groups	20	20	20	20

Notes: Values are regression coefficients (associated robust standard errors). The constant is included but not reported. DCCE, dynamic common correlated effects estimator; DK-FE, Driscoll and Kraay fixed effects.
*Significant at 10%; **significant at 5%; ***significant at 1%.

severely insufficient to guarantee the financing of a growing number of public services. This result is the expected consequence of a large concentration of the tax base in the northern regions and the fact that per-capita income, on average, is four times higher in the north than in the south.

Looking at the short-run coefficients does not improve the picture. At a national level (Table 3), the elasticity of the RTPA is higher than that estimated for the RPIT. Furthermore, using the DCCE, the short-run elasticity is greater than 1, which means that cyclical fluctuations are higher than those for regional GDP, making it difficult, in recession periods, to finance public services that are more cycle insensitive. Again, the cyclical response of the RTPA is extremely differentiated between the two groups of regions (Table 4). Where statistically significant, the short-run elasticity is much higher in the south, which makes the conditions of southern regions even more severe. Ultimately, this would amplify the differences with the richest regions of the north, especially if we take into account the lower ability of subnational governments to smooth temporary deficits with borrowing instruments.

CONCLUSIONS

This paper has shown that the two main taxes used by Italian regional governments, the RPIT and RTPA, have some undesirable characteristics in terms of long-run potential growth and reactions to the economic cycle. The empirical analysis reveals that while the RPIT performs well in terms of long-run growth, this growth is higher in the northern regions, which gives them a comparative advantage in the use of this tax. In addition, this advantage is significantly amplified in the case of the RTPA where significant long-run growth has been estimated only in the northern regions.

Short-run elasticities also show much higher values for the RTPA in the southern regions, signalling a greater degree of instability. Again, this outcome would amplify the distance from the northern regions both in the ability to face adverse economic cycles and to guarantee a growing level of essential public services. There is no doubt that between these two financing sources the RTPA has the most severe problems in terms of both its characteristics and the size of tax resources that it actually provides to

Table 4. Error correction model (ECM) estimations for the regional tax on productive activities (RTPA) for northern and southern regions.

	$\Delta\ln(RTPA_{i,t})$ in northern regions				$\Delta\ln(RTPA_{i,t})$ in southern regions			
Dependent variable	**DK-FE (1)**	**DK-FE (2)**	**DCCE (3)**	**DCCE (4)**	**DK-FE (5)**	**DK-FE (6)**	**DCCE (7)**	**DCCE (8)**
$RTPA_{i,t-1}$	–0.38***	–0.38***	–0.44***	–0.72	–0.45***	–0.40***	–0.52***	–0.65**
	(0.095)	(0.094)	(0.082)	(0.59)	(0.064)	(0.071)	(0.065)	(0.27)
$\Delta Y_{i,t}$	0.67***	0.69**	1.12***	–0.32	0.23	0.43	1.22***	2.07***
	(0.16)	(0.25)	(0.15)	(0.71)	(0.26)	(0.25)	(0.17)	(0.63)
$Y_{i,t-1}$	0.65**	0.54	0.41***	1.03	0.076	0.061	0.11	0.16
	(0.19)	(0.29)	(0.075)	(0.76)	(0.086)	(0.11)	(0.085)	(0.62)
$\Delta Self\text{-}employees_{i,t}$		0.15		0.55		–0.067*		–1.29**
		(0.084)		(0.44)		(0.036)		(0.51)
$Self\text{-}employees_{i,t-1}$		0.084**		0.15		–0.0093		–1.28
		(0.024)		(0.55)		(0.071)		(0.78)
$\Delta N\ firms_{i,t}$		0.34		0.52		0.23**		–0.25
		(0.37)		(1.01)		(0.088)		(0.47)
$N\ firms_{i,t-1}$		0.025		5.75**		0.020		–0.38
		(0.17)		(2.30)		(0.087)		(0.84)
$Discretionary\ CG\ on\ RTPA_{i,t}$		0.0013		–0.039		0.00077		0.0033
		(0.0070)		(0.036)		(0.0049)		(0.026)
Regional fixed effects	Yes	Yes			Yes	Yes		
Time fixed effects	Yes	Yes			Yes	Yes		
t-test for $\Delta Y_{i,t}$ coefficient = 1	–2.00	–1.24	0.80	–1.80	–2.80	–2.28	1.29	1.60
R^2			0.466	0.943			0.611	0.917
Observations	80	80	80	80	120	120	120	120
Groups	8	8	8	8	12	12	12	12

Notes: Values are regression coefficients (associated robust standard errors). The constant is included but not reported. DCCE, dynamic common correlated effects estimator; DK-FE, Driscoll and Kraay fixed effects.
*Significant at 10%; **significant at 5%; ***significant at 1%.

regions. These problems cannot be easily overlooked for long if we consider that both regional taxes are linked to the financing of the NHS in Italy.

More generally, the results suggest that unitary states that try to make concessions to fiscal federalism by maintaining significant centralized rules on regional tax sources and regional spending may run the risk of exacerbating territorial asymmetries. In this framework, a crucial role is played by both the degree of tax-and-spending autonomy assigned to local governments. One major problem with the Italian regional system of fiscal federalism has been that of maintaining strong power in the hands of the central governments to limit both tax resources and spending powers through institutional mechanisms. The golden rule of giving local governments only spending competencies that are not in the central interest and of leaving tax resources that cannot be affected by national policies has been frequently violated in Italy, leading to unavoidable conflict over the proper level of economic resources that regions should have to finance essential public services.

Overall, our results cast some doubt on the ability of these two regional taxes to finance an adequate level of public services in the long run, especially when this level has to be guaranteed throughout the whole country. The dualism of the country would risk being exacerbated by giving regions the power to apply the RPIT and RTPA, with a growing need to centralized equalization transfers in future. This feature could characterize all countries with a similar decentralized structure.

ACKNOWLEDGEMENTS

The authors thank the associate editor and two anonymous referees for their insightful comments on the paper. Special thanks are due to Joan Maria Mussons, Miriam Hortas-Rico and Elisa Tosetti for their helpful suggestions and discussions. All remaining errors are the authors' own. A previous version of this paper was circulated as 'The growth and variability of local taxes: an application to the Italian regions' (GEN Working Paper No. B 2016-1).

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

FUNDING

Raffaele Lagravinese acknowledges financial support from the Regione Puglia (Future in Research Project). The research carried out in this paper is part of a wider project on 'Crisi economica, distribuzione dei redditi e criteri di accesso alle politiche di assistenza' (R876/2015).

SUPPLEMENTAL DATA

Supplemental data for this article can be accessed at https://doi.org/10.1080/00343404.2017.1313400.

NOTES

1. This is also due to the fact that the possibility to resort to alternative financing sources – such as debt – is more limited everywhere for subnational governments than for national governments.
2. Usually, corporate income taxes experience the greatest short-run variability, followed by personal income taxes, sales taxes and excise taxes (Sobel & Holcombe, 1996; Garrett, 2009).
3. As noted by Rodden and Wibbels (2010), existing comparative studies are indeed more prone to emphasizing the role of national tax-transfer systems as a whole in cushioning asymmetrical regional shocks rather than focusing on single tax instruments at subnational levels.
4. The focus on regions is justified by the fact that even though a certain degree of taxing power has been recently left to provinces and municipalities, the major changes refer to regions (e.g., Constitutional Law 3/2001, Law 42/2009).
5. Since 2001, the Italian National Health Service (NHS) has implemented decentralization reforms in health management by assigning more responsibilities to subnational governments (basically, regions). The NHS provides essential levels of health services (ELS) to the whole population. The ELS are defined and financed by the central government but provided by regional authorities.
6. *Irap* and *Addizionale Regionale IRPEF* in Italian.
7. This tax is also applied to all public entities (state, regions, provinces and municipalities).
8. Over the last few years, deductions in labour costs have progressively increased. These provisions, however, do not affect the time span of our analysis.
9. We mainly focus on the OSRs since the special statutory regions (SSRs) are characterized by different financing mechanisms mostly based on the devolution to these regions of all taxes collected in their territories. However, we also include the SSRs in the empirical analysis for robustness purposes.
10. On average, the public RTPA provides 25% of total revenue, with a peak of 32% in Lazio, where the bulk of the public administration is located. It is applied with a fixed rate of 8.5%, thus differing from the standard rule for the RTPA on private activities.
11. Percentages slightly different from both the ordinary minimums and maximums (2.9% and 4.9%, respectively) are due to the conversion procedure between 2008 and 2009 when the base tax rate decreased from 4.25% to 3.90%. Thus, the reduction in the range of variation – calculated according to the ratio between 3.90% and 4.25% – would go from 1.0 to 0.92 percentage points.
12. In fact, the opportunity to change the tax rate was seldom used until 2004 since regions had been prevented by financial law (L. 289/2002, L. 350/2003 and L. 311/2004) from increasing both the RTPA and RPIT, a limit that has been removed from 2004 onward.
13. In other words, one variable can move up in the same period in which another is moving down simply because

the variables deviated from the levels implied by their long-run relationship.

14. Equation (1) is obtained by adding the error-correction term derived from a long-term equation (where variables are considered in levels) to a short-term equation (where variables are considered in differences), suggesting that deviations from the long-run pattern of the tax base may have an impact on the short-term tax base.

15. One shortcoming of including time fixed-effects is that they may capture part of the cycle (i.e., the part common to all regions). However, if we do not include time fixed-effects, an omitted variable bias may occur, compromising our estimations more heavily.

16. In this vein, Hines (2010) uses variables in per-capita terms to investigate how differently federal, state and local tax revenues respond to the business cycle. More recently, Riedl and Rocha-Akis (2012) used per-capita corporate income tax bases to estimate tax-base elasticities with regard to domestic and foreign competing countries' tax rates in OECD countries.

17. After observing the residual correlation over time, we use a two-lag correction for autocorrelated errors. Results are also robust to increasing the lag structure up to three (not reported in the paper).

18. The routine developed by Ditzen (2016) introduced a new Stata command, *xtdcce*. In detail, we apply the recursive mean adjustment bias-correction method that does not require any knowledge of the error factor structure and can be applied to the mean group estimates (Everaert & De Groote, 2016) by removing the partial mean from all variables. The partial mean is lagged by one period to prevent it from being influenced by contemporaneous observations (Chudik & Pesaran, 2015).

19. The estimated upper bound of the confidence interval with a DK-FE estimator is 0.389. The corresponding upper bound with DCCE estimator is 0.782.

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