NEED EQUALIZATION TRANSFERS AND PRODUCTIVE EFFICIENCY OF LOCAL GOVERNMENTS

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Abstract: We analyse, with a simple stylized model, the impact of the change of parameters of Need equalization formula for intergovernmental grants on productive efficiency of a local government providing a public service. In our context, this kind of efficiency means producing, at minimum costs and at high quality, a output level at least equal to a minimum standard, fixed by the central government for pursuing horizontal equity among jurisdictions.

Key words: Need Equalization, local public services provision, quality and cost-efficiency
JEL: H70, H72, H77.

1. Introduction

In many federal countries central government transfers resources to local jurisdictions in order to alleviate the imbalance between expenditures needs and revenues. The aim is to ensure to every citizen the access to reasonably comparable levels of public services within a chosen locality, at a cost in line with what would be paid elsewhere. Therefore, equalization transfers promote horizontal equity by permitting fiscal treatment of identical persons in a federation and by enabling jurisdictions to provide minimum standards of essential packages of public services. Specific notions of equalization are

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disciplined by many Constitutional acts, as, for instance, in Canada, Australia, Germany (Shah 1996) and recently also in Italy[1].

Around the world, in industrialised countries and in less developed countries as well, we may find applications of *Fiscal capacity equalization* that, on the basis of the so-called Representative Tax System (RTS), tends to equalize the difference between standard revenue and the effective local one (at standardised tax rates)[2] and of *Need equalization* which, instead, tends to cover the difference between a standardised local need expenditure, measured on the basis of the so-called Representative Expenditure System (RES), and some benchmark (Dafflon and Mischler 2008, Shah 2010). Combinations of RTS and RES are often also applied[3].

Equalization systems, as said, are specifically devoted to guarantee horizontal equity but they have also efficiency implications. In this respect economic literature has developed two specific issues. On one hand, it has analysed the consequences of migration and factor mobility, due to equalization, on productivity of the local firms (Boadway 2006). On the other hand, the economic literature has deeply discussed the efficiency consequences of equalization in terms of the level of tax rates and public expenditure, taking also into account tax competition phenomena. This second body of literature starts from Smart (1998), going ahead, until, at last, Kenders and Koethenbuergher (2010), who provide a theoretical integrated analysis including most of the results of previous literature, and Kotsogiannis (2010), who provides an analysis of both vertical and horizontal tax competition with revenue equalization. The main results of this literature suggest that fiscal equalization induces higher tax rates than the efficient ones and public services overprovision. However, when there is tax competition, equalization tax distortion may restrain the undesirable "race to the bottom"[4] and then increase overall fiscal efficiency.

In this paper we deal with the efficiency implications of Need equalization by a different perspective, as we look at the consequences of

[1] See Constitutional act n. 3/2001 and the successive applying bill n.49/2009. Equalization issue is deeply analysed by international organizations like International Monetary Fund (Ahmad and Searle 2005), World Bank (Boadway and Shah 2007, Shah 1996, 2005) and OCDE, (Blöchingler and Charbit 2008).

[2] Canada provides the most known application of this criterion. see Smart (2007) and references therein.

[3] The quoted bill n.42/2009 in Italy disciplines the two criteria according to the typologies of public functions carried on by regions and municipalities.

[4] The issue has also been analysed by a stream of empirical contributions. See, at last, Egger *et al* (2010).

such transfers on productive efficiency in local public services provision. For "local government productive efficiency" in this context we mean that, given the level of a public service output, defined by a minimum standard fixed by the central government, a local government should provide at least this amount, at the maximum level of quality and at the minimum cost.

In order to examine this matter, we build up a simple model where the flow of federal transfers to local governments is given by a revenue sharing of a federal tax and a need equalization grant. The latter is specified along a well known RES rule, now applied in Italy in similarity to those actually applied in other federal countries like Australia and Canada. According to this, the grant is linked to the gap between a need standardised expenditure index and a standardised local tax revenue index. Further, we assume that local politicians have some preference on cost-inefficiency, as they can acquire political consensus with perks and wasteful expenditures, so they are conflicting with users of public services who want high quality services and low local taxes. As well known, conflicts of this sort originate a specific Principle-Agent relationship (Besley 2007), whose final outcome is conditioned by local politicians accountability[5]. Thus the chance of exploiting cost-inefficiency may depend on the impact of equalization on accountability. In this respect, Kotsogiannis and Schwager (2008) have shown that, with equalized fiscal resources, citizens attach more importance to any remaining variation in public services supply, in terms of quantity as well quality, thus they can more easily punish the rent-taking and incompetent politicians. However, the complexity and the lack of transparency, in defining the exact measure of "potential fiscal capacity and need" to be equalized, may introduce a perverse fiscal incentive that reduces accountability and then efficiency. Indeed, yardstick competition effects are limited and monitoring activities by central governments are not easily implementable[6].

The main results of the paper are the following ones. An increase of the revenue sharing rate tends to reduce the quality of the public service, while it tends to induce the politicians and the public officials to contain production costs. On the contrary, an increase of the rate of the equalization and of the standard tax rate have opposite effects. An increase of the minimum standard of the public service provision has a beneficial effect on cost-efficiency, while the impact on quality is not determined, depending on

[5] This is the framework of the so called "second generation" approach to fiscal federalism (Oates 2005, Weingast, 2006, Vo 2010)

[6] In this respect, see also the specific reliefs pointed out by Shah (2010).

the structure of technology and costs. However, we find that, if quality and quantity are substitute both in preference and costs, then the local government reduces the quality. Finally, it is confirmed, also in this setting, that organising the equalization system with adequate transparency and simplicity can improve, through a higher accountability, cost-efficiency.

The paper runs as follows. Section 2 shows the stylized model we are going to elaborate. Section 3 analyses of the impact of need equalization on quality and cost-efficiency, throughout a Proposition, whose proof is shifted in Appendix, that suitably signs the main effects. Section 4 concludes.

2. The set-up model

We consider a federation with a pre-committed central government and several local governments, not fiscally interconnected each other (Koethenbuergher 2008)[7]. Hence we may simply model a local government that, facing a representative consumer-tax payer, provides a local public service, considered as a essential (merit) good by the national legislation[8]. It finances the production costs of quantity q and quality m, the latter measured by a real number in a closed interval[9], with a surtax at rate t on a tax base B, which is also taxed, at rate τ, by the central government. The latter remains on the shadow, in the sense that own tax rates and fiscal arrangements of the equalization transfers system are exogenously given. The aim is, as said, to ascertaining the local government response to changes of these fiscal parameters, in terms of productive efficiency of public services provision.

2.1. *Consumer preferences*

These are represented by the following separable function

$$V = \upsilon(t+\tau, I) + \varphi(q, m). \qquad (1)$$

[7] This implies that we disregard, for the time being, the horizontal tax-competition concern.

[8] We may think, as in Italian legislation, at health care, social assistance and education. These are goods provided at regional level, but with essential packages of quantity provision established at the central level.

[9] For instance, with reference to health care, think at hospital admissions, for q, and at length of waiting lists or at mortality rates after 30 days from hospital treatments, for m (Propper *et al* 2008).

$\upsilon(t+\tau, I)$ is an indirect sub-utility function of aggregate tax rate and initial endowment of resources (income). By duality, this derives by maximizing a quasi-concave direct utility function which depends on a untaxed commodity, the *numeraire*, and a taxed one, whose value at producer price turns out to be the tax base, B[10]. Accordingly, by Roy identity[11], $\upsilon_{t+\tau} = -\upsilon_I B < 0$. Moreover, from consumer equilibrium, it can be derived the consumer reaction function to fiscal choices, $B(t+\tau, I), B_{t+\tau} < 0.$

$\varphi(q,m)$ is a sub-utility function of quantity and quality of the public service, with $\varphi_q > 0, \varphi_m > 0$. Quantity and quality can be complements ($\varphi_{mq} > 0$) as well substitutes ($\varphi_{mq} < 0$); thus the marginal willingness to pay for quality can increase or decrease with the consumption of the service, according to the type of it[12]. With $\zeta_{mq} \equiv \frac{\varphi_{mq} q}{\varphi_m} \geq (<) 0$ we denote the demand-elasticity of substitution between quality and quantity.

2.2. *Local revenues*

The local government obtains funds from three sources. First, the local taxation, *tB*. Secondly, a revenue sharing over the federal tax yield, *ατB,* where $0<\alpha<1$ is the fraction decided by federal government. In this case the revenue sharing goes from central to local governments, like for regional TVA and income tax in Italy, but it can run also in the opposite direction, for yield acquired at locale level, like for business tax in Germany and recently also for house taxation in Italy. In the latter case, the local jurisdiction yields *tB* and transfers *αtB* to the central government so the model must be accordingly changed (Kenders and Koethenbuergher 2010). Thirdly, the local government gets funds from a equalization grant, if entitled. Indeed, we consider a gross, vertical, equalization process, by which only "poor" regions receive a grant, and the total of grants are funded by federal taxation. Consequently the transfer is given by

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[10] For instance, in case of income taxation, *B* can be labour income and the untaxed commodity leisure.

[11] With X_y we mean, as usual, $\partial X / \partial y$.

[12] As far as health care services are concerned, we may find treatments where a high quality of care can favor as well discourage an increase of quantity demanded (e.g. length of stay in hospital).

$$G = Max\,[\beta(N - t^s B), 0]. \tag{2}$$

$0<\beta\leq 1$ is the equalization rate, N the Need lump sum component of the grant, that we'll discuss in the successive sub-section, and t^s is the standardised surtax rate, which might be the average of the rates applied by all regions or a fiscal policy arrangement.

RES rule (2), with $\beta=1$, is now applied in Italy, as far as the regional expenditures on health care, social assistance and education are concerned. It is also applied for financing public services provided by municipalities within Landers in Germany (Otter, 2008, Egger *et al.* 2010). In the case of RTS Equalization criterion, as in Canada, the lump sum component in (2) is instead given by $N \equiv t^s B^s$, where B^s is the standardised (average) tax base (Smart 2007, Kotsogiannis 2010). In both RES and RTS, G is a matching grant, linearly and negatively related to local tax base.

Summing up we get the following revenues function:

$$R = \beta N + \hat{t} B \tag{3}$$

where $\hat{t} = t + \alpha\tau - \beta t^s$ is the "effective local tax rate", i.e. the perceived local rate to which the fiscal distortion at local level are linked (Grazzini and Petretto 2006). In the case of revenue sharing from local to central government it would be $\hat{t} = (1-\alpha)t - \beta t^s$ and the following results should be easily integrated.

2.3. *Needs and costs*

We adopt the RES interpretation according to which the "Needs" are measured by the product of a standardised unitary cost c^s with the minimum (essential) standard of output provision, q_E.

$$N \equiv c^s q_E. \tag{4}$$

The parameter c^s is specific to the considered jurisdiction, and it may be estimated or computed by one of the several RES techniques, e.g. the regression analysis (Dafflon and Mischler 2008).

As far as the production costs of the jurisdiction are concerned, we assume this factorised, quasi-linear, function:

$$C(q, m, e; A) = c(q, m; A)eq, \tag{5}$$

A is a vector of demographic and environmental variables, like population density and population ageing, orographical characteristics of the territory, like average altitude, level of precipitations, etc. assumed to influence production costs. $e \geq 1$, is a variable of cost-inefficiency, an index measuring perks and wasteful expenditures made by the local politicians and bureaucrats seeking for political consensus and power. Therefore it is also an index of the incumbent politicians ability or competence in that jurisdiction.

The shape of the cost function is as follows

$$C_q = [c_q q + c(q,m;A)]e > 0,\ C_m = c_m eq > 0,\ C_e = c(q,m;A)q > 0$$
$$C_{eq} = C_q / e > 0, \qquad (6)$$
$$C_{mq} = (c_{mq} q + c_m)e \geq (<)0 \Leftrightarrow \xi_{mq} + 1 \geq (<)0,\ \xi_{mq} \equiv \frac{c_{mq} q}{c_m}$$

The marginal costs of quantity, quality and inefficiency index are positive, as all employ scarce resources, while the positive sign of C_{eq} implies that quantity and inefficiency are cost-substitutes. C_{mq} is not instead signed, depending on the sign of c_{mq} and then on the cost-elasticity of substitution of quality w.r.t. quantity. If ξ_{mq} is higher (lower) than -1 quality and quantity are cost-substitutes (complements). In the latter case, the technology exhibits *economies of scope* in producing output with high quality[13].

Given (5), we may interpret the standardised unitary cost c^s in this way. Let us assume that central government knows the local technology and cost function $C(.)$, but does not observe the quality locally realised, being able only to estimate the mean value from a probability distribution, $\overline{m} = \mathrm{E}(m)$. Environmental features A are observed and employed in econometric analyses for estimating the standardised cost. The variable effort e is not observed and then not acknowledged in the "contract" defined by the equalization rule. Therefore, the standard unitary may be as follows:

$$c^s = c(q_E, \overline{m}; A) \qquad (7)$$

[13] An innovation increasing the standard of quality may reduce as well require more resources for producing the service (e.g. physicians hours of labor in that hospital department).

which might be lower or higher than the effective unitary cost $c(q,m;A)e$, depending on the level of output (returns to scale), the actually realised level of quality and the inefficiency index.

2.4. *Local politicians preferences*

We suppose they have, as pay-off function, the sum of utility function of the representative consumer (1) and the following benefit function of extra-costs for perks and wasteful expenditures:

$$a\psi(e), \psi' > 0, \psi'' < 0\,, \tag{8}$$

where $\psi(e)$ reflects the Leviathan preference component[14] of the pay-off function and $a \geq 0$ shows the allowed, by institutional rules, degree of non-benevolence or rent-taking of local politicians. If $a=0$, they are perfectly benevolent as rightly accountable. If $a>0$ they are in some extent rent-takers. As underlined by Kotsogiannis and Schwager (2008), accountability depends on transparency and simplicity of the techniques applied for assessing the Need index and implementing the chosen equalization[15].

Let us now define with

$$E(q_E, m, e) \equiv [c(q_E, m; A)e - c^s]q_E \tag{9}$$

the discrepancy, positive or negative, between actual costs for producing the minimum standard and the Need index *N*. Further, let, for instance, consider the case where $\beta=1$, and $c^s = c(q_E, \overline{m}; A) < c(q_E, m; A)e$. From (3), (4), (5), (6) and (7) we have

$$E(q_E, m, e) = \hat{t}B = [(t - t^s) + \alpha\tau]B\,. \tag{10}$$

Hence the effective local taxation, i.e. the difference between revenues by effective and standardised surtax rate plus the revenue sharing, is entirely

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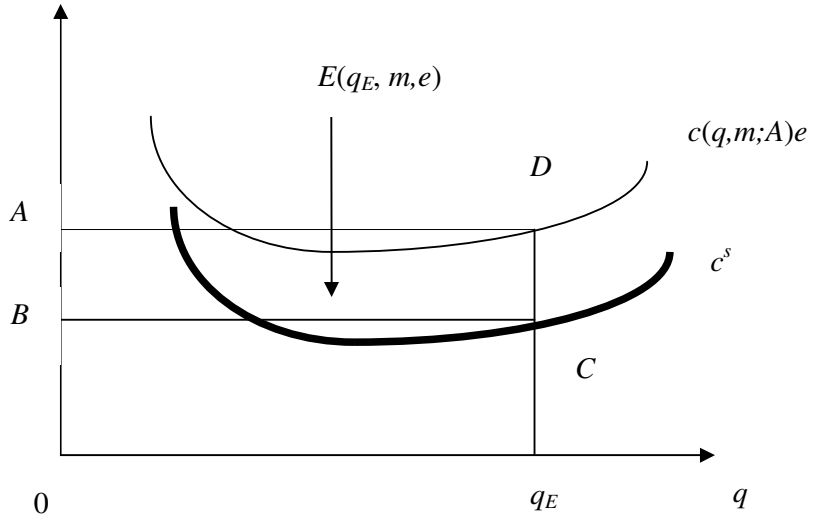
[14] Notice that, from (3) and (5), $e = \dfrac{R}{c(q,m;A)q}$; thus an increase of *R*, for given *q* and *m*, guarantees to the Leviathan an increase of *e*.

[15] On the general effects of transparency of institutional rules in terms of reputation and effectiveness of public decision making see Levy (2007), Gavazza and Lizzeri (2007) and Mattozzi and Merlo (2007).

devoted to cover the extra cost, over the RES level, made by non-benevolent local politicians (*ABCD* in Fig. 1). This overspending, if persisting, could generate a permanent deficit and debt increase.

Fig.1. Overspending due to productive inefficiency



The local politicians choose their strategies knowing the federal government fiscal choices and the consumer reaction function, i.e. the shape of the tax base function. We want to ascertain how local politicians, once in equilibrium, would change their strategies on m and e, in response to changes on fiscal arrangements α, β, t^s, on the minimum standard q_E and also on parameter a[16].

3. The impact of equalization on public services quality and cost-efficiency

3.1. *Equilibrium and comparative statics*

[16] These changes have, of course, also effects on local tax rate t, but here we may disregard them as we are concentrating on productive efficiency.

The equilibrium of local government is obtained by solving the following maximization process:

$$\underset{(q,m,t,e)}{\text{Max}} \quad W = \upsilon(t+\tau, I) + \varphi(q,m) + a\,\psi(e) \tag{11}$$

s.t.

$$\begin{aligned} &\beta N + \hat{t}B = c(q,m;A)eq \quad (\lambda) \\ &q \geq q_E \qquad (\mu),\ \mu(q - q_E) = 0 \end{aligned} \tag{12}$$

The corresponding Lagrangean is the following function:

$$L = W + \lambda\left[\beta N + \hat{t}B - c(q,m;A)eq\right] + \mu(q - q_E)\,. \tag{13}$$

The multiplier λ reflects, as usual, the marginal cost of taxation, while the multiplier μ reflects the benefit of the service as a merit good and also the cost of strengthening the binding minimum standard constraint.

By applying the envelope theorem to the maximum function $W^*(\alpha,\beta,t^s,q_E,a)$, we get:

$$\begin{aligned} &\frac{\partial W^*}{\partial \alpha} = \lambda \tau B > 0, \frac{\partial W^*}{\partial \beta} = \lambda(N - t^s B) > 0, \frac{\partial W^*}{\partial t^s} = -\lambda\beta B < 0, \\ &\frac{\partial W^*}{\partial q_E} = \lambda\beta\left(c^s + \frac{\partial c^s}{\partial q_E} q_E\right) - \mu, \frac{\partial W^*}{\partial a} = \psi(e) > 0 \end{aligned} \tag{14}$$

Therefore, given the marginal cost of taxation, the local government objective function is, at maximum, increasing with the revenue sharing rate and the equalization rate, and decreasing with the standard tax rate. As far as the minimum standard is concerned, the sign depends on the comparison between the benefit of alleviating the budget constraint, because of a higher grant[17], $\lambda\beta\frac{\Delta N}{\Delta q_E}$, and the opportunity cost of diverting resources from others objectives (e.g. quality as well perks), μ. Of course the local politicians pay-off function in equilibrium is increasing with the degree of rent-taking opportunity.

[17] However, notice that economies of scale, c_q<0, could even reduce the standardised cost and then the grant.

The F.O.C.s of maximizing (13) are as follows

$$\text{- } (q^*): \ (\varphi_q + \mu) - \lambda C_q = 0, \quad q^* = q_E \tag{15}$$

$$\text{- } (m^*): \ \varphi_m - \lambda C_m = 0 \tag{16}$$

$$\text{- } (t^*): \quad \lambda = \upsilon_I \eta(\alpha, \beta, t^s), \tag{17}$$

where $\eta(\alpha, \beta, t^s) \equiv \dfrac{1}{1 - \dfrac{\hat{t}\varepsilon}{1 - t - \tau}}; \varepsilon \equiv -B_{t+\tau} \dfrac{t+\tau}{B} > 0;$

$$\text{- } (e^*): \ a\psi'(e) - \lambda C_e = 0 \tag{18}$$

The corresponding equilibrium conditions for quantity (around the minimum standard), quality and cost-efficiency, are obtained by comparing the marginal benefits with the marginal costs of funds devoted to these local government strategies. So they are respectively:

$$MB\big|_{q=q_E} \equiv \frac{\varphi_q + \mu}{\upsilon_I} = C_q \eta \equiv MC\big|_{q=q_E} \tag{19}$$

$$MBm \equiv \frac{\varphi_m}{\upsilon_I} = C_m \eta \equiv MCm \tag{20}$$

$$MBe \equiv \frac{a\psi'}{\upsilon_I} = C_e \eta \equiv MCe \tag{21}$$

In conclusion, by comparative statics of the F.O.C.s, we state the following:

Proposition:

1. *Impact of equalization parameters on quality*:

$$(i) \frac{\partial m}{\partial \alpha} < 0, (ii) \frac{\partial m}{\partial \beta} > 0, (iii) \frac{\partial m}{\partial t^s} > 0, (iv) \frac{\partial m}{\partial q_E} \gtrless 0 \text{ if } \zeta_{mq} \geq (<) \xi_{mq} + 1$$

2. *Impact of equalization parameters and rent-taking (accountability) index on cost-inefficiency*:

$$(i) \frac{\partial e}{\partial \alpha} < 0, (ii) \frac{\partial e}{\partial \beta} > 0, (iii) \frac{\partial e}{\partial t^s} > 0, (iv) \frac{\partial e}{\partial q_E} < 0, (v) - \frac{\partial e}{\partial a} < 0$$

Proof: Appendix

3.2. *Implications of the Proposition*

We summarize the results and implications in Table 1.

Table1: Impacts of fiscal arrangements on productive efficiency

FISCAL ARRANGEMENTS	**OUTPUT QUALITY**	**COST INEFFICIENCY**	**OVER SPENDING**
Revenue sharing rate, $\Delta\alpha$	**-**	**-**	**-**
Equalization rate, $\Delta\beta$	**+**	**+**	**+**
Standard tax rate, Δt^s	**+**	**+**	**+**
Minimum standard output, Δq_E	**?**	**-**	**?**
Accountability, $-\Delta a$		**-**	**-**

An increase of the revenue sharing rate tends to reduce the quality of the public service, while it tends to induce the politicians, and public officials, to improve the internal efficiency of the productive process[18]. The opposite effect is reached by increasing the rate of the equalization and the standardised tax rate. Notice that these effects are working throughout the level of the effective local tax rate, $\hat{t} = t + \alpha\tau - \beta t^s$, while remaining unchanged the aggregate rate influencing the tax base, $\tau+t$. Changes of the grants parameters α, β and t^s have, by this way, a different impact on the marginal cost of public funds devoted to increase quality, given by (20), and rent-taking activities, given by (21), as $\frac{\partial \eta}{\partial \alpha} > 0, \frac{\partial \eta}{\partial \beta} < 0, \frac{\partial \eta}{\partial t^s} < 0$ (see Appendix). This explains why α, which increases the effectively perceived local tax rate $\hat{t}$, has an opposite effect w.r.t. β and t^s, which instead decrease it.

As far as the effects of changes of minimum standard are concerned, recall that an increase of q_E, if $\mu>0$, implies an increase of q. Consequently, the effect on quality of an increase of the minimum standard of the public service provision is not determined, as it depends on the relative shape of marginal utility and marginal cost of quality. Indeed, the sign of φ_{mq} and C_{mq} is not given *a priori.* If, for instance, $\varphi_{mq}<0$ (demand-substitutes), and $C_{mq}>0$ (cost-substitutes, no *economies of scope*), as it is well conceivable, $\zeta_{mq} < 0 < \xi_{mq} + 1$, then m decreases with q_E. However, with quality and quantity as complements and/or with *economies of scope, m* might increase

[18] The sign of the effects is of course reversed if the revenue sharing goes from local to central level.

too. The cost-inefficiency tends instead to certainly decrease with an increase of the minimum standard, because of the cost-substitutability between inefficiency index and quantity, $C_{eq}>0$, which increases the opportunity cost of wasteful expenditures. It is also straightforward that any reform increasing the transparency of the equalization system, and then the accountability of the local political set-up, implies a reduction of cost-inefficiency, without influencing the level of quality.

The last column of the Table 1 summarises the effects of changes of fiscal and equalization parameters on extra-cost – actual expenditure less the standardised RES level- for supplying the service at the minimum standard q_E:

$$E(q_E, m, e; x) \equiv [c(q_E, m; A)e - c^s]q_E,\ x = \alpha, \beta, t^s, q_E, a \qquad (22)$$

Indeed we have:

$$\begin{aligned}
\Delta E &= (c_m \frac{\partial m}{\partial \alpha} + c\frac{\partial e}{\partial \alpha})\Delta\alpha \\
\Delta E &= (c_m \frac{\partial m}{\partial \beta} + c\frac{\partial e}{\partial \beta})\Delta\beta \\
\Delta E &= (c_m \frac{\partial m}{\partial t^s} + c\frac{\partial e}{\partial t^s})\Delta t^s \qquad (23) \\
\Delta E &= c\frac{\partial e}{\partial a}\Delta a \\
\Delta E &= [(c_q + c_m \frac{\partial m}{\partial q_E} + c\frac{\partial e}{\partial q_E} - \frac{\partial c^s}{\partial q_e})q_E + (ce - c^s)]\Delta q_E
\end{aligned}$$

Hence, from the Proposition and the first two columns of the table, we have that

$\Delta x = \Delta\alpha > 0, \Rightarrow \Delta E < 0,$ and

$\Delta x = \Delta\beta > 0, \Delta t^s > 0, \Delta a > 0, \Rightarrow \Delta E > 0$.

For $\Delta x=\Delta q_E>0$, ΔE is not instead signed as the overall impact depends on many factors, e.g. the returns to scale (the sign of c_q).

Therefore, revenue sharing tends to reduce overspending, while equalization and rent-taking by politicians tends to increase it. The effect of an increase of the minimum standard is instead uncertain.

3.3. *Equalization and central government trade-offs*

Central government in choosing fiscal strategies acts as a Stackelberg leader, i.e. it maximizes its pay-off taking into account the reactions functions of the followers, i.e. all regions and consumers as well. Let us suppose it is interested to guarantee everywhere a good level of quality of the local public service but limiting the potential deficit of regions, i.e. the overspending which the poor regions may incur in. If it wants, for instance, to evaluate the policy of increasing the equalization rate β and consequently adjusting the revenue sharing rate α, it should take into account the incentive of all regions toward quality and cost-efficiency performances.

Let us denote with $i=1,\ldots n$ all the regions of the federation, with $k=1,..n_k$ the poor regions for which $G_k>0$ and with $j=1,..n_j$ the rich regions for which $G_j=0$, $n_k+n_j=n$. The federal budget constraint is as follows

$$Rf \equiv \tau\sum_{i=1}^{n} B_i - \alpha\tau\sum_{i=1}^{n} B_i - \beta\sum_{k=1}^{n_k}(N_k - t^s B_k) = Gf \qquad (24)$$

The aggregate revenue is funding both types of transfers to the whole system of regions and *Gf,* the federal expenditure on a national public good.

The federal government in evaluating changes on equalization parameters is constrained by (24) and also by the reaction functions $t_i(x)$, $m_i(x)$, $e_i(x)$, $B_i(\tau+t_i)$, $i=1,..n$. In this respect, by total differentiating (24), in Appendix we prove that, if there are no reverse Laffer effects, it is $\left.\frac{\Delta\alpha}{\Delta\beta}\right|_{dRf=0} < 0$. Thus, given the federal budget constraint, there is a negative relationship between changes of α and β, maintaining fixed the other fiscal parameters and the federal public expenditure, if tax revenues are normally increasing with the aggregate tax rate $\tau+t_i$, $i=1,..n$. Hence, given the Proposition, the expressions in (23), it turns out that the central government faces these compound effects of the policy $\Delta\beta>0$:

$$\Delta m_k = [\frac{\partial m_k}{\partial \beta} + \frac{\partial m_k}{\partial \alpha}\frac{\Delta \alpha}{\Delta \beta}\Big|_{dRf=0}]\Delta\beta > 0,\ k = 1,...n_k$$

$$\Delta E_k = [\frac{\partial E_k}{\partial \beta} + \frac{\partial E_k}{\partial \alpha}\frac{\Delta \alpha}{\Delta \beta}\Big|_{dRf=0}]\Delta\beta > 0,\ k = 1,...n_k \qquad (25)$$

$$\Delta m_j = \frac{\partial m_j}{\partial \alpha}\frac{\Delta \alpha}{\Delta \beta}\Big|_{dRf=0}\ \Delta\beta > 0,\ j = 1,..n_j$$

The quality increases in all the regions but with an increase of poor regions overspending. Thus, it derives straightforwardly the trade-off the central government has to manage: The policy has a beneficial impact in terms of quality, fulfilling equity concerns, but increases the risk of deficit of poor regions with high cost-inefficiency.

4. Concluding remarks

Need equalization is a worldwide used criterion of intergovernmental transfers. Many developed and also underdeveloped countries are applying variants of it. The main objective of it refers to equity concerns, as it tends to reduce the differences in terms of resources for assuring to all the access to a adequate levels of essential public services.

However, as shown by a wide recent literature, any equalization system defining a grant inversely correlated to local tax base has efficiency consequences on the of level of local tax rates and public expenditure. In this paper we have extended the analysis of these consequences to productive efficiency of local government in providing local public services. With this notion we mean to provide, at the maximum conceivable level of quality and at the minimum cost, a level of the output of the service at least equal to a minimum standard fixed by the central government.

We have proved that an increase of the revenue sharing rate tends to reduce the quality of the public service, while it tends to induce the politicians and the public officials to extend the effort for improving the efficiency of the productive process. The opposite effect is given by an increase of the rate of the equalization and of the standard tax rate, given the opposite effect on the marginal cost of public funds. The effect on quality of an increase of the minimum standard of the public service provision is, instead, not determined, as it depends on the structure of costs and

technology. However, it this respect, we have obtained a quite readable condition for signing the effect: If quality and quantity are substitute in preferences and costs then the local government reacts reducing quality. Finally, the effect on effort toward cost-efficiency of an increase of the minimum standard is certainly beneficial. Also desirable it is an increase of degree of accountability and benevolence.

The combination of effects due to change of quality and cost-efficiency implies also some univocal impacts on local government overspending (actual expenditure less standardised one). An increase of revenue sharing rate decreases the overspending, while an increase of equalization rate and standardised local tax rate increases this kind of loss. Uncertain is instead the impact of an increase of the minimum standard.

In conclusion the central government, in designing the structure of grant parameters, faces a trade-off between quality and cost-efficiency of local public services provision that should be appropriately managed. Higher quality means a more actually equitable public provision, while higher cost-efficiency means harder budget constraint, less potential deficit and a minor risk of bail-out. Should the central government attaches a higher weight to quality (cost-efficiency), it should reduces (increase) the revenue sharing rate in favour an increase (reduction) of equalization parameters. In any case, all political reforms improving politicians accountability increase, as expected, cost-efficiency and reduces overspending phenomena, without reducing the level quality, then with no trade-off at all.

Appendix

Prof of Proposition

As far as the effects on quality of the first part of the Proposition are concerned, from F.O.C. (16) we derive the following implicit function

$$\varphi_m - \lambda C_m \equiv \Gamma(m;\alpha,\beta,t^s,q_E) = 0 \qquad \text{(A1)}$$

where $\lambda = \upsilon_I \eta(\alpha,\beta,t^s)$ and $C_m = c_m e q_E$. From the implicit function differentiation we get:

$$\frac{dm}{dx} = -\frac{\dfrac{\partial \Gamma}{\partial x}}{\dfrac{\partial \Gamma}{\partial m}},\ x = \alpha,\beta,t^s,q_E \qquad \text{(A2)}$$

As, from S.O.C., $\frac{\partial \Gamma}{\partial m} < 0,$ we have that

$$Sign \frac{dm}{dx} = Sign \frac{\partial \Gamma}{\partial x},\ x = \alpha, \beta, t^s, q_E \qquad \text{(A3)}$$

Therefore, we compute as follows[19]

$$\frac{\partial \Gamma}{\partial \alpha} = -\upsilon_I \frac{\partial \eta}{\partial \alpha} c_m e q_E < 0, \text{ as } \frac{\partial \eta}{\partial \alpha} = -\frac{-\tau \frac{\varepsilon}{1-t-\tau}}{\left[1-\hat{t}\frac{\varepsilon}{1-t-\tau}\right]^2} > 0 \qquad \text{(A4)}$$

$$\frac{\partial \Gamma}{\partial \beta} = -\upsilon_I \frac{\partial \eta}{\partial \beta} c_m e q_E > 0, \text{ as } \frac{\partial \eta}{\partial \beta} = -\frac{t^s \frac{\varepsilon}{1-t-\tau}}{\left[1-\hat{t}\frac{\varepsilon}{1-t-\tau}\right]^2} < 0 \qquad \text{(A5)}$$

$$\frac{\partial \Gamma}{\partial t^s} = -\upsilon_I \frac{\partial \eta}{\partial t^s} c_m e q_E > 0, \text{ as } \frac{\partial \eta}{\partial t^s} = -\frac{\beta \frac{\varepsilon}{1-t-\tau}}{\left[1-\hat{t}\frac{\varepsilon}{1-t-\tau}\right]^2} < 0 \qquad \text{(A6)}$$

and

$$\frac{\partial \Gamma}{\partial q_E} = \varphi_{mq} - \upsilon_I \eta C_{mq} = \varphi_{mq} - \frac{\varphi_m}{c_m q e} e(c_m + c_{mq} q) \qquad \text{(A7)}$$

where we have taken into account that, from (16) and (17), it is $\lambda = \upsilon_I \eta = \frac{\varphi_m}{C_m}$.

Hence by substituting (A4). (A5), (A6), (A7) in (A3), we prove the first part of Proposition.

Now, as far as the effects on cost-inefficiency are concerned, we derive, from F.O.C. (18), the following implicit function

$$a\psi'(e) - \lambda C_e \equiv \Omega(e; \alpha, \beta, t^s, q_E, a) = 0 \qquad \text{(A8)}$$

where, as before, $\lambda = \upsilon_I \eta(\alpha, \beta, t^s)$ and $C_e = c(m, q; A) q_E$. Consequently now we get:

[19] Notice that the elasticity ε is independent on fiscal parameters of revenue sharing and equalization.

$$\frac{de}{dx} = -\frac{\frac{\partial \Omega}{\partial x}}{\frac{\partial \Omega}{\partial e}},\ x = \alpha, \beta, t^s, q_E, a \tag{A9}$$

Giving that, from S.O.C., also $\frac{\partial \Omega}{\partial e} < 0,$ it obtains

$$Sign\ \frac{de}{dx} = Sign\ \frac{\partial \Omega}{\partial x},\ x = \alpha, \beta, t^s, q_E, a \tag{A10}$$

Therefore, we respectively compute as follows

$$\frac{\partial \Omega}{\partial \alpha} = -\upsilon_I \frac{\partial \eta}{\partial \alpha} c(q, m; A) q_E < 0, \tag{A11}$$

$$\frac{\partial \Omega}{\partial \beta} = -\upsilon_I \frac{\partial \eta}{\partial \beta} c(q, m; A) q_E > 0, \tag{A12}$$

$$\frac{\partial \Omega}{\partial t^s} = -\upsilon_I \frac{\partial \eta}{\partial t^s} c(q, m; A) q_E > 0, \tag{A13}$$

$$\frac{\partial \Omega}{\partial q_E} = -\upsilon_I C_q / e < 0, \tag{A14}$$

and

$$\frac{\partial \Omega}{\partial a} = \psi'(e) > 0 \tag{A15}$$

Hence by substituting (A11). (A12), (A13), (A14), A15) in (A10), we prove also the second part of Proposition.□

Proof of $\left.\frac{\Delta \alpha}{\Delta \beta}\right|_{dRf=0} < 0.$

Let us differentiate the federal budget constraint (24) in this way:

$$\tau(1-\alpha)\sum_{i=1}^{n} \frac{\Delta B_i}{\Delta \beta} - \frac{\Delta \alpha}{\Delta \beta} \tau \sum_{i=1}^{n} B_i = \sum_{k=1}^{n_k} (N_k - t^S B_k) - \beta t^S \sum_{k=1}^{n_k} \frac{\Delta B_k}{\Delta \beta} \tag{A16}$$

where

$$\frac{\Delta B_i}{\Delta \beta} = B_{\tau + t_i} \frac{\Delta t_i}{\Delta \beta} = B_{\tau + t_i} \left(\frac{\partial t_i}{\partial \beta} + \frac{\partial t_i}{\partial \alpha} \frac{\Delta \alpha}{\Delta \beta}\right) \tag{A17}$$

Recall that $\frac{\partial B_i}{\partial (\tau + t_i)} \equiv B_{\tau + t_i} < 0$. Further, according to the results of the literature on local taxation efficiency with fiscal equalization and revenue sharing (see at last Kelders and Koethenbuergher 2010 and therein quoted

contributions), we have: (i) $\frac{\partial t_k}{\partial \beta} > 0$, $k = 1,..n_k$, i.e., for all regions receiving the transfer, the optimal local tax rate is increasing with the equalization rate; (ii) $\frac{\partial t_j}{\partial \beta} = 0$, $j_=1,..n_j$, i.e. changes on rate of equalization do not impact on the optimal choice of the tax rate by rich regions; (iii) $\frac{\partial t_i}{\partial \alpha} < 0, i = 1,..n$, i.e. the optimal tax rate is decreasing with the revenue sharing rate in all regions. By substituting (A17) in (A16) we have

$$\tau(1-\alpha)\sum_{i=1}^{n} B_{\tau+t_i}\left(\frac{\partial t_i}{\partial \beta}+\frac{\partial t_i}{\partial \alpha}\frac{\Delta\alpha}{\Delta\beta}\right)-\frac{\Delta\alpha}{\Delta\beta}\tau\sum_{i=1}^{n} B_i=\sum_{k=1}^{n_k}(N_k-t^S B_k)-\beta t^S\sum_{k=1}^{n_k}\left(\frac{\partial t_k}{\partial \beta}+\frac{\partial t_k}{\partial \alpha}\frac{\Delta\alpha}{\Delta\beta}\right) \quad \text{(A18)}$$

By resolving for $\frac{\Delta\alpha}{\Delta\beta}$, and using (ii), we get

$$\frac{\Delta\alpha}{\Delta\beta}=\frac{\sum_{k=1}^{n_k}(N_k-t^S B_k)-[\beta t^S+\tau(1-\alpha)]\sum_{k=1}^{n_k} B_{\tau+t_k}\frac{\partial t_k}{\partial \beta}}{\tau(1-\alpha)\sum_{i=1}^{n} B_{\tau+t_i}\frac{\partial t_i}{\partial \alpha}-\tau\sum_{i=1}^{n} B_i+\beta t^S\sum_{k=1}^{n_k} B_{\tau+t_k}\frac{\partial t_k}{\partial \alpha}} \quad \text{(A19)}$$

The numerator of (A19), given (i) and (iii), is clearly positive, while the denominator is negative if the first order effects of a change on local tax rates, due to a change in α, are greater than the second order ones. Of course, this suitably occurs when the Laffer curve is in the increasing tract.□

References

AHMAD, E., BROSIO, G. (eds.) (2006), *Handbook of Fiscal Federalism*, Edward Eldgar, Cheltenham.

AHMAD, E, SEARLE, B. (2005), "On the Implementation of Transfers to Subnational Governments", *WP/05/130*, International Monetary Fund, Washington, U.S.A.

BESLEY, T. (2007), *Principled agents? The Political economy of good government*, Oxford University Press, Oxford.

BOADWAY, R. (2006), "Intergovernmental Redistributive Transfers: efficiency and equity", in AHMAD, E., BROSIO, G. (eds.) (2006), 355-380.

BOADWAY., R., SHAH. (eds.) (2007), *Intergovernmental Fiscal Transfers: principles and practice,* The World Bank, Washington, D.C.
BLOCHLINGER, H., CHARBIT, C. (2008), "Fiscal Equalization", *OECD Economic Studies*, OECD, 44 (1), 2-21.
DAFFLON, B., MISCHLER, P. (2008), "Expenditure Needs Equalization at the Local Level", in KIM, J., LOTZ, J. (eds.) (2008).
EGGER, P., KOETHENBUERGHER, M., SMART, M. (2010), "Do Fiscal Transfers Alleviate Business Tax Competition? Evidence from Germany", *Journal of Public Economics*, 94, 235-246.
GAVAZZA, A., LIZZERI, A. (2007), The Perils of Transparency in Bureaucracies", *American Economic Review, Papers and Proceedings,* 97(2), 300-305.
GRAZZINI, L., PETRETTO, A. (2006), "Vertical Tax Competition with Tax Sharing and Equalization Grants", *Giornale degli Economisti e Annali di Economia,* 65 (1), 75-93.
KELDERS, C., KOETHENBUERGHER, M. (2010), "Tax Incentives in Fiscal Federalism: an Integrated Perspective", *Canadian Journal of Economics*, 43 (2), 683-703.
KIM, J., LOTZ, J. (eds.) (2008), *Measuring Local Governments Expenditure Needs, The Copenhagen Workshop 2007*", The Korea Institute of Public Finance and the Danish Ministry of Social Welfare.
KOETHENBUERGHER, M. (2008), "Federal Tax-Transfer Policy and Intergovernmental Pre-Commitment", *Regional Science and Urban Economics,* 38, 16-31.
KOTSOGIANNIS, C. (2010), "Federal Tax Competition and The Efficiency Consequences for Local Taxation of Revenue Equalization", *International Tax and Public Finance*, 17, 1-14.
KOTSOGIANNIS, C., SCHWAGER, R. (2008), "Accountability and Fiscal Equalization", *Journal of Public Economics*, 92, 2336-2349.
LEVY, G. (2007), "Decision Making in Committees: Transparency, Reputation and Voting Rules", *American Economic Review,* 97(1), 150-168.
MATTOZZI, A., MERLO, A. (2007), "The Transparency of Politics and the Quality of Politicians", *American Economic Review, Papers and Proceedings,* 97(2), 311-315.
OATES, W. (2005), "Towards a Second-generation Theory of Fiscal Federalism", *International Tax and Public Finance,* 12, 349-373.
OTTER, N. (2008), "Issues in Fiscal Needs Equalization in Germany", in KIM, J., LOTZ, J. (eds.) (2008).

PROPPER, C. BURGESS, S., GOSSAGE D. (2008), "Competition and quality: evidence form the NHS internal market 1991-1999", *The Economic Journal*, 118, 138-170.
SHAH, A. (1996), "A Fiscal Need Approach to Equalization", *Canadian Public Policy*, XXII (2), 99-115.
SHAH, A. (2005), "A Framework for Evaluating Alternate Institutional Arrangements for Fiscal Equalization Transfers", *Policy Research Working Papers Series* 3785, The World Bank.
SHAH, A. (2010), "Public Services and Expenditure Need Equalization: Reflections on Principles and Worldwide Comparative Practices", Invited lecture at the International Conference on *Services Standards and Financial Equalization in Decentralised Countries: International Evidence and Perspective for Italy*, University "L. Bocconi", Milan, Italy.
SMART, M. (1998), "Taxation and Deadweight Loss in a System of Intergovernmental Transfers", *Canadian Journal of Economics*, 31, 189-206.
SMART, M. (2007), "Raising Taxes Through Equalization", *Canadian Journal of Economics,* 40 (4), 1188-1212.
VO Duc Hong (2010), "The Economics of Fiscal Decentralization", *Journal of Economic Surveys,* 24 (4), 657-679.
WEINGAST, B. (2006), "Second Generation Fiscal Federalism: Implications for Decentralized Democratic Governance and Economic Development", IFIR/CISifo Conference, *New directions in Fiscal federalism*, Lexington, Kentucky, U.S.A., http//ssrn.com/abstract=1153440.