Emergence of Asymmetric Fiscal Federalism: Centrifugal and Centripetal Forces

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Abstract

In this paper we provide a simple analytical model that shows the emergence of asymmetric fiscal federalism. We derive in particular that asymmetric federalism, under some circumstances, may constitute a Pareto-improvement both with respect to centralization and with respect to secession. In this sense it could safeguard the unity of a nation-state by granting some regions a special status with more autonomy.

Keywords: Asymmetric fiscal federalism, Distribution of income, Fiscal flows

JEL classification: H4, H7.

1 Introduction

One of the major trends in multi-level governance over the past decades is that an increasing number of countries are using differentiated/asymmetric approaches in assigning public responsibilities to subnational governments (SNGs) [1] . This means that governments at the same subnational government level (regions or municipalities) are given different political, administrative or fiscal powers depending on their population size, ethnicity, linguistic and cultural identity, geographic characteristics or fiscal capacity (Congleton, 2015). During the last seven decades or so, asymmetric decentralization have become more common especially among unitary countries. In 1950 some 45 percent of the countries covered by the Regional Authority Index (Hooghe et al., 2016) and organized in regions had some kind of differentiated governance (autonomy, asymmetry, or dependency). In 2010, this figure had increased to 62 percent.

Some asymmetric decentralization arrangements are increasingly adopted for various reasons in Spain, France, Sweden, United Kingdom and is under discussion in Italy. In particular, in Italy asymmetric decentralization at regional level is provided for by a constitutional reform passed in 2001 (art. 116 comma 3). This allows that all ordinary statute regions can ask for additional forms of autonomy in a rather vast array of public intervention areas. [2] At the moment, this reform is at a standstill due to some unresolved issues, that is, how to reconcile wide margins of autonomy for the regions that demand more autonomy with the national equalization mechanisms.

Asymmetric decentralisation can be justified on the basis of various political, administrative and fiscal considerations. First of all, there may be historical, cultural and ethnic reasons for the special treatment of some regions or subnational governments both in federal countries (Belgium, Canada, India, Russia and Spain) and in unitary ones (France, UK and Italy with the case of Special statute regions). The aim

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[1] See Allain-DuprÃĺ, D. (2018); Bird,R. and R.Ebel (2006)

[2] A very important subject is education. At present central government decides for education according to uniform distribution criteria throughout the national territory. Education is also financed by general taxation. Lombardia and Veneto have asked for greater autonomy in education.

can for example be to safeguard the unity of a nation-state by granting some regions a special status with more autonomy.
The arguments proposed by the economic literature seem to be rather weak to support asymmetric decentralization. Asymmetric administrative arrangements can be justified by efficiency considerations: if the majority of subnational governments are not yet equipped with the capacity required to take charge of service provision at local level, it may make sense to decentralise responsibilities first to a limited number of regions. An asymmetric approach to decentralization may also help to accommodate heterogeneous preferences about autonomy among subnational jurisdictions. Asymmetric decentralization can be seen as a device to experiment new arrangements to manage public services and therefore as a incentive to innovation in public sector.
Finally, accommodating diverse preferences for political and fiscal autonomy across regions by asymmetric decentralization may mitigate separatist movements, prevent secession and help maintain political stability (see the case of autonomous region in Spain [3]. Asymmetric decentralization can be interpreted therefore as a sort of partial secession.
The aim of this paper is to provide an analytical framework to explain the determinants when a region opts for asymmetric decentralization as an alternative to centralization and secession.
In other words, the analysis will show that asymmetric federalism may represent an institutional/constitutional solution to control the independence pressures. Some regions, in fact, in case of a choice between centralisation and secession, maybe be willing to choose the complete secession with the benefit of avoiding the inter-regional equalising obligations (fiscal flows) and the cost of being required to supply inefficient public goods for which economies of scale cannot be fully exploited (e.g. national defence). For these regions, an intermediate solution, such as asymmetric federalism (if constitutionally envisaged), could be convenient.
The paper is organized as follows: Section 2 presents the institutional framework; Section 3 presents the set-up in perfect centralization; Section 4 presents the set-up under secession and analyzes the incentives that may lead a region to opt to secede; Section 5 analyzes asymmetric federalism and the conditions under which it is likely to emerge; Section 6 concludes.

2 Institutional framework

In the paper we will show that the institutional set-up of a country, chosen by both the central and by the regional governments, results from the interplay of three effects: a *regional specificity* effect, related to the demands for the public good, that differ across regions; an *efficiency/economy of scale* effect, capturing a reduction of marginal costs in producing some kind of public goods at the national level; and, finally a *fiscal flow* effect, capturing the fact that a region, as long as it does not secede, still has solidarity obligations towards other regions.
In this paper we consider a country composed of three regions, indexed by subscript i, that differ in income, and two public goods (a publicly provided public good G and a pure public good Z, that is characterized by high economies of scale). We consider three possible institutional set-ups: centralization, secession and asymmetric federalism. As synthesized in Table 1, each set-up is characterized by the following (constitutional) rules:

- Centralization, indexed by superscript n: the two public goods are centrally provided, and there exist fiscal flows (FF) across regions. Fiscal flows are the difference between what the each and every individual of each region receive in terms of public goods and what they actually pay in taxes to the central government. Fiscal flows consent an inter-regional redistribution of resources. We assume that the central government offers a uniform quantity of public good across citizens (g^{n*} and Z^{n*}), satisfying the average demand ($g^n = E[(g^n)_i^d]; Z = E[(Z^n)_i^d]$).

- Secession, indexed by superscript s: the public goods are regionally provided and are fully financed only by the fiscal capacity of each region. There are no fiscal flows across regions. The regional

[3] Castells (2017)

government satisfies the regional demands for the public goods, that, therefore, are tailor-made to regional preferences (g_i^{n*} and Z_i^{n*}).

- Asymmetric Federalism, indexed by superscript fed: the public good characterized by high economies of scale is still provided at the national level (Z^{n*}), like in centralization, whereas the publicly provided public good is tailor-made to regional preferences and is regionally provided (g_i^{fed*}. Fiscal flows do exist.

	SOLIDARITY (Fiscal Flows)	PRODUCTION of PUBLIC GOODS	QUANTITY OF PUBLIC GOODS
CENTRALIZATION	YES: FF_i^{n*}	g^{n*}, Z^{n*}	$g^n = E\left[(g^n)_i^d\right]; Z^n = E\left[(Z^n)_i^d\right]$
SECESSION	NO	g_i^{s*}, Z_i^{s*}	$g_i^s = (g^s)_i^d; Z_i^s = (Z^s)_i^d$
ASYMMETRIC FEDERALISM	YES: FF_i^{n*}	$g_i^{fed*}, Z^{n*};$	$G_{::}\ g_i^{fed} = \left(g^{fed}\right)_i^d; Z^{fed} = Z^n = E\left[(Z^n)_i^d\right]$

Table 1: (Constitutional) rules of each institutional set-up.

We derive that the functioning of these (constitutional) rules are affected by the characteristics of the economy, namely: distribution of income across regions (mean, variance and skewness) and the production technology of each good (in particular the existence of economies of scale in the production of Z). These characteristics are such that the effective functioning of the (constitutional) rules are pros or cons toward the emergence of a specific institutional setting. Moreover, our results will show that also when income differs substantially across regions (that is the inter-regional distribution of income exhibits high variance and/or high right-skewness), regional specificities (different incomes and production technologies) may lead to asymmetric fiscal federalism as a pareto improvement with respect to centralization and with respect to secession. Put differently, as always stressed by the literature of fiscal federalism, in presence of regional specificities, centralization is always inefficient. However, this inefficiency comes at different degrees, according to the distribution of income across regions. Not always differences in income lead to demand of regional autonomy. Only when richest regions are highly richer than the others, it may be the case that asymmetric fiscal federalism constitutes a pareto-improvement, that is both regional and central governments can benefit from increasing regional autonomy.

3 Centralization

In order to understand when both regional and central governments can benefit from increasing the local autonomy of a subset of regional governments in the provision of a subset of public goods, giving rise to asymmetric federalism, we need to start modelling perfect centralization.
Let us assume that in a centralized economy there exist three regions ($i = 1, 2, 3$). Individuals are identical inside each region i. Let population of region i be N_i, and let total population of the country be N, so that $N = \Sigma_i N_i$. Each region has income Y_i. Region 3 is richer than region 2, that in turn is richer than region 1, that is $Y_1 < Y_2 < Y_3$. Notice that aggregate income is the product of per-capita income y_i and population N_i. We also assume that $y_1 < y_2 < y_3$. [4]
In the economy there exist three goods: a private good and two public goods. Let c_i^n be the private good, consumed in centralization by each individual of region i. As mentioned in the introduction, let Z^n be a pure public good. Let finally G_n be a publicly provided private good, denoting by G_i^n the public good provided by the national government and targeted to region i.
As emphasized in the literature of fiscal federalism (Oates 1972), with centralization, the preference-revelation mechanism (or constitutional rules aiming at guaranteeing interpersonal equity) restricts the government to offer a uniform quantity of publicly provided public good among citizens, g^n,

[4] Things are straightforward as long as $N_1 \leq N_2 \leq N_3$, whereas restrictions on $N_i yi$ will be binding as long as $N_1 > N_2 > N_3$, so that $N_1 y_1 < N_2 y_2 < N_3 y_3$

and we assume that the level of public provision would be an average [5] of the individual demands $(g^n)_i^d$:

$$g^n = E((g^n)_i^d) = \Sigma_i(\frac{N_i}{N}(g^n)_i^d) \tag{1}$$

It comes out that:

$$G^n = \Sigma_i G_i^n = \Sigma_i N_i g^n = N g^n \tag{2}$$

The public goods are financed by the fiscal capacity of all regions, with a marginal tax rate τ^n.
The central government budget constraint is therefore:[6]

$$P_g G^n + P_z^n Z^n = \tau^n \Sigma_i Y_i \tag{3}$$

Recalling eq. (2) therefore we get:

$$\tau^n = \frac{P_g \Sigma_i (N_i g^n) + P_z^n Z^n}{\Sigma_i Y_i} \tag{4}$$

This equation can be rewritten in terms of fiscal flows, namely the difference between what each and all the individuals of each region receive in terms of public goods and what they actually pay in taxes to the central government. Let us now define FF_i^n the fiscal flow of region i under centralization, as $FF_i^n = P_g N_i g^n + P_z^n \frac{N_i}{N} Z^n - \tau^n Y_i$, since Z^n can be written as $Z^n = \Sigma_i \frac{N_i}{N} Z^n$, eq. (4) can be rewritten as follows:

$$P_g N_i g^n + P_z^n \frac{N_i}{N} Z^n + \Sigma_{-i} F F_{-i}^n = \tau^n Y_i \tag{5}$$

Or equivalently:

$$F F_i^n = -\Sigma_{-i} F F_{-i}^n \tag{6}$$

Individual preferences depend on the level of all goods:

$$U_i = U\left(c_i^n, g^n, Z^n\right) \tag{7}$$

As far the private good is concerned, the representative agent of region i consumes his disposable income, that is:[7]

$$P_c c_i^n = (1 - \tau^n) y_i \tag{8}$$

Substituting eq. (5), after dividing it by N_i, into eq. (8), the individual budget constraint under centralization becomes:

$$P_g g^n + P_z^n \frac{1}{N} Z^n + P_c c_i^n = y_i - \frac{1}{N_i} \Sigma_{-i} F F_{-i}^n \tag{9}$$

Therefore, the problem of the representative individual of each region i is

$$\underset{c_i^n, g^n, Z^n}{Max}\ U_i \tag{10}$$

subject to the budget constraint, that is eq. (9).
Individual demands for public goods, when they are nationally provided, follow:

$$(g^n)_i^d = U'\left(P_g, P_z^n, P_c, Y_i, Y_{-i}, N_i, N, \tau^n\right) \tag{11}$$

and

$$(Z^n)_i^d = U'\left(P_g, P_z^n, P_c, Y_i, Y_{-i}, N_i, N, \tau^n\right) \tag{12}$$

[5] Cerniglia and Longaretti 2015 demonstrate that this mechanism is equivalent to the standard utilitarian maximizer solution, as far as the individual demands are linear differs from the "median voter" choice as far as the distribution of income is asymmetric.

[6] We assume that the marginal cost, and in turn the price, of the publicly provided private good G is the same whatever the institutional set-up considered, therefore we simplify the notation avoiding the superscript n in P_g^n.

[7] Similarly as we did for G, we assume that the marginal cost, and in turn the price, of the private good is the same whatever the institutional set-up we consider, and so we do not use the superscript n in i P_c^n.

As far as the demand of c is concerned, similarly we obtain:

$$(c^n)_i^d = U'\left(P_g, P_z^n, P_c, Y_i, Y_{-i}, N_i, N, \tau^n\right) \tag{13}$$

The important result of this simple algebraic framework is that, as far as all the goods are normal goods, each regional demand is increasing in regional own income and in fiscal flows from other regions (captured by Y_{-i} and τ).
As we will show below, fiscal flows are therefore a double-edged sword: on one hand perfect inter-regional redistribution of resources guarantees that individuals living in poorer regions may afford a reasonable level of public good, on the other hand perfect inter-regional redistribution may be an incentive for individuals living in rich regions to demand regional autonomy.
As far as the supply side of goods is concerned, each price is equal to the marginal cost of production, that we assume exogenous and constant. That is:

$$P_g = MC_g \tag{14}$$

and

$$P_z^n = MC_z^n \tag{15}$$

and

$$P_c = MC_c \tag{16}$$

Therefore, focusing on the public goods, this means that, as said above, the central government satisfies the average individual demand of each public good at its respective marginal cost. Therefore:

$$g^n = E[(g^n)_i^d] = \Sigma_i \frac{N_i}{N} U'\left(MC_g, MC_z^n, MC_c, Y_i, Y_{-i}, N_i, N, \tau^n\right) \tag{17}$$

and

$$Z^n = E[(Z^n)_i^d] = \Sigma_i \frac{N_i}{N} U'\left(MC_g, MC_z^n, MC_c, Y_i, Y_{-i}, N_i, N, \tau^n\right) \tag{18}$$

As far as the the private good is concerned, instead:

$$(c)_i^n = U'\left(MC_g, MC_z^n, MC_c, Y_i, Y_{-i}, N_i, N, \tau^n\right) \tag{19}$$

These are not yet the equilibrium values. In order to calculate the equilibrium values $(c^{n*}, G^{n*}, Z^{n*}, \tau^{n*)}$ the following system of equations has to be solved:

$$\begin{cases} c_i^n = U'\left(MC_g, MC_z^n, MC_c, Y_i, Y_{-i}, N_i, N, \tau^n\right) \\ Ng^n = \Sigma_i N_i (U'\left(MC_g, Y_i, Y_{-i}, N_i, N, \tau^n\right)) \\ Z^n = \Sigma_i \frac{N_i}{N} (U'\left(MC_z^n, Y_i, Y_{-i}, N_i, N, \tau^n\right)) \\ \tau^n = \frac{MC_g \Sigma_i (N_i g_i^n) + MC_z^n Z^n}{\Sigma_i Y_i} \end{cases} \tag{20}$$

that is

$$c_i^{n*} = U'\left(MC_g, MC_z^n, MC_c, Y_i, Y_{-i}, N_i, N\right) \tag{21}$$

$$G^{n*} = f\left(MC_g, MC_z^n, MC_c, Y_i, Y_{-i}, N_i, N\right) \tag{22}$$

$$Z^{n*} = f\left(MC_g, MC_z^n, MC_c, Y_i, Y_{-i}, N_i, N\right) \tag{23}$$

and

$$\tau^{n*} = f\left(MC_g, MC_z^n, MC_c, Y_i, Y_{-i}, N_i, N\right) \tag{24}$$

In Figure 1, we depict the individual choice between c and g, given the optimal level of the pure public good Z_n^*

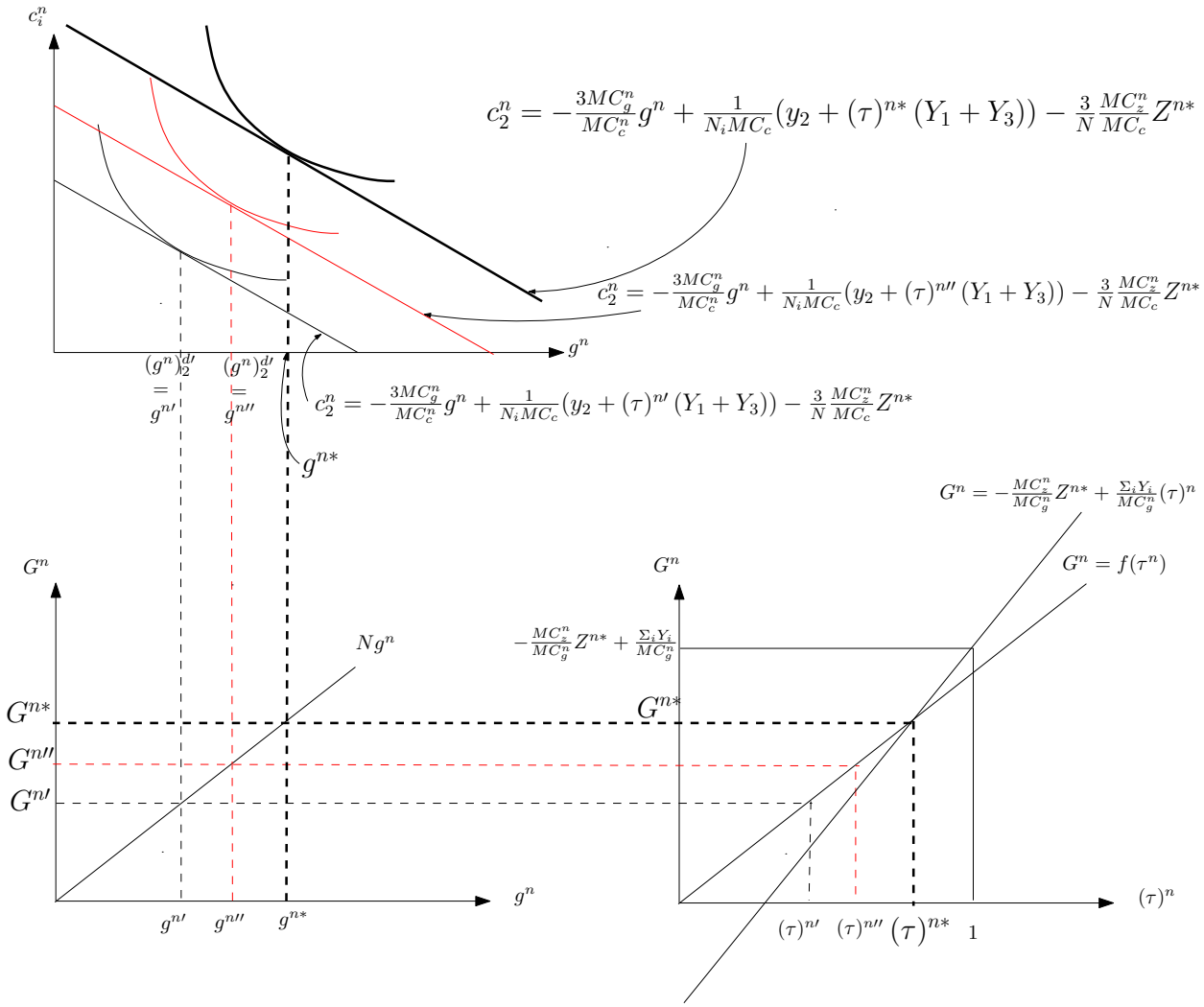

Figure 1: Regional demand for public good g, and equilibrium values of g^{n*} and of τ^{n*} in centralization

In the figure we assume that average demand coincides with the demand of region 2, therefore we depict only the budget constraints referred to region 2. We parameterize each budget constraint to the equilibrium level of Z. Moreover the black one on the left is parameterized to τ', whereas the red one is parameterized to τ''. Therefore, graphically we obtain, in the panel to the bottom right, the function $G^n = f(\tau^n$. The interception between that function with the function that plots the couples (G^n, τ^n) that guarantee the balance of the national government budget constraint, gives the equilibrium marginal tax rate. Given that, backward we plot in bold also the equilibrium average budget constraint, that again coincides with the one of region 2 and the equilibrium value g^{n*}.
Figure 2 instead plots the different levels of individual utility in equilibrium for the three regions, assuming a uniform distribution of income. Since income is greater (lower) than the average one for region 3 (2), it follows that:

$$c_1^{n*} < c_2^{n*} < c_3^{n*} \tag{25}$$

and

$$U_1^{n*} < U_2^{n*} < U_3^{n*} \tag{26}$$

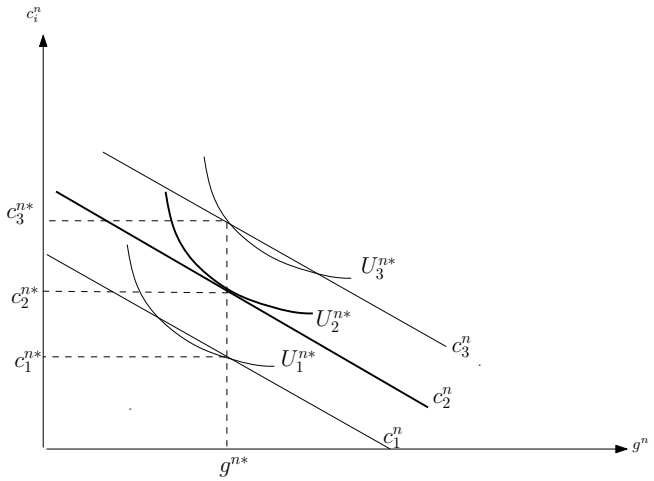

Figure 2: Equilibrium individual utility for each region in centralization

From this analysis, it comes out that, under centralization, since regions differ each other according to their own income and, in turn, according to their own demand, a uniform centralized provision of the public good generates static inefficiency. This result is not new and comes in accordance with the decentralization theorem (Oates 1972).
As you can see in figure 3, the static inefficiency from this uniform provision of public good, could be measured as the difference from the utility level (U^n_{3Max})), to which would be parameterized the indifference curve tangent to the budget constraint c^n_3, and that citizens of region 3 would get if g was targeted to them, and the utility level (U^{n*}_3), that citizens of region 3 effectively get.
It is interesting to focus on how things change as the distribution of income changes. In figure 3 we plot different distributions of income. We keep income and the budget constraint of region 3 fixed and, passing from panel (a) to panel (b) we increase the variance, keeping the distribution uniform. Instead passing from panel (a) to panel (c), we increase the right-skewness. In all cases, we assume that the average demand is equal to the demand of region 2. What it comes out is that, as the mean decreases, and as the variance and the right skewness increase, the static inefficiency for region 3 increases.

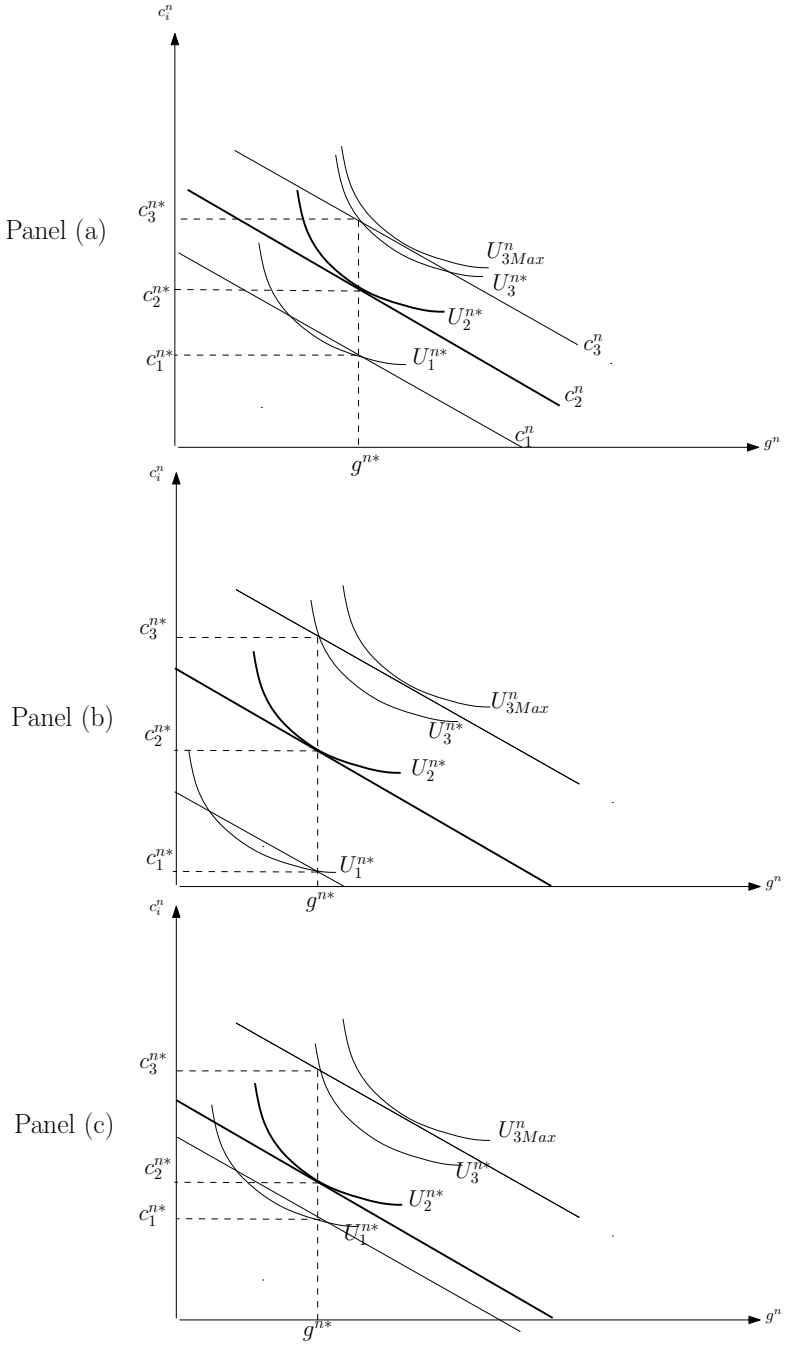

Figure 3: Static inefficiency of centralization for region 3, as the distribution of income changes

However, we aim to understand if this sort of inefficiency can be a pre-condition for some regions to ask for secession.

4 Secession

We analyze now the possibility that a region secedes.
Under secession, a region provides and finance autonomously all public goods, without any

solidarity/equalizing obligation. The regional government budget constraint is therefore:

$$P_g G_i^s + P_z^s Z_i^s = \tau_i^s Y_i \tag{27}$$

where

$$G_i^s = N_i g_i^s \tag{28}$$

As for c,:

$$P_c c_i^s = (1 - \tau_i^s) y_i \tag{29}$$

Therefore the individual budget constrain under secession is:

$$P_g g_i^s + P_z^s \frac{Z_i^s}{N_i} + P_c c_i^s = y_i \tag{30}$$

We likely assume that there exist high economies of scale in producing Z at the national level, therefore marginal cost of producing Z regionally is strongly higher that the marginal cost of producing it nationally. Therefore, we can assume $MC_z^s > MC_z^n$.
The maximization of the utility function $U(c_i^s, g_i^s, Z_i^s)$, under the individual budget constraint, given the balance of regional government budget constraint, gives the following equilibrium values $(c^{s*}, g^{s*}, G^{s*}, Z^{s*)}, \tau^{s*)}$:

$$c^{s*} = f\left(MC_g, MC_z^s, MC_c, y_i\right) \tag{31}$$

$$g^{s*} = f\left(MC_g, MC_z^s, MC_c, y_i\right) \tag{32}$$

$$G^{s*} = f\left(MC_g, MC_z^s, MC_c, y_i\right) \tag{33}$$

$$Zs* = f\left(MC_g, MC_z^s, MC_c, y_i\right) \tag{34}$$

and

$$\tau_i^{s*} = \frac{MC_g N_i g_i^s + MC_z^s Z^s}{Y_i} \tag{35}$$

The graphical derivation of the equilibrium is depicted in figure 4.

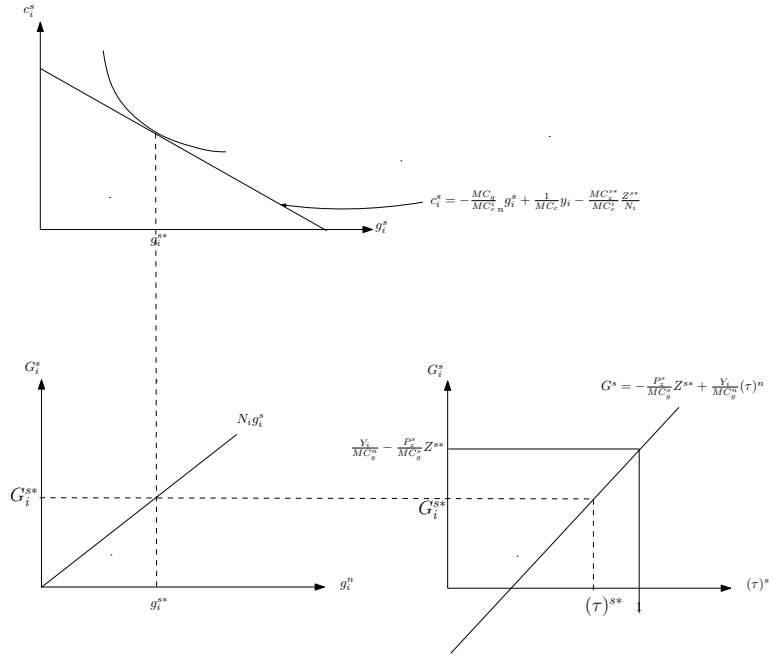

Figure 4: Equilibrium in case of secession

We now want to show that for the richest region, that is region 3, there exists the eventuality to opt to secede. Our analysis is conducted graphically in Figure 4. As depicted in Figure 5,[8] the following relations are likely to hold:

$$g^{n*} < g_3^{s*} \tag{36}$$

and

$$c_3^{n*} < g_3^{s*} \tag{37}$$

and

$$Z^{n*} > Z_3^{s*} \tag{38}$$

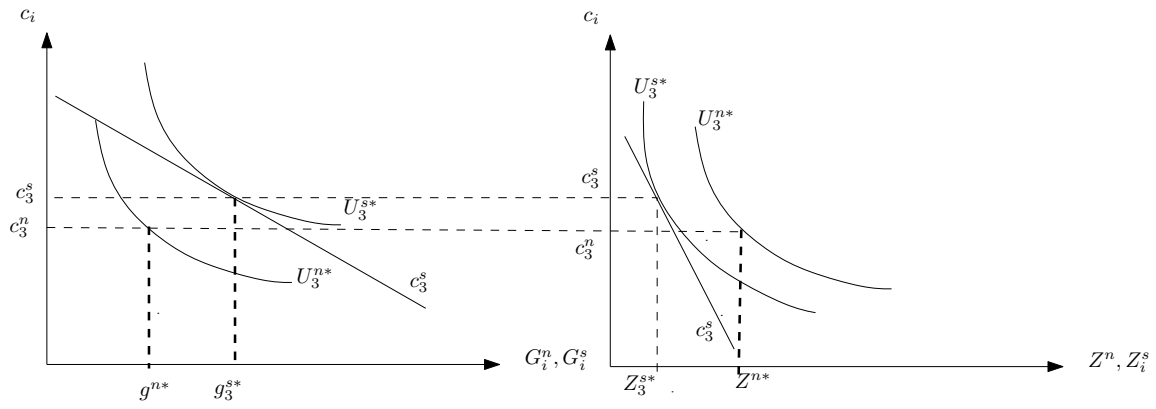

Figure 5: Secession vs Centralization

A region may be willing to choose to secede if the benefit, in terms of gains in the individual utility of avoiding the inter-regional equalising obligations (fiscal flows) and of tailor-making the provision of G (this can be seen in the left panel, as $U_3^{s*} > U_3^{n*}$), overcome the cost of being required to supply inefficiently a public good for which economies of scale cannot be fully exploited, that is Z (this can be seen in the right panel, as $U_3^{s*} < U_3^{n*}$). The net effect depends on many variables. It is reasonable to think that this incentive increases:

- the richer the region is with respect to the average. This in turn depends on the distribution of income (recall figure 3);
- the lower the economies of scale in the production of the pure public good.

5 Asymmetric federalism

We consider a setting in which a regional government asks a central government for increased autonomy in a policy area of mutual interest. For example, a local, state, or regional government may seek special authority to produce services that are initially within the jurisdiction of a higher level of government.
The central government generally controls what might be called the supply of local autonomy. As mentioned in the introduction, the supply of higher local autonomy may result in order to avoid the secession of some regions. This institutional set-up, if designed optimally, would allow to avoid secessionist instances. Decentralisation could be the tool that could be used to compensate some jurisdictions, allowing them the possibility of choosing the optimum level of some public goods to be offered to their residents thereby decreasing the costs that they should incur in the case instead of a uniform centralised

[8] Notice that, in Figure 5, the derivation of the equilibrium levels for region 3 in centralization comes from Figures 1 and 2.

supply.
In order to analyze this issue, we assume that the public good with high economies of scale, that is Z, continues to be provided centrally, whereas the central government allows regions to choose to provide G autonomously, but in this case they still have solidarity obligations in order to guarantee to the other regions the same level of G that they would have had under centralization.
However asymmetric federalism implies that region i may provide autonomously its own public good, but still has to pay taxes to the central government. This implies that each region i has to contribute to the provision of G^{n*} to all other regions and it has to contribute to the provision of Z^{n*} to the whole country, according to the fiscal flows it would pay in centralization, that is according to $(-FF_i^{n*})$, that is negative for rich regions.
The central government budget constraint is therefore:

$$MC_g \Sigma_{-i} G_{-i}^{n*} + MC_z^n Z^{n*} = \tau^{n*} \Sigma_{-i} Y_{-i} + (\tau^{n*} Y_i - MC_g G_i^{n*}) \tag{39}$$

This can be interpreted as follows: the left-hand-side is the total expenditure for the central government, whereas the right-hand-side is its revenues. Revenues for the central government in this case are $\tau^{n*} Y_i - MC_g G_i^{n*}$, that is equal to what the central government had in centralization, less $MC_g G_i^{n*}$, since region i provides autonomously to its own G.
Rewriting, we get:

$$MC_g \Sigma_{-i} G_{-i}^{n*} + MC_z^n \Sigma_{-i} \frac{N_i}{N} Z^{n*} = \tau^{n*} \Sigma_{-i} Y_{-i} + (\tau^{n*} Y_i - MC_g G_i^{n*} + MC_z^n \frac{N_i}{N} Z^{n*}) \tag{40}$$

The left-hand-side represents the part of the central government expenditure, that is targeted to the $(-i)$ regions. The right-hand-side shows how the central government finances it, that is *via* taxes in income of the $(-i)$ regions, and *via* fiscal flows from region i.[9]
Let us now move to analyze the regional government budget constraint. The total expenditure for the regional government is $P_g G_i^{fed}$, and regional government finances its total expenditure, imposing τ^{fed} on the disposable income that region i has, once it has payed its (negative) fiscal flows to the central government. Therefore the regional government budget constraint is:

$$P_g G_i^{fed} = \tau^{fed} (Y_i + FF_i^{n*}) \tag{41}$$

Individual budget constraint instead is:

$$P_g g_i^{fed} + P_c c_i^{fed} = y_i + \frac{FF_i^{n*}}{N_i} \tag{42}$$

Notice that in the individual budget constraint, $G_i^{n*}, Zn*$ and τ^{n*} are included *via* FF_i^{n*}. As for the supply side at the regional level, once again:

$$P_g = MC_g \tag{43}$$

and

$$P_c = MC_c \tag{44}$$

If the public good is regionally provided, regional demand for public goods comes, again, from the maximization of the utility function $U_i(c_i^{fed}, g_i^{fed}, Z^{n*})$.[10]
The maximization of the utility function under the individual budget constraint, given the infinitely elastic supply functions, and given $G^{n*}, Z^{n*}, \tau^{n*}$, gives rise to the following equilibrium:

$$c_i^{fed*} = f(MC_g, MC_c, Y_i, G^{n*}, Z^{n*}, \tau^{n*}) \tag{45}$$

$$G_i^{fed*} = f(MC_g, MC_c, Y_i, G^{n*}, Z^{n*}, \tau^{n*}) \tag{46}$$

[9] Notice that $(\tau^n Y_i - MC_g G_i^{n*} - MC_z^n \frac{N_i}{N} Z^{n*}) = -FF_{-i}^{n*}$

[10] Notice that, since Z is nationally provided, individuals don't maximize for Z, since we consider it exogenously fixed, and equal to Z^{n*}

$$\tau^{fed*} = \frac{MC_g G_i^{fed*}}{Y_i + FF_i^{n*}} \tag{47}$$

In figure 6, we depict in red the equilibrium in asymmetric federalism, given $G_i^{n*}, Zn*$ and τ^{n*}

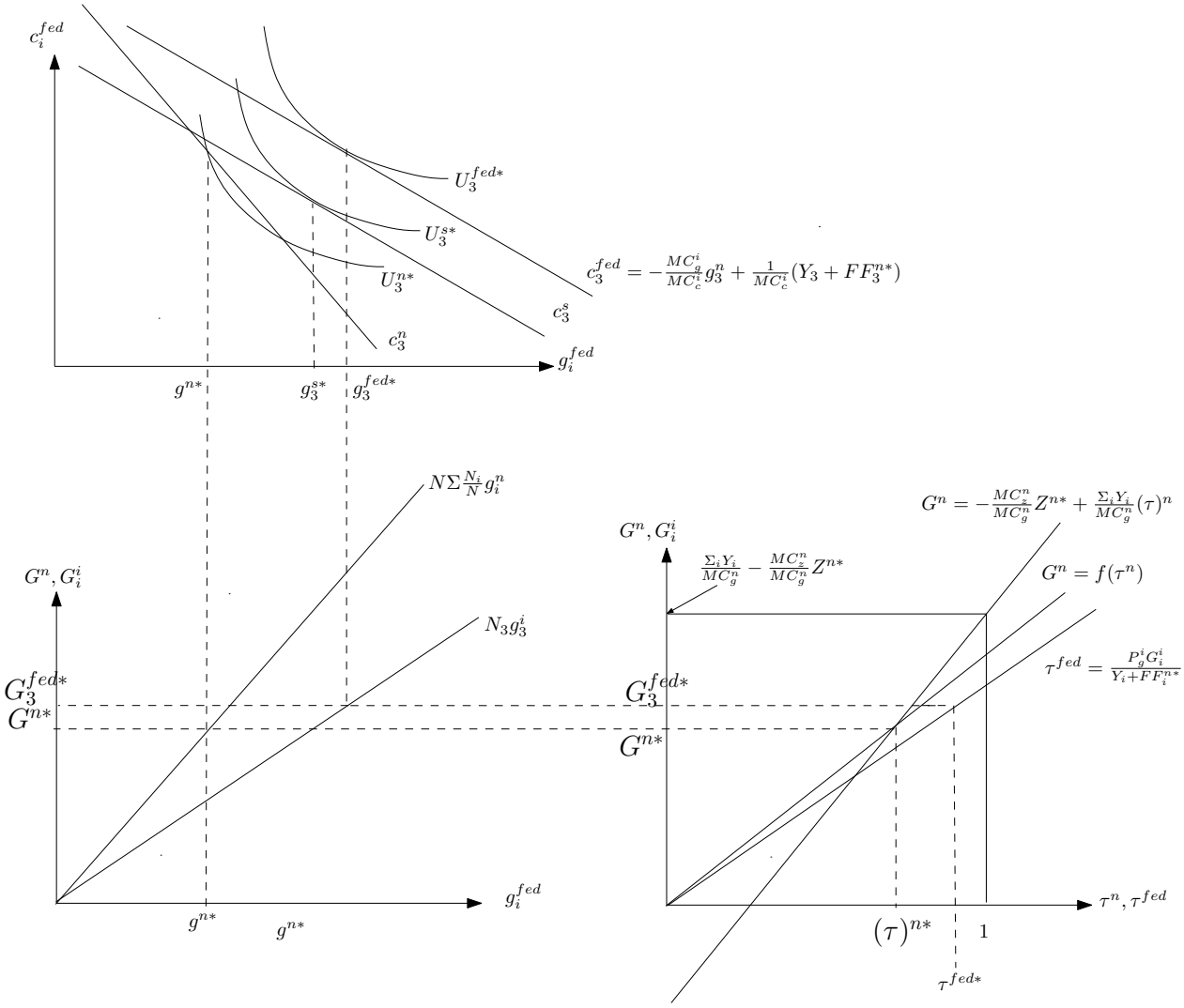

Figure 6: The equilibrium and the emergence of asymmetric federalism

In Figures 6 and 7 we depict three different emerging institutional set-ups. In Figure 6, we depict a scenario in which asymmetric federalism is the first best institutional set-up, meaning that $U_3^{fed*} > U_3^{s*} > U_3^{n*}$. This means that for a region, that could possibly have incentives to secede, asymmetric federalism may be a Pareto improvement. This graphical result comes from many restrictive conditions about production technologies of goods, economies of scale and distribution of income across regions.

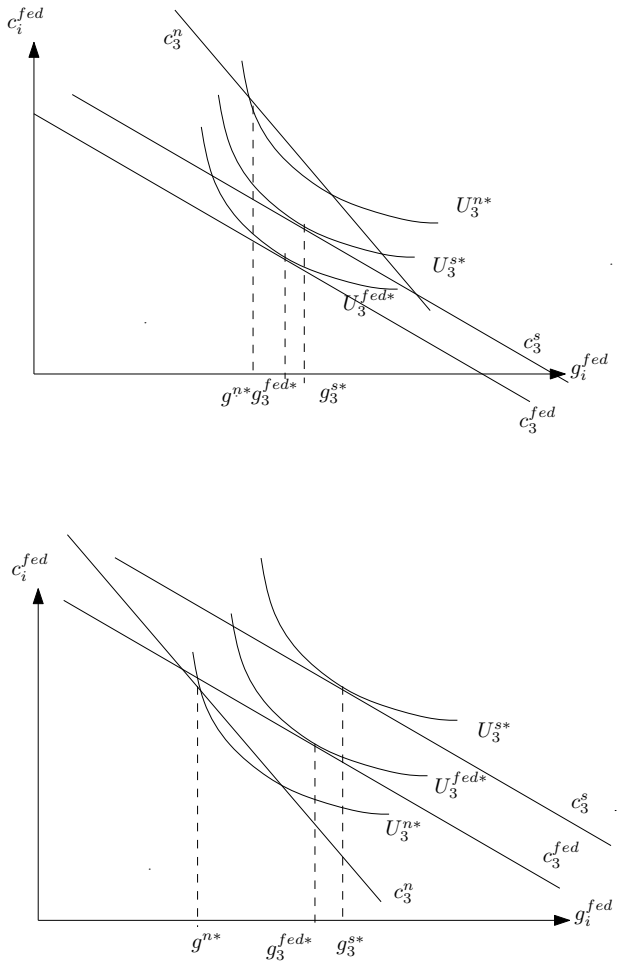

Figure 7: The emergence of centralization (panel a) vs the emergence of secession (panel b)

In Figure 7 (panel a) instead we depict a scenario in which centralization is the first best institutional set-up, meaning that $U_3^{fed*} < U_3^{s*} < U_3^{n*}$. Finally in Figure 7 (panel b) we depict a scenario in which secession is the first best institutional set-up, meaning that $U_3^{n*} < U_3^{fed*} < U_3^{s*}$.
Therefore we have shown that the functioning of the (constitutional) rules of each institutional set-up is affected by the characteristics of the economy, namely: distribution of income across regions (mean, variance and skewness) and the existence of economies of scale in the production of Z. Table 2 shows how these characteristics are such that the effective functioning of the (constitutional) rules are pros (+) or cons (-) toward the emergence of a specific institutional setting. Obviously pros overcome cons, according to the size of each effect.

Therefore, the effects of the characteristics of the economy (distribution of incomes and the presence of economies of scale in the production of the pure public good) on the functioning of the (constitutional) rules of each of the three institutional set-ups, may lead, according to the magnitude of each effect, to one institutional set-up preferred to the others. One possibility is synthesized in Table 3.[11]

[11] Notice that, anyways, centralization may be the first best (together with asymmetric federalism) whenever economies of scale are very high and the variability of income is negligible. Furthermore this would be the case if we add economies of scale also in the production of G.

		Tailor made g	Solidarity	Ec. of scale for Z
LOW VARIABILITY OF INCOMES	CENTR.	$\sim(-)$	$\sim(-)$	$\sim(+)$
LOW ECONOMIES OF SCALE	SEC.	$\sim(+)$	$\sim(+)$	$\sim(-)$
	AS. FED.	$\sim(+)$	$\sim(-)$	$\sim(+)$
		Tailor made g	Solidarity	Ec. of scale Z
LOW VARIABILITY OF INCOMES	CENTR.	$\sim(-)$	$\sim(-)$	$(+)$
HIGH ECONOMIES OF SCALE	SEC.	$\sim(+)$	$\sim(+)$	$(-)$
	AS. FED.	$\sim(+)$	$\sim(-)$	$(+)$
		Tailor made g	Solidarity	Ec. of scale Z
HIGH VARIABILITY OF INCOMES	CENTR.	$(-)$	$(-)$	$\sim(+)$
LOW ECONOMIES OF SCALE	SEC.	$(+)$	$(+)$	$\sim(-)$
	AS. FED.	$(+)$	$(-)$	$\sim(+)$
		Tailor made g	Solidarity	Ec. of scale Z
HIGH VARIABILITY OF INCOMES	CENTR.	$(-)$	$(-)$	$(+)$
HIGH ECONOMIES OF SCALE	SEC.	$(+)$	$(+)$	$(-)$
	AS. FED.	$(+)$	$(-)$	$(+)$

Table 2: Pros (+) and cons (-) towards each institutional set-up.

	LOW ECONOMIES OF SCALE FOR Z	HIGH ECONOMIES OF SCALE FOR Z
LOW VARIABILITY OF INCOMES (variance and/or right skewness)	Secession $\succeq$ Asymm. Fed $\succ$ Centralization	Asymm. Fed $\succ$ Secession $\succeq$ Centralization
HIGH VARIABILITY OF INCOMES (variance and/or right skewness)	Secession .$\succ$ Asymm. Fed $\succ$ Centralization	Secession. $\succeq$ Asymm. Fed $\succ$ Centralization

Table 3: Preferred institutional set-up.

6 Conclusions

In this paper we have developed an analytical model that aimed to clarify algebraically the interplay between regional specificity and efficiency/economies of scale, in shaping the demand and the emergence of asymmetric fiscal federalism. We have focused on the role played by the distribution of income across regions in shaping the demand for higher regional autonomy and in determining the rise of asymmetric fiscal federalism. We have derived in particular that the variance and skewness of the distribution of income across regions are key factors together with regional average income in the resulting institutional set-up.

Summing up, static inefficiency of centralization, suggested by the decentralization theorem (Oates 1972), shapes incentives toward asymmetric federalism and this is in line with Congleton et al. (2003 and 2015), saying that the emergence of asymmetric fiscal federalism may come from a situation in which *overcentralization* would lead to demand for secession by some regions. [12]
Summing up, asymmetric federalism, under some circumstances (showed in the paper), may constitute a Pareto-improvement both with respect to centralization and with respect to secession.

[12] "In the case of initially overcentralized states, we demonstrate that cases exist where some, but not all, regions or urban centers will seek and obtain the power to regulate, tax, or produce government services." (Congleton et al. 2003).

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