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ECONOMIC INTEGRATION, TAX EROSION,
AND DECENTRALISATION: AN EMPIRICAL ANALYSIS

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Economic Integration, Tax Erosion, and Decentralisation: An Empirical Analysis

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Abstract

This paper addresses the issues of whether and how the degree of economic integration may affect central government tax revenues and the intensity of decentralisation. To this purpose, we empirically test the direct impact of economic integration on central tax revenues using the concept of *implicit tax rates* (ITRs) updated to take into account mobile and immobile capital taxation. On this basis we derive a country-specific measure of *tax erosion* that is used as a determinant of the decentralisation of the public sector in an Arellano-Bond environment. We find that: *i)* an increase of economic integration generates a downward pressure on ITRs on mobile capital, which is growing at increasing rates as far as economic integration increases; *ii)* the process of tax erosion gives rise to a corresponding process of increasing public sector decentralisation.

Keywords: economic integration, fiscal federalism, tax competition.
JEL Classification: H77, H87, F20

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1. Introduction

A large number of contributions that address the impact of international tax competition on public finance variables reveal that economic integration may introduce significant constraints on *national* public policies. Yet, in these cases, the public sector is usually considered as a monolithic entity and the impact of economic integration analysed 'as if' states were unitary. On the other hand, those studies that investigate the link between decentralisation and government size disregard the possibility that the vertical structure of the public sector may be affected by economic integration, thus analysing the issue 'as if' states were closed.[1]

This paper tries to build a bridge between these two strands of literature, addressing in a unified empirical framework the relations among economic integration, national tax revenues and the decentralisation of the public sector.[2] In particular, we maintain the hypothesis that economic integration produces first a *direct impact* on central tax revenues and then an *indirect impact* on the vertical structure of the public sector, i.e. decentralisation. The main justification lies on the possibility that following increasing tensions on the use of central tax bases and on the levels of central public spending caused by wider economic integration, the central government might find convenient to decentralise both tax and spending powers as a way to spread responsibilities among government levels.

In order to verify this hypothesis, we develop an econometric strategy in two steps using a sample of OECD countries. In the first stage, economic integration is directly used as a determinant of the size of central tax revenues, measured by the *implicit tax rates* (*ITR*) developed by Mendoza *et al.* (1994) and updated by Gastaldi (2008) to introduce the distinction between *ITRs* on *mobile* and *immobile* capital. This feature avoids conflating taxes on corporations and on immovable properties under the same heading of '*capital tax rates*', as instead usual in the standard version of the approach. Indeed, the expected reactions of these two forms of 'capital taxes' to economic integration might be significantly different and additional information may therefore be conveyed by separating the implicit tax rates on the corresponding tax bases.

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[1] A notable exception to this artificial division of interests are Stegarescu (2006) and Stegarescu (2009), who finds (among EU countries) that greater economic integration may be positively associated with higher public sector decentralisation through the increasing demand for productive local public goods that would be stimulated by economic openness. In this case, however, the countries' level of decentralisation is *directly* related to their degree of economic integration, implicitly assuming that two countries exhibiting the same level of economic openness would experiment the same level of tensions on public finance variables despite potentially remarkable differences in their pre-existing tax and spending structures.

[2] For a theoretical setting in this direction, see Stegarescu (2006), Stegarescu (2009) and Liberati and Scialà (2008).

In the second stage, a measure of *erosion* of central tax revenues (henceforth *tax erosion*) will be derived (defined as the elasticity of *ITRs* with respect to economic integration) and used as a determinant of the decentralisation of the public sector, maintaining the hypothesis that more tax erosion at central level will cause higher decentralisation levels. The results of the empirical analysis show that economic integration actually erodes *implicit tax rates* on mobile tax bases, while producing no effects on other *ITRs*. The measure of tax erosion is then found to have a significant explanatory power in shaping the degree of decentralisation.

2. Economic integration, tax revenues and decentralisation

2.1. *Economic integration and tax revenues*

Whether economic integration is potentially able to affect *national* tax and spending policies is an open issue.[3] The literature on tax competition suggests that capital taxation would be lower with higher international capital mobility, as capital mobility would prevent national governments from differentiating the tax burden on mobile production factors. "Abused" tax bases might indeed sanction undesirable public policies by *exit* national borders.[4]

In an extreme version of this model – that has become popular as the *race-to-the-bottom* hypothesis – capital mobility would cause tax revenues to disappear in the attempt of governments to create favourable conditions for investments, a feature that has led many authors to define tax competition as 'harmful'.[5] In a milder version, governments would be "disciplined" to use resources efficiently, the reason why this outcome is also referred to as the *efficiency hypothesis* in the spirit of Brennan and Buchanan (1980). Both cases would fall into what Swank (2002) calls the *capital flight* hypothesis and both, in principle, would lead to lower optimal tax rates on mobile factors in open rather than in closed economies.[6]

On the other hand, some authors argue that citizens in countries with a large exposure to international trade and capital mobility try to *demand* compensation through public spending (especially social spending) to cushion the additional risk embodied in opening markets (e.g. unemployment).[7] This possibility, usually labelled as the *compensation hypothesis*, is at the root of a possible corresponding increase of taxation (and debt) as a way to actually *supply*

[3] See the review by Schulze and Ursprung (1999) and, more recently, Gastaldi and Liberati (2009).
[4] See, for example, the classical model by Bucovetsky and Wilson (1991), who show that if capital cannot be taxed with the residence principle (that would guarantee capital export neutrality), it is optimal for a small economy to tax labour only.
[5] This is the classic "fiscal termites" argument by Tanzi (1995, 2000). See also Lee and McKenzie (1989), Kurzer (1993) and Steinmo (1994).
[6] Gordon (1986); Razin and Sadka (1991).
[7] The main reference for this hypothesis is Rodrik (1998).

additional public spending.[8] Whether this additional demand can actually be accommodated by tax increases is however controversial, as national governments experience both increasing tensions on the tax side of the public budget and complaints by market forces about what they consider *unproductive* public spending.[9]

This variety of theoretical positions do not find a synthesis on the empirical side, not least because the empirical evidence investigating the relation between economic integration and tax levels is not abundant (unlike what is available on the spending side). On the contrary, existing empirical studies show a mixed evidence on the impact of economic integration on tax revenues.[10] Some of them give indirect support to the compensation hypothesis[11]; other studies reinforce the intuition that economic integration is a stressing factor for public finances.[12]

In both cases, however, there are common flaws that make them hardly comparable. First, and most important, the existing literature does not agree on a common indicator of the tax burden, swinging from *statutory tax rates* to *forward-looking* or *backward-looking* effective tax rates (with various possibilities of normalisation), to measures of tax burden based on tax ratios.[13] Results are therefore different as they measure different things.

Second, existing studies usually do not distinguish between capital taxes falling on *mobile* and *immobile* tax bases, which is instead crucial to capture the influence of capital mobility. In this respect, our analysis makes an innovative step in this direction, by explicitly introducing a distinction between *ITRs* on mobile and immobile capital.

Third, economic integration is more often modelled as *trade integration*, usually disregarding outward and inward flows of foreign direct investments.[14] Again, this implies

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[8] Even though built to explain the behaviour of social spending, the compensation hypothesis may therefore be taken as an indirect indicator of the behaviour of tax revenues, at least when additional spending is not totally financed by debt.

[9] As a result of economic integration, some authors argue that public spending would be more oriented towards privately productive public goods (e.g. infrastructures, training programmes, human capital) and less towards transfers and social welfare expenditures. See Keen and Marchand (1997) and Taylor-Gooby (1997).

[10] In all cases, results are affected by a lack of a 'true' counterfactual scenario. The statement that economic integration does not harm national tax policies, for example because taxes do not decrease, implies that taxes are as they would have been in the absence of economic integration. This statement is however debatable. For example, if labour taxes increase more rapidly than capital taxes in the presence of high economic integration, the *share* of capital taxes on total tax revenue declines, even though the *level* of capital taxes does not.

[11] See, for example, Cameron (1978), Huber *et al.* (1993), Garrett (1995), Quinn (1997), Hallerberg and Basinger (1998), Swank (2002), Dreher (2006).

[12] See Rodrik (1997), Swank (1998), Heinemann (1999), Swank and Steinmo (2002), Bretschger and Hettich (2002), Winner (2005), Schwartz (2007).

[13] For a detailed treatment of this issue, see Gastaldi (2008).

[14] While this might have been an innocuous assumption in the past – where most financial markets were actually closed – the liberalization of capital movements in many advanced countries – especially in Europe in the Nineties – does not legitimate to disregard *capital integration* (CI) anymore. As suggested by Schulze and Ursprung (1999; 314), even though there are reasons to believe that countries with higher trade shares tend to be countries with higher capital mobility, trade openness and capital

that the concept of economic integration adopted by these studies is actually measuring different things. Also in this respect, our approach will attempt to proxy the degree of potential mobility by considering trade and capital openness at the same time.

As a matter of further complication, existing studies differ widely with regard to the set of countries and years involved. Countries included often differ in number and, more important, by geographical areas. Some analyses are confined to OECD countries, others extend over this subset, including transitional and less developed ones. The number of years covered only rarely is updated to very recent times also for recent studies, with the consequence that results might be severely biased by not considering the period where economic integration has actually developed most.[15]

2.2. Economic integration and decentralisation

The relation between economic integration and decentralisation is even less generously investigated; yet the existing studies suggest some speculations. First, a possible nexus between the two variables straightforwardly arises from the extension of the compensation hypothesis to local governments. Since the shield provided by social spending against additional risk is thought to be best served by centralised fiscal arrangements (e.g. Oates, 1972), the consequential outcome is that globalisation should increase the size of central governments and relatively reduce the weight of local governments, especially if regions are specialised in production.[16]

Second, economic integration may reduce the cost of secession by part of small regions and provide for smaller benefits to larger countries (e.g. Alesina and Spolaore, 1997; Alesina and Wacziarg, 1998). According to this view, 'political separatism should be associated with increasing economic integration' (Alesina and Spolaore, 1997; 1041), as exit threats might become more credible (and cheaper) in an integrated world than in an autarchic world. This would lead to more decentralisation with high economic integration. Under this same perspective, if fiscal decentralisation is interpreted as a backstop to avoid the inefficiency costs

mobility are two distinctively different concepts – possibly with asymmetric effects on the ability of national governments to tax and spend.
[15] In particular, a large part of the empirical evidence stops around the first half of the Nineties, a period in which capital liberalisation is likely not to have explained all its effects, as many countries (especially in Europe) have abolished capital controls in that period. See Gastaldi (2008) and Gastaldi and Liberati (2009).
[16] See also Garrett and Rodden (2003).

associated to secession, as in Bolton and Roland (1997), more economic integration should lead to more decentralised countries.[17]

A third explanation tends to highlight the role of economic integration as a fiscal discipline device. Economic integration would impose harder budget constraints on decentralised governments (de Mello, 2005), reduce the 'deficit bias' empirically observed in more decentralised countries – originated by either implicit or explicit bail-out guarantees from the central governments[18] – and favour the implementation of a market-preserving federalism (e.g. Qian and Weingast, 1997; Qian and Roland, 1998).[19]

A fourth explanation is based on the existence of opportunistic behaviour by part of either government level involved in the process. In particular, the existing literature has focused on the case where central governments may offload public expenditures to local governments. Economic integration, for example, command fiscal balance[20], may increase the domestic cost for central governments of pursuing redistributive aims[21] and favour more decentralisation on a political ground, something that can be referred to here as the shifting hypothesis.[22] If one assumes that the most powerful pressure to maintain fiscal balance comes from capital markets, the argument that tensions on the tax side give incentives to central governments to offload public spending to local governments ends up to be the argument advanced in this paper that more economic integration may lead to change the vertical structure of the public sector.

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[17] The reason is that central governments will be willing to pay more local governments to avoid secession – for example, by increasing transfers or by devolving spending and taxation power to them. Nonetheless, as Garrett and Rodden (2003) pointed out, central governments may try to 'buy' loyalty of voters – especially in would-be breakaway regions – by direct spending rather than by transfers, by this way recovering the possibility that economic integration would increase (more) the size of central governments. The authors, however, seem to disregard the possibility that local voters might be more effectively 'bought' by increasing either the size of – possibly unconditional – transfers or the amount of taxes devolved to local territories (at least if one assumes that local citizens are better informed about what happens at local rather than at central level or that less rents are dissipated at local level. On this latter point, see Ferejohn, 1999). Salmon (1987) also provides a framework of horizontal competition among local governments in which taxpayers have wide information and comparison opportunities of local public policies.

[18] See, for example, Alesina and Perotti (1998).

[19] However, it has recently been shown that hard budget constraints for sub-national governments may not be socially optimal, as under some circumstances socially efficient projects may not be undertaken (Besfamille and Lockwood, 2004).

[20] This hypothesis is known as the *domestic balance* hypothesis. See Swank (2002).

[21] To some extent, the reason is the same as predicted by Tiebout (1956) when perfect mobility is assumed. In this latter case, redistribution is a hardly tenable function for local governments and unstable equilibria may originate. See also Stigler (1957).

[22] The relevance of this *shifting hypothesis* is not new in the economic literature. Its origin can be traced back to the literature on regulation authorities. See, for example, Mitnick (1980). Garrett and Rodden (2000), for example, argue that strategic behaviour may be followed by central governments facing increasing pressures to maintain fiscal balance, by attempting to cut expenditures by offloading expenditures and deficits to local governments. In other terms, openness would induce central governments to shift budget deficits to local governments. The previous argument by de Mello (2005) is therefore turned on its head, as in this latter case, openness should remedy the fact that more decentralised countries have higher budget deficits.

3. Empirical strategy and data

In order to analyse the relationship between economic integration, tax erosion and decentralisation, a two-stage empirical strategy is introduced. Before proceeding any further, it is worth stating the two hypotheses that will be tested:

Hypothesis 1

Economic integration would cause a process of tax erosion at central level.

Hypothesis 2

Tax erosion at central level leads to increasing public sector decentralisation.

To give a theoretical intuition of the implications of these two hypotheses one can make recourse to the concept of the Marginal Efficiency Cost of Funds (MECF) developed by Slemrod and Yitzhaki (1996). Suppose that a central government collect tax revenue R_C according to the following scheme:

$$R_C = t_r \Upsilon_r(t_r) + t_{nr} \Upsilon_{nr}(t_{nr}) \tag{1}$$

where t_r is the tax rate applied on the "resident" tax base Υ_r and t_{nr} is the tax rate on the "non-resident" tax base Υ_{nr}. "Resident" and "non resident" can be interpreted here as proxies for relatively immobile and mobile tax bases, respectively. Now, the efficiency cost of collecting funds either from resident or non-resident tax bases depends on the level of additional tax revenue that can be obtained by increasing the corresponding tax rate. To this purpose, define:

$$MR_r = \Upsilon_r(t_r) + t_r \Upsilon_r'(t_r) \tag{2}$$

$$MR_{nr} = \Upsilon_{nr}(t_{nr}) + t_{nr} \Upsilon_{nr}'(t_{nr}) \tag{3}$$

as the marginal revenue that can be obtained by increasing either t_r or t_{nr}, with $\Upsilon_r'(t_r) = \dfrac{d\Upsilon_r}{dt_r}$.

Equations (2) and (3) can be interpreted as the sum of the "tax rate effect" ($\Upsilon_r(t_r)$) and of the "tax base effect" ($t_r \Upsilon_r'(t_r)$). In particular, one could also rewrite $MR_j = \Upsilon_j - (\Upsilon_j - MR_j)$,

$j = r, nr$, by which the marginal revenue is defined by the "potential tax base" (Υ_j) minus the "leak" outside the tax system represented by $(\Upsilon_j - MR_j)$.

Now, by normalising both (2) and (3) by the potential tax base Υ_r and Υ_{nr}, respectively, one can get the marginal revenue for unit of tax base:

$$\frac{MR_j}{\Upsilon_j} = 1 + \varepsilon_{\Upsilon_j, t_j} \tag{4}$$

where $j = r, nr$ and $\varepsilon_{\Upsilon_j, t_j} = \dfrac{t_j \Upsilon_j'}{\Upsilon_j}$. By (4), the definition of the marginal efficiency cost of fund arises by taking the inverse (with $j = r, nr$):

$$MECF_j = \frac{\Upsilon_j}{MR_j} = \frac{1}{1 + \varepsilon_{\Upsilon_j, t_j}} \tag{5}$$

It follows from (5) the general principle that the MECF will be higher for more elastic tax bases, while it will be smaller in the case of less elastic tax bases. In our case, if mobile tax bases are assumed more elastic to taxation, it will be that $\left| \varepsilon_{\Upsilon_{nr}, t_{nr}} \right| > \left| \varepsilon_{\Upsilon_r, t_r} \right|$ and $MR_{nr} < MR_r$ (i.e. the marginal revenue that can be obtained by taxing more elastic tax bases is lower as part of the tax base disappears). This latter condition implies $MECF_{nr} > MECF_r$.

This means that if the central government wants to collect a given amount of tax revenue, it has some convenience – up to a certain point – to shift taxation from mobile to immobile tax bases, as this minimises the "leak" of tax revenues. Our hypothesis 1, while based on whether economic integration induces a tax erosion of the central government tax revenue, indirectly aims at measuring whether economic integration is inducing an increased *MECF* on more mobile ("non resident") tax bases. If it does, it would imply that increased economic integration, on an efficiency ground, encourages (or increase the probability of) a shift of taxation on less mobile ("resident") tax bases (e.g., labour).

This may occur at different speeds in various countries, because of the concurrence of different conditions, but there is some consensus that economic integration, in recent years, may have to some extent accelerated the shift of the power balance between politics and economics in favour of the latter. As recently observed (Hülsemeyer, 2004; 13), the power of politics (to be extended to the power of taxation) has weakened because of several interrelated reasons. First, economic integration has enhanced the number of tradable goods and services

in the financial sector (i.e., the most mobile production factor). Second, to the extent that multinational corporations are the primary owners of mobile production factors, they enjoy a strengthened leverage with respect to territorial actors (i.e. those owning relatively immobile production factors like land and labour). Third, markets have outgrown states in size, which implies that states have increasing difficulties to regulate and tax markets unless political institutions are adjusted accordingly.

These (and other) external pressures would therefore beg the question of whether one can expect a reallocation of public goods provision among government levels. Presumably, global economic pressures have increased the necessity to shift the task of resource allocation beyond national frontiers (Hülsemeyer, 2004; 26) and reinforced the case to devolve both stabilization and redistributive functions to supranational governments.[23] At the same time, they might have forced states to increasingly make recourse to the *subsidiarity* principle and therefore devolve to the least centralised competent authorities all matters that they can efficiently deal with. In this latter case, decentralisation of taxation and spending competencies may catch the political opportunity to territorially differentiate the collecting points on the same tax base; or may favour a better correspondence between spending and taxes at local level (the *benefit* principle of taxation) contrasted with what would be possible at central level; or may reduce the domestic costs of maintaining redistributive public goods by insulating local spending and taxation from global pressures. Whether decentralisation is actually pursued is therefore a matter of empirical evidence, which is embodied in our hypothesis 2.

From an empirical point of view, hypothesis 1 is tested in the first stage of an econometric procedure, where economic integration enters as an explanatory variable of *ITRs*. In particular, the first stage consists of estimating the following equation:[24]

$$ITR_{i,t}^h = \alpha^h + \beta_1^h ITR_{i,t-1}^h + \beta_2^h OPEN_{i,t} + \beta_3^h OPEN_{i,t}^2 + \sum_{i=1}^N \theta_i^h d_i OPEN_{i,t} + \sum_{p=1}^P \eta_p X_{i,t}^p + e_{i,t} \qquad (6)$$

where *ITR* is the implicit tax rate falling on the tax base *h* (where *h* is, alternatively, labour income, consumption, immobile capital, and mobile capital);[25] *OPEN* is a measure of economic openness defined as the sum of exports, imports, and both inward and outward foreign direct

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[23] One exploited argument to limit national redistributive policies is that they are perceived as being responsible for reducing incentives to work and to invest (e.g., Cerny, 1995).

[24] All variables are expressed in logarithms; see table A.1 and A.2 for definitions of variables and country coverage, respectively.

[25] Full details of this procedure are given in Gastaldi (2008). For mobile capital, two different methods of determining the appropriate tax bases have been considered: a) *net operating surplus of corporations* computed with the OECD methodology (OM2); b) *net operating surplus of corporations* computed as in Mendoza *et al.* (1994) taking into account the correction proposed by Carey and Rabesona (2002) (OMM2). In both cases only corporations are considered. See table A.1 for some details. In what follows, tKS_OMM2 will denote the implicit tax rate on mobile capital; tKK_OM2 will denote the implicit tax rate on immobile capital; tL_O will indicate the implicit tax rate on labour; tC_E will finally denote the implicit tax rate on consumption.

investment as a share of GDP, aimed at capturing the degree of *potential mobility* in the most comprehensive way;[26] $d_i OPEN_{i,t}$ is an interaction term between a country dummy and the variable *OPEN*; *X* is a vector of control variables including: population and per-capita income in US$, to control for demographic and wealth; general government expenditures as a percentage of GDP, to control for government size; $ITR_{i,t}^k$ for $k \neq h$, to control for the existing tax structure; and a vector of year dummy variables, to control for time effects. In addition, a measure of the total fiscal burden has been also considered, approximated by the usual ratio between total tax revenues and GDP.

If equation (6) produces statistically significant coefficients, a set of *ITR*-based country-specific elasticities with respect to economic integration can be derived. Indicating with $\hat{\beta}_j^h$ $(j \in \{2,3\})$ and $\hat{\theta}_i^h$ $(i \in \{1..N\})$ the estimated value of the parameters in (6), elasticities will be given by:

$$\hat{E}_{i,t}^h = \ln\left(\hat{\beta}_2^h + 2\hat{\beta}_3^h OPEN_{i,t} + \hat{\theta}_i^h d_i\right) \tag{7}$$

$\hat{E}_{i,t}^h > 0$ would imply that *ITR* will increase with economic integration, while $\hat{E}_{i,t}^h < 0$ would imply the opposite. In a *static* perspective, tax erosion will emerge when this latter condition is satisfied, which means that a country is at a stage where a further increase of economic integration would reduce the effective tax burden on *h*. In a *dynamic* perspective, tax erosion cannot however be excluded by $\hat{E}_{i,t}^h > 0$, provided that $\hat{E}_{i,t}^h$ follows a decreasing pattern over time. This would imply that even if the tax burden on *h* would grow with economic integration, it may grow at decreasing rates.[27] Intuitively, the process of tax erosion should be less intense for those countries where the tax system mainly relies on less mobile tax bases.

In the second stage of the econometric procedure, we focus on the relation between $\hat{E}_{i,t}^h$ and the degree of decentralisation. To this purpose, the following equation is estimated:

$$\Delta_t D_i = \gamma^h + \delta_1^h \Delta_{t-1} D_i + \delta_2^h \Delta_{t-2} D_i + \varphi^h \Delta_t \hat{E}_i^h + \sum_{q=1}^{Q} \psi_q^h \Delta_t Z_i^q + u_{i,t} \tag{8}$$

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[26] See Liberati (2007) for an application of these measures. This comprehensive measure aims at giving a synthetic measure of the total international exposure of a country, in the same spirit as public and private debt over GDP are usually summed to give signals on its degree of indebtness.

[27] Hagen *et al.* (1998), for example, have argued that if capital owners shift capital out of high-tax jurisdictions, governments may be forced to increase the effective tax burden on capital in order to maintain the same revenue from an eroding tax base.

where, for a generic variable x, $\Delta_t x = x_t - x_{t-1}$; D is the degree of decentralisation measured by the ratio between local and total public spending; Z is a vector of control variables that are a subset of the control variables included in the regression at the first stage regression.[28] Note that in this second stage regression, an Arellano-Bond (1991) method is used. Approaching this dynamic perspective makes possible to verify whether a stronger intensity of tax erosion is associated to a stronger intensity of public sector decentralisation, by this way capturing short-run co-movements. A negative sign of φ^h would support hypothesis 2 for tax h.

4. Results

4.1. *The first stage relation between economic integration and effective tax rates*

Table 1 reports a set of five regressions (with a Feasible Generalised Least Squares method), experimenting equation (6) first on a global measure of tax burden (total taxes over GDP, in column A) and then on specific measures of implicit tax rates. In particular, the same model has been estimated considering *ITR* on mobile capital (*tKS_OMM2* in column B), on labour income (*tL_O* in column C), on consumption (*tC_E* in column D) and on immobile capital (*tKK_OM2* in column E). In all cases, the list of regressors includes the one-period lagged dependent variable, to take into account the partial rigidity of tax variables. The other regressors are the same across regressions, including a vector of interaction terms between economic integration and country dummy variables and a vector of year dummy variables (whose coefficients are not reported in table). As noted above, the set of control variables includes $ITR_{i,t}^k$ for $k \neq h$.

The most striking result involves the sign of the coefficients of economic integration (*OPEN*). Just recall that a negative sign would give support to the hypothesis of tax erosion (hypothesis 1). Our results show that this process has statistical significance only for taxes on mobile capital (column B). The coefficients of *OPEN* and *OPEN²* are both negative, signalling that an increase of economic integration may not only generate a downward pressure on implicit tax rates on mobile capital, but also that this pressure may grow at increasing rates as far as economic integration increases. The coefficients of $ITR_{i,t}^k$ also show that the implicit tax rate on mobile capital has an inverse relation with the implicit tax rate on labour. This

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[28] Following Pagan (1984) the latter requirement generates consistent standard errors from the estimation of equation (8), which includes the 'generated' regressor $\hat{E}_{i,t}^h$. See, in particular, the theorems 3.iii, 4 and 5.

suggests that if economic integration leads to a reduction of the tax burden on mobile tax bases, part of the compensating effect (in terms of tax burden) is likely to fall on labour, rather than on other tax bases. This conclusion is reinforced by combining the results in columns *B* and *C*; disregarding the causality nexus, there is evidence that implicit tax rates on labour and mobile capital go in opposite directions in both cases.

Columns *C* to *E*, instead, reveal that the other implicit tax rates (on labour, consumption and immobile capital) are not directly responsive to economic integration. It means, as expected, that the main and most direct impact of economic integration falls on taxes on mobile capital; and that the other (relatively less mobile) tax bases are natural candidates to backstop the tax erosion induced by economic integration. Unlike other studies on the same topic, it is particularly important that these results are captured after having disentangled *ITRs* on mobile and immobile capital, showing that economic integration *may* well have an effect when tax bases have an exit option from the country. The result that only specific tax bases react to economic integration could also partially explain why the regression run on total tax revenues over GDP (column A) does not show a statistical significance of the coefficients of *OPEN*; comprehensive measures of tax burden (as total taxes on GDP) may conceal opposite effects, giving the false impression that nothing is happening.

Thus, the set of regressions in table 1 confirms that implicit tax rates on mobile capital can actually be eroded by economic integration, while tax erosion can be excluded for other tax bases. This means that the only meaningful set of elasticities of *ITRs* with respect to economic integration can be estimated for mobile capital ($\hat{E}_{i,t}^{KS}$).

This is done in table 2, where country-average elasticities are calculated. Elasticities are either positive or negative and, with the exception of Austria, all of them are statistically significant at 1 per cent level. From a *static* perspective, a negative elasticity is a sufficient condition to state that a process of tax erosion has already taken place. However, this seems to occur only for three countries in the sample (Germany, Italy and the Netherlands), while all other countries would deny support to the existence of a tax erosion process. This may be partially justified by the fact that, for most countries, our dataset extend from 1973 to 2005, with only the last decade particularly buoyant in terms of flows of trade and foreign direct investments. In other terms, a process of erosion may be in place that is only observed since few years or will be more likely observed in the next years.

To capture the possible presence of this trend, one can consider a *dynamic* perspective, where what actually matters is not the point estimate of elasticities, but their change over the time span. To this purpose, the last column of table 2 reports the difference between the elasticity measured in the first and in the last year in which each country is observed in the dataset. The overwhelming prevalence of negative signs (with the exception of Canada)

indicates that, even when positive, elasticities tend to reduce over time. For five countries (Austria, France, Germany, Italy, and the Netherlands), elasticities start on the positive and end up on the negative side. In all other cases, the lower positive values indicate that increasing economic integration generates a decreasing profile of the additional tax burden that can be collected on mobile tax bases. In other words, a *decreasing* trend of *positive* elasticities may still signal that a process of erosion is evolving towards the negative side and therefore towards erosion. To some extent, therefore, our estimates (and our measure of economic openness) seem to correctly pick some important characteristics of the process of economic integration and this is actually what is perceived in figure 1, where it is cleat that $\hat{E}_{i,t}^{KS}$ show a declining profile in most countries.

4.2. *The second stage relation between elasticities and decentralisation*

The estimation of $\hat{E}_{i,t}^{KS}$ allows us to move towards the second stage of our analysis. It is worth recalling again that this second stage is motivated by the aim of verifying whether the process of tax erosion at central level may cause second-round effects on the vertical structure of the public sector. The theoretical justification of this hypothesis is grounded in the idea that economic integration falls first on central government − having no hierarchically higher government levels to rely on − and then to local governments as a possible result of an increased difficulty of central governments to manage the same levels of tax revenue and public spending. This would lead central governments to favour the implementation of the *subsidiarity* principle.

As discussed in section 3, our maintained hypothesis is that, given the increased constraint to the action of the central public sector, the process of tax erosion would give rise to a corresponding process of increasing public sector decentralisation. At this stage, however, we are not interested in measuring the relation among *levels* of erosion and decentralisation, rather in measuring whether the two process may evolve together. To this purpose, our method of estimation shifts towards an Arellano-Bond technique, where changes of the relevant variables are considered. The estimation of equation (8) gives the results reported in table 3. The sign of φ^{KS} is negative as expected. This implies that, regardless of the initial sign of the elasticity, its change goes towards fostering a process of decentralisation. In other words, a reduction of the elasticity (which means increasing difficulties of obtaining additional tax revenues from mobile capital) would be associated to an increase of the size of local public sectors, where taxes on less mobile tax bases are presumably and more properly applied.

Our preferred explanation is that when central governments find mounting difficulties in managing tax bases, they are more incline to decentralise all competencies local governments can efficiently deal with in agreement with the subsidiarity principle. This allows them to reduce the size of the central public spending, by contemporaneously shifting external constraints to local governments in various institutional forms, of which, for example, Internal Stability Pacts introduced in many European countries may be the most visible form.

5. Concluding remarks

Starting from a theoretical intuition based on the concept of the marginal efficiency cost of funds developed by Slemrod and Yitzhaki (1996), this paper has empirically investigated two related issues with reference to a representative sample of eighteen OECD countries. First, we have tested whether and how the degree of economic integration may affect central government tax revenues. Second we have verified whether and how the process of tax erosion at central level may cause second-round effects on the vertical structure of the public sector.

To address the first issue we have estimated an equation where economic integration (along with a number of controls) enters as an explanatory variable of *ITR*s relative to four tax bases (labour, mobile capital, immobile capital and consumption) as well as to a global measure of tax burden. The results show that the process of tax erosion brought about increasing economic integration has statistical significance only for taxes on mobile capital. Moreover, our results provide evidence that an increase of economic integration may not only generate a downward pressure on implicit tax rates on mobile capital, but also that this pressure may grow at increasing rates as far as economic integration increases. This suggests that if economic integration leads to a reduction of the tax burden on mobile tax bases, part of the compensating effect (in terms of tax burden) is likely to fall on labour, rather than on other tax bases. Disregarding the causality nexus, there is evidence that implicit tax rates on labour and mobile capital go in opposite directions in both cases.

It is worthwhile pointing out that – unlike other studies – these results are captured after having disentangled *ITR*s on mobile and immobile capital, showing that economic integration may well have an effect when tax bases have an exit option from the country. It means, as expected, that the main and most direct impact of economic integration falls on taxes on mobile capital; and that the other (relatively less mobile) tax bases are natural candidates to backstop the tax erosion induced by economic integration.

The second issue investigated in this paper is addressed by estimating an Arellano-Bond regression where a proxy of the possibly enacting process of tax erosion enters as explanatory variable of a measure of fiscal decentralisation.

We find that increasing difficulties of obtaining additional tax revenues from mobile capital would be associated to an increase of the size of local public sectors. Our preferred explanation is that when central governments find mounting difficulties in managing tax bases, they are more incline to decentralise competencies to local governments. This allows them to reduce the size of the central public spending, by contemporaneously shifting external constraints to local governments in various institutional forms, of which, for example, Internal Stability Pacts introduced in many European countries may be the most visible form.

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Table 1 – Economic integration and implicit tax rates

Method	FGLS		FGLS		FGLS		FGLS		FGLS	
Dependent Variable	tax_GDP		tKS_OMM2		tL_O		tC_E		tKK_OM2	
	A		**B**		**C**		**D**		**E**	
Regressors	Coefficients	Sig. level	Coefficients	Sig. level	Coefficients	Sig. level	Coefficients	Sig. level	Coefficients	Sig. level
tax_GDP $_{(t-1)}$	0.886	***								
tKS_OMM2 $_{(t-1)}$			0.707	***						
tLO $_{(t-1)}$					0.896	***				
tC_E $_{(t-1)}$							0.878	***		
tKK_OM2 $_{(t-1)}$									0.840	***
OPEN	-0.060		-0.5438	***	-0.073		0.036		0.178	
OPEN ^{2}	-0.032	*	-0.2420	***	-0.034		0.007		0.084	
lggov	-0.003		-0.0110		-0.004		-0.003		0.014	
lpopulation	-0.030	***	-0.1242	**	-0.031	**	-0.042	***	0.154	***
linc_us2	0.073	**	0.1870		0.045		0.019		-0.092	
tKS_OMM2					-0.039	***	0.025	***	0.121	***
tL_O			-0.2521	***			0.022	*	0.109	**
tC_E			0.1781	***	0.032				0.105	*
tKK_OM2			0.0955	***	0.026	***	0.002			
dOPEN_AU	0.044		0.2692	*	0.009		0.042		-0.099	
dOPEN_DEN	0.007		0.9264	***	0.094		-0.060		-0.566	***
dOPEN_FIN	0.031		0.5314	***	0.007		-0.009		-0.160	
dOPEN_FR	-0.046	**	0.1497	**	-0.028		-0.061	**	-0.008	
dOPEN_GE	-0.015		0.0223		-0.051		-0.053	*	0.240	***
dOPEN_GR	0.018		0.4065	***	-0.002		-0.025		-0.047	
dOPEN_IT	-0.031		0.1213		-0.096	***	-0.050	**	0.159	**
dOPEN_NL	-0.044		0.3999	*	-0.134		0.055		-0.043	
dOPEN_PO	0.044		0.4509	*	0.077		-0.022		-0.240	
dOPEN_SW	-0.010		0.5230	***	-0.024		0.000		-0.177	
dOPEN_UK	-0.015		0.3616	***	0.077	**	-0.073	***	-0.249	***
dOPEN_AUS	0.049	**	0.3312	***	0.067	**	0.014		-0.251	***
dOPEN_CAN	0.027		0.5197	***	0.072	*	-0.002		-0.399	***
dOPEN_NOR	0.087	*	0.8026	***	0.117	*	-0.030		-0.329	*
dOPEN_SP	-0.005		0.3150	***	0.001		-0.033		-0.119	
Constant	-0.679	*	-1.489		-0.332		-0.153		0.410	
Year dummy variables	Yes		Yes		Yes		Yes		Yes	
Number of observations	452		452		452		452		452	
Number of countries	16		16		16		16		16	
Wald chi ^{2}	(53) 31474.94 ***		(56) 5735.36 ***		(56) 28640.89 ***		(56) 71214.84 ***		(56) 16914.24 ***	
Panels	Heteroskedastic Panel-specific AR(1)		Heteroskedastic Panel-specific AR(1)		Heteroskedastic Panel-specific AR(1)		Heteroskedastic Panel-specific AR(1)		Heteroskedastic Panel-specific AR(1)	

Note: *** 1% significance level; ** 5% significance level; * 10% significance level

Source: Authors' elaborations

Table 2 – The elasticity of implicit tax rates

Country	Mean elasticity	S.E.	Sig. level	First year observed	Last year observed	Difference
Australia	0.435	0.014	***	0.559	0.323	-0.236
Austria	0.016	0.016		0.124	-0.205	-0.329
Canada	0.256	0.022	***	0.303	0.368	0.065
Denmark	0.657	0.015	***	0.730	0.537	-0.192
Finland	0.298	0.018	***	0.377	0.184	-0.193
France	0.067	0.016	***	0.207	-0.073	-0.280
Germany	-0.153	0.016	***	0.022	-0.357	-0.379
Greece	0.482	0.025	***	0.569	0.454	-0.115
Italy	-0.061	0.012	***	0.044	-0.161	-0.204
Netherlands	-0.095	0.014	***	0.021	-0.266	-0.286
Norway	0.548	0.006	***	0.549	0.492	-0.058
Portugal	0.185	0.012	***	0.307	0.217	-0.091
Spain	0.304	0.027	***	0.517	0.138	-0.378
Sweden	0.254	0.018	***	0.440	0.108	-0.332
United Kingdom	0.184	0.009	***	0.261	0.149	-0.113
United States	0.316	0.019	***	0.606	0.162	-0.444
Total	0.153	0.015	***			

Note: *** 1% significance level; ** 5% significance level; * 10% significance level
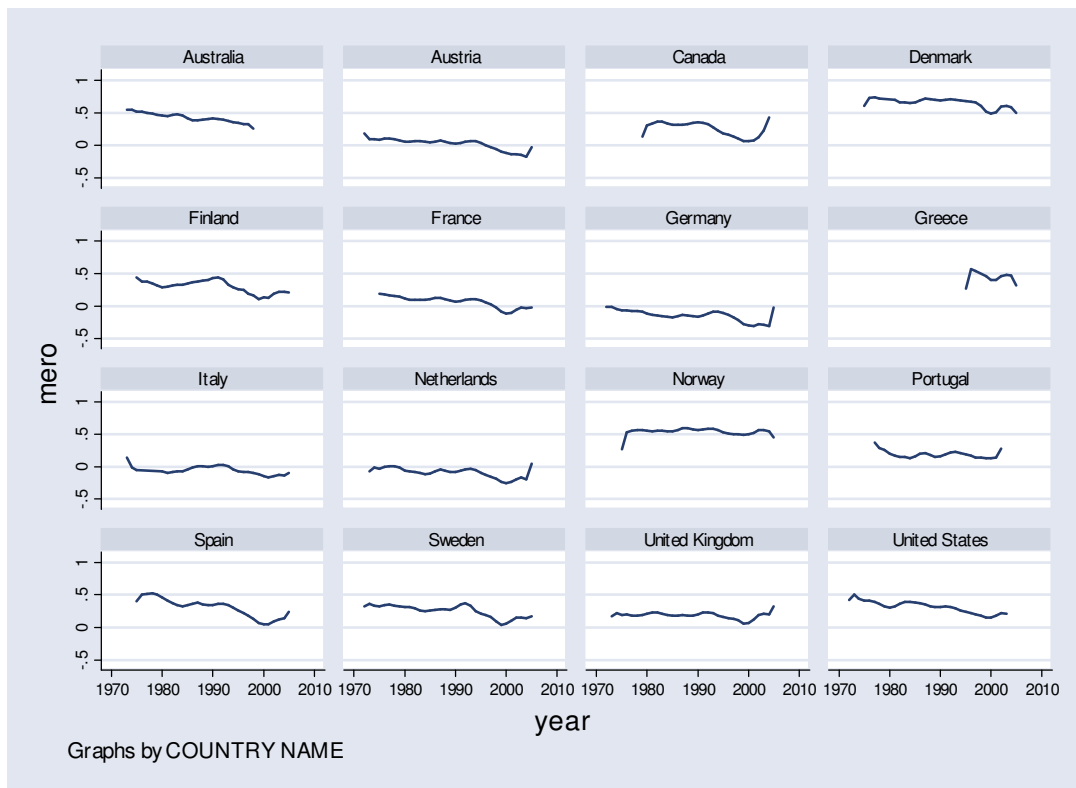
Source: Authors' elaborations

Table 3 – Tax erosion and decentralisation

Method	Arellano-Bond	
Dependent Variable	Δ lloc	
Regressors	Coefficients	Sig. level
Δ lloc (t-1)	0.9134	***
Δ lloc (t-2)	-0.0305	
Δ lggov	0.0015	
Δ lpopulation	0.0220	
Δ linc_us2	0.1376	**
Δ lE	-0.1683	***
Constant	-0.0025	*
Number of observations	415	
Number of countries	16	
Wald chi^2	(6) 2189.54	***
Sargan test (chi^2 (397))	423.98	
No first order autocorrelation	-10.98	***
No second order autocorrelation	-0.35	

Note: *** 1% significance level; ** 5% significance level; * 10% significance level

Source: Authors' elaborations

Figure 1 – The time profile of elasticities of ITR with respect to economic integration

Graphs by COUNTRY NAME

Note: Three-year moving average

Source: Authors' elaborations

Appendix

Table A.1 – Definition of variables and source

Main variables [*]	Description	Source
tKS_OMM2	Effective tax rate on mobile capital	
	(Ratio between tax revenue in the corporate sector (excluding taxes on immovable properties) and the net operating surplus in the corporate sector)	
tL_O	Effective tax rate on labour	
	(Ratio between taxes on labour income and the total employment income)	
tC_E	Effective tax rate on consumption	
	(Ratio between consumption taxes and aggregate consumption)	
tKK_OM2	Effective tax rate on immobile capital	
	(Ratio between taxes on immovable properties and the net operating surplus in the corporate sector)	
tax_GDP	Tax burden	
	(Ratio between total tax revenue and GDP)	
OPEN	Degree of economic integration	
	(Numerator: exports + imports + inward FDI + outward FDI; Denominator: GDP)	
$OPEN^2$	OPEN squared	
lggov	General government spending over GDP	
lpopulation	Population	
linc_us2	Real income in PPP $	
lE	Elasticity of effective tax rate to economic integration	

(*) In the empirical section, some variables are used in first difference (indicated by Δ) and lagged (indicated by $_{t-1}$)

Note: OECD = Organisation for the Economic Cooperation and Development; IMF = International Monetary Fund

Table A.2 – Country and period coverage

Country	Initial year	Final year	Missing years	Number of observations
Australia	1972	1998		27
Austria	1972	2005		34
Canada	1979	2004		26
Denmark	1975	2005	1979, 1980	29
Finland	1975	2005		31
France	1975	2005		31
Germany	1972	2005		34
Greece	1995	2004	1998	9
Italy	1973	2005	1976-1979	29
Netherlands	1973	2004		32
Norway	1975	2005		31
Portugal	1977	2002		26
Spain	1975	2005		31
Sweden	1972	2005		34
United Kingdom	1973	2004		32
United States	1972	2004		33
Total				469