Does Fiscal Decentralization Promote Fiscal Discipline?

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Abstract

We investigate the efficiency and equity implications of fiscal decentralization (FD) under a redistributive rule that takes into account both local tax collection efforts and deviation of local incomes from respective targets. We show that, if hard budget constraints apply, such an institutional set up leads to higher fiscal discipline, measured by higher tax collection effort, than under centralized redistribution. Centralized redistribution, however, yields better income distribution than FD, whereas the latter also improves income distribution unambiguously only when equalization across regions is explicitly targeted. In addition, privatization enhances the disciplinary effect of decentralization in case localities act strategically.

Key terms: Fiscal Decentralization, Fiscal Discipline, Redistribution
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1. Introduction

Fiscal decentralization (FD) can be described as an institutional mechanism whereby fiscal power and responsibilities are transferred from the central government towards local levels of government. Following the seminal work of Oates (1972), the literature on FD has been extensive. This paper contributes to this literature by developing a model to explore the relationship between FD and fiscal discipline.

In many countries, local governments rely to a great extent on central government transfers to finance their fiscal activities. The need for transfers arises from both vertical and horizontal imbalances, the former of which are common due to greater capacity of central governments in revenue collection than local governments,[2] while the latter arise from the varying fiscal capacities across different regions of a country. Aside from these imbalances, insufficient tax collection effort of local governments, which is a form of moral hazard, may also necessitate local governments' reliance on central government transfers.

Fiscal institutions have potentially important welfare implications via their effects on macroeconomic stability and income equality. As an important fiscal institution, redistributive mechanisms can increase welfare by reducing or eliminating the vertical and horizontal imbalances. However, moral hazard and common pool problem may also be exacerbated when redistribution mechanisms are not well-designed. This study analyzes the fiscal disciplinary effect of FD by proposing a redistributive mechanism that takes both efficiency and equity criteria into account. A redistributive mechanism, however demanding its information requirements and implementation may be, that takes both of these criteria into

[2] The capacity of central government is usually better than that of local governments due both to greater tax bases available to them and tax collection capabilities, such as the quality of personnel. Though many developed countries tend to have lower *vertical imbalances* due to federal systems (although in Canada, Switzerland, US and Germany, for example, central government transfers still constitute 50% to 70% of local government budgets), developing countries often have much higher vertical imbalances (local governments in some Latin American countries rely on the central government for between 70% to 80% of their revenues. In countries like Peru, Portugal and Iran this ratio has been more than 90%).

account is considered to be the most desirable one.[3] This redistributive rule combined with fiscal decentralization defines the fiscal institutional design whose fiscal outcomes are investigated in this paper.

The main motivation for this study arises from the fact that the literature has not yet offered a clear framework to analyze the macroeconomic effects of FD. A growing literature on the socio-economic consequences of FD provides mixed evidence on the merits of FD.[4] Likewise, the recent strand of the empirical literature that investigates the macroeconomic implications of FD is far from a consensus.[5] In brief, the evidence on the effects of FD is mixed and the effectiveness of FD in attaining the socio-economic objectives seems to depend on various structural characteristics and institutional factors.

Against the background, a couple of recent studies investigate the welfare impact of FD in view of specific redistributive schemes. Sanguinetti and Tomassi (2004) compare the rule-based versus discretionary fiscal transfers using a game theoretic framework where

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[3] In a survey of nine developed countries, Ma (1997) reports the characteristics of four classifications of fiscal transfer systems observed in practice. These systems focus on either efficiency or equity objectives or both. In Australia, Germany, Japan, Korea and United Kingdom, transfers are made on the basis of both equalization of fiscal capacities and expenditure needs across regions. The second method only considers equalization of fiscal capacities (for example, in Canada), assuming the same expenditure need across the regions. The third transfer method only considers equalizing expenditure needs, measured by a weighted average of various socio-economic and demographic indicators (for example, in India, Italy and Spain). A final classification of fiscal transfer methods entails the equalization of transfers only on the per capita basis (for example, Turkey and, with regards to certain types of transfers also Germany, Canada, England and India).

[4] See, for example, Bardhan and Mookherjee (1998), Panizza (1999), Barrett (2000), Blanchard and Shleifer (2000), Dethier (2000), Lin and Liu (2000), Norris et al. (2000), de Mello (2000a and 2000b), Tanzi (2000), Treisman (2000), Von Braun and Grote (2000), Eaton (2001), Wasylenko (2001), de Mello and Barenstein (2001), Fisman and Gatti (2002), Feltenstein and Iwata (2002) and Hope, (2002). While some of these studies show a positive relationship between FD and governance, others argue otherwise.

[5] Davoodi and Zou (1998) report a negative relationship between FD and growth in less developed countries, although Martinez-Vazquez and McNab (2006) show a mixed evidence on this relationship and Thiessen (2003) argues that only moderate FD leads to growth. King and Ma (2001) and Neyapti (2004) both show negative relationship between revenue decentralization and inflation. Jin and Zou (2002) show that government size is positively related with expenditure decentralization and negatively related with revenue decentralization. Neyapti (2006) shows that revenue decentralization leads to better income distribution, the better the governance. Kappeler and Välilä (2008) argue that FD boosts public investment productivity. Neyapti (2010) shows that FD is significantly associated with lower budget deficits in largely populated countries.

transfers are considered as insurance against local shocks across regions under asymmetric information. Welfare comparisons reveal that discretionary financing is more preferable in the event of large local shocks, while rule-based transfers are preferred in case of a high degree of FD that increases the degree of common pool problem.[6] Stowhase and Traxler (2005) model fiscal competition where costs of tax enforcement are shared across regions where, similar to the current paper, tax effort (in their case the rate of auditing local tax collection) becomes local government's strategic tool. Their analysis reveals that the fiscal equalization scheme, based on net revenue sharing, helps to internalize fiscal externalities.[7] The authors concede, however, that the feasibility of the redistributive mechanism they suggest to improve the efficiency in tax collection is questionable in view of informational asymmetries.

The current paper approaches to the concept of inefficiency in public good provision in terms of the deviation from the revenue collection capacity (target revenue), which can be computed as the product of an average tax rate and the tax base. The redistributive mechanism suggested in this paper differs from Stowhase and Traxler's net-revenue sharing in that it also considers the income compensation aspect.

We investigate the fiscal disciplinary implications of two alternative schemes of redistribution. Under fiscal decentralization, local governments optimally choose their tax collection efforts given a pre-announced redistributive rule that both punishes a less-than-full tax-collection effort and compensates for the deviation of local incomes from their target.[8] We argue that the degree of tax collection effort implies the degree of efficiency of local fiscal activity in general.[9] Because local governments benefit from their own spending but not

[6] Their model is not directly comparable to the current one due to the various differences between the two models, including that they do not consider a redistributive rule such as the one employed in the current paper and taxes are set by both local and federal governments.
[7] As in the current model, the authors consider a fixed statutory tax rate.
[8] One may consider punishment as a second type of tax that the central government imposes on local governments in case of insufficient tax effort.
[9] Even though the local governments are not in charge of income tax collection, they contribute to it via reporting the local activity effectively.

directly from own tax collection effort, redistribution of a common revenue pool may lead to inefficiencies when incentive mechanisms implied by the redistribution rule facing local governments are inadequate. Given a common set of taxes, moral hazard may arise in the form of less than full tax collection effort by a local government.[10]

Under the fiscal decentralization scheme, we consider two alternative scenarios that are differentiated by the nature of interactions among the local governments. The first of these is characterized by many small local governments (denoted by FD). In the second (denoted by FD^{Nash}), the number of localities is relatively few and they act strategically, taking into account each others' optimal action since each local government may think the other's behavior may affect its own. Under the alternative scheme, the central government (CG) decides on the level of transfers without a pre-announced redistribution rule.[11]

We compare the solutions of the respective problems (FD, FD^{Nash} and CG) to evaluate the effectiveness of the proposed fiscal institutional design. Due to the complexity of the expressions resulting from the model's solutions, we perform simulations to evaluate the results. The basic model outlined above is rich of potential extensions. Besides the benchmark case of full information, we analyze the sensitivity of the results under asymmetric information, when the poor and rich regions are hit by positive or negative shocks that local governments observe but the central government does not. In addition, we investigate the effect of incorporating the target of convergence (equal income) across localities in the redistributive rule. We also investigate the income distribution implications of both the benchmark and the rest of the scenarios.

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[10] Hence, the problem addressed in the current framework is not one of optimal taxation; nonetheless, local governments choose the effective tax rate optimally by choosing their tax collection effort. Existing studies that investigate the redistributive role of the government are usually in the optimal tax literature that emphasizes the equalization of marginal cost of taxation across different tax sources. Boadway, et al. (2001), for example, examine the relationship between FD and equalization via redistribution in that context, with a focus on migration across regions.
[11] The comparison of central and local government decisions is similarly done in both Boadway at al (2001) and Stowhase and Traxler (2004).

Simulations reveal that, when local governments face a hard budget constraint, decentralization leads to greater efficiency, measured by higher tax collection effort and lower size of redistribution, than under centralized decision making. The results remain robust in the case of informational asymmetries between the central and local governments about the local shocks.[12] When budget deficits are allowed to arise under decentralization, which usually happens since hard budget constraints are often not effectively imposed on localities, the results are reversed however.[13] Redistribution under the central decision making dominates the decentralized decision making with regards to income distribution. When convergence across localities is targeted in the redistributive rule, however, redistribution under decentralized decision making also improves income distribution unambiguously, although not as much as under centralized decision making. Interestingly, and consistent with Bouton et al. (2008), improvements in income distribution under decentralization is inversely related with the size of redistribution.

The paper is organized as follows: In Section 2, we present the basic features of the model. Section 3 reports the redistributive outcomes of different fiscal schemes in a comparative way. Section 4 provides two main extensions to the base-line scenario and evaluates their results. Section 5 concludes.

2. The Model

The current model focuses on the analysis of public sector behavior, taking the decisions of private sector as given in a static framework. The economy consists of *n* local governments,

[12] In the absence of informational asymmetries, simulations do not allow a ranking between the FD^{Nash} and CG problems with respect to the total effort and the size of redistribution.

[13] Modifying the current model to explicitly incorporate the burden of spending in the FD problem is an interesting extension, although it adds further the current complexity of the model and makes the solution untractable. We consider that the component of the redistributive rule that punishes the less-than-full tax-collection effort serves towards the same purpose, however.

redistribution among which is made via the central government. The local governments take policy variables, such as the tax rate (t) set by the central government, as given exogenously. For the sake of simplicity, tax is assumed to be of one type: that on income. The income of each region is assumed to be exogenous.[14] Taxes are collected by the local governments whose efforts in tax collection may vary.[15] Each local government i (i=1….n) thus has an *effective tax rate* that is given by $t_i = tA_i$ where A_i is the tax collection effort. The portion (1-c) of tax revenues is spent by the local government, constituting part of its expenditures (G_i), where c is the proportion sent to the common revenue pool. In addition, local governments spend what is transferred back to them (TR_i) by the central government according to the announced rule of redistribution. Local government spending is the only form of government spending in a locality. The government spending in region i is therefore given by:

$$G_i = (1- c)t_iY_i + TR_i$$

where Y_i is the local income, which is commonly observed. For simplicity, localities are assumed to differ only in their income levels that are known ex-ante. Alternatively, localities can be assumed use the same technology while they differ in their ex-ante known levels of capital and labor. The level of private spending C_i is given by[16]:

$$C_i =(1- t_i)Y_i$$

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[14] Here, we assume that the levels, not the relative magnitudes of productive factors may vary across regions, indicating different output levels. A natural extension of this model is to introduce heterogeneity across regions in terms of output variability across regions and over time, by allowing not only the level of factor endowments across regions, but also their relative magnitudes to vary, suggesting different product types across regions, such as agricultural and industrial, an issue to be further explored in an extension of this paper.

[15] While income–tax is generally centrally collected, unless perhaps in federal systems, the local government's optimization decision regarding the tax collection effort can be justified on a couple of grounds: first, by helping monitor the economic activity subject to tax collection, local governments can be rewarded via some pre-announced incentive mechanisms, as this model proposes. Second, local government's effort to collect income tax entails recording or eliminating unrecorded economic activity and tax evasion, which helps improve the collection of other local taxes that are assumed away in this model for the purpose of simplicity.

[16] For the economy as a whole, total transfers are equal to common pool of revenues, leading one to obtain: $\Sigma Y_i = \Sigma(C_i+G_i)$. For a given locality, $C_i+G_i= Y_i$ +"net transfers", where "net transfers" are given by: (TR_i - ct_iY_i).

The total size of the transfers (TR) by the central government is equal to the sum of revenues collected in the common pool: $TR = c\Sigma t_i Y_i$, and other forms of financing do not exist. Given these basic features, the local and central government problems are presented in Parts 2.1 and 2.2, respectively.

2.1 Local Governments' Problem: The Case of Fiscal Decentralization

Under fiscal decentralization, two alternative scenarios are considered: i) no strategic interaction among the local governments (LGs) and ii) the Nash solution, where LGs' act strategically but non-cooperatively, denoted by FD and FD^{Nash} respectively. The FD^{Nash} scheme is relevant for the case of a few or highly polarized LGs that leads them to act strategically, thinking that others' decision significantly affect her own welfare. In both schemes, CG optimally selects the parameters of the redistributive rule for all possible values of local tax collection effort (see Appendix 2). Having observed this rule, the LGs optimally choose their effort. Sections 2.1.1 and 2.1.2 report the solutions of FD and FD^{Nash}.

2.1.1 *No Strategic Interaction among the LGs (FD):*

The procedure of FD is defined by an optimization problem where each of the many local governments (LGs) maximizes the utility obtained from its own jurisdiction, subject to a redistribution rule. We assume that (aggregate) budget deficit is not a concern of non-strategically acting local governments; hence, overall budget balance is not taken as a constraint. In this sense, FD problem is the case of numerous localities each of which receives a minimal share of the social cost of their own action, leading to a common pool problem. Each LG chooses its level of A_i, where $0<A_i\leq 1$, which stands for the effectiveness in tax

collection. For purposes of tractability, we use a Cobb-Douglass type of utility, in a log-linear form, defined over both private and public consumption:[17]

$$\max_{A_i} \quad \alpha \ln C_i + \beta \ln G_i \quad ; \quad where \;\; i = 1 \ldots n \tag{1}$$

$$subject\ to \quad TR_i = k\, t\, Y_i\, (A_i - 1) + m\, (Y_i^* - Y_i) \tag{2}$$

where i denotes each of the n local governmental units (regions) and C_i , G_i , TR_i , Y_i and Y_i^*. α and β represent the relative weights of private and government spending in utility. Equation (2) is the rule that gives the amount of transfers for locality i. Y_i^* is the exogenously given target of Y_i.[18] The problem indicates that the cost of increasing effort is the loss of private sector utility resulting from decreased disposable income. k and m denote the extent to which less than full tax collection effort (A_i -1) is punished and income deviation from a target is compensated, respectively. Hence, the redistributive rule accounts for both efficiency and equity objectives. While this rule is therefore desirable (see Ma, 1997), its implementation can be demanding, though not impossible.[19]

The solution of the LG problem can be written in terms of the optimum effort (A^o):[20]

$$A_i^o = \frac{-\alpha m(Y_i^* - Y_i) + Y_i(\beta - \beta c + k(t\alpha + \beta))}{tY_i(\alpha + \beta)(1 - c + k)} \tag{3}$$

The amount of total transfers implied by optimal tax effort A_i^o is given by:

$$TR = \sum_{i=1}^{n} TR_i = m(1 + \alpha k)(\sum_{i=1}^{n} Y_i^*) - \frac{(c-1)(m+kt)\alpha + (c-1-k)(m+k(t-1))\beta}{(c-1-k)(\alpha+\beta)}(\sum_{i=1}^{n} Y_i) \tag{4}$$

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[17] The assumed concavity and the increasing form of the utility function are to satisfy the necessary condition for the existence of a solution. Sufficiency conditions are also met.

[18] In an extension provided below, Y_i^*'s will be taken to be the same across localities.

[19] To measure the level of tax collection effort, regions with similar income levels can be taken into account to calculate a benchmark level of tax revenue.

[20] This is similar to the leader-follower type game because the simulations are conducted such that the interaction between LGs and the CG is achieved by matching the optimal A_i's resulting from the LG problem with those used as the feed values in the redistributive rule of the CG.

2.1.2. *Nash Solution to the LG Problem* (FD^{Nash})*:*

In case of a small number of LGs, each LGacts strategically, viewing that its transfers result from a common pool of revenues that is partially determined by the efforts of the rest of the LGs. The common pool of revenues is given by:

$$TR = \sum_i TR_i = c\, t \sum_i A_i Y_i \,, \quad \text{for i =1....n.} \tag{5}$$

Given the redistributive rule (2), the optimal level of effort by each LG_i (where j=1…n, and i≠j) thus depends on others' optimal efforts:

$$TR_i = TR - \sum_{j \neq i}^{n} TR_j = c\, t \sum_{i=1}^{n} A_i Y_i \text{ -}(\sum_{j \neq i}^{n} ktY_j (A_j - 1) + m(Y_j^* - Y_j)\,) \tag{6}$$

The optimization problem then yields:

$$A_i^o = \frac{(k-c)\alpha t A_j Y_j + \beta Y_i - \alpha kt Y_j + m\alpha (Y_j^* - Y_j)}{(\beta + \alpha) t Y_i}$$

Since each LG assumes that the others select their optimal efforts in the same fashion, the Nash equilibrium for A_i^o is given by:

$$A_i^{o-Nash} = \frac{((k-c)\alpha)(\beta Y_j - \alpha kt Y_i + m\alpha (Y_i^* - Y_i)) + (\alpha + \beta)(\beta Y_i - \alpha kt Y_j + m\alpha (Y_j^* - Y_j))}{((\beta + \alpha)^2 - ((k-c)\alpha)^2) t Y_i} \tag{7}$$

Although the FD process is likely to result in budget deficits, its costs are not fully internalized by local governments, where the LGs decide on their optimal effort levels regardless of the level of the overall budget. This is the classical case of the common pool problem. Given that the current model does not account for the cost of deficit financing, both FD^{Nash} and CG problems assume balanced-budget rule. FD^{Nash} hence offers a decentralization scheme that is appropriate to investigate the effects of the proposed redistributive rule in case some form of fiscal rule or specifically a hard budget constraint is implemented.

2.2 Central Government's Problem

As an alternative to the FD problem, the central government (CG) is assumed to be a benevolent planner who optimally chooses the level of transfers by maximizing the overall welfare of the society. In this case, LGs' efforts are taken as exogenous.[21] The only constraint of the problem is the equality between total transfers and the common pool of revenues:

$$\underset{TR_i}{Max} \qquad \sum_{i=1}^{n}[\alpha \ ln \ C_i + \beta \ ln \ G_i] \tag{8}$$

$$subject \ to \quad \sum_{i=1}^{n} TR_i = ct\sum_{i=1}^{n} A_i Y_i \tag{9}$$

The solution to this problem is:

$$TR_i = (t/n) \sum_{i=1}^{n} (A_i \ Y_i) - (1\text{-}c)t \ A_i Y_i \tag{10}$$

which implies that redistribution results in equal local government spending in each locality (G_i) that is to the average effective tax revenue.

3. Implications

In order to derive policy implications regarding the three fiscal schemes outlined above, we perform a comparative static analysis. The signs of the partial derivatives that are unambiguous are all in the expected directions: in case of CG's optimization, c, t, A_i and Y_i all have positive effects on total transfers. Under FD, the effect of the deviation of income from target on A_i and TR_i are negative and positive, respectively. In addition, in the FD^{Nash} problem, efforts of localities are positively correlated. Due to the complexity of the expressions, explicit signs for the rest of the partial derivatives could not be obtained. Using a reasonable

[21] To compare the optimal TR's of the CG with those of FD or $FD^{Nash.}$, we perform the simulations using the same level of efforts across the fiscal schemes; likewise, the same set of TRs are used to compare the implied effort levels for case of CG with those of FD or FD^{Nash}.

set of model variables and parameters, we perform a simulation analysis to obtain those signs. The results of all the comparative-statics are reportered in Appendix 1. The simulations also enable us to obtain a ranking of the alternative FD schemes and the CG problem *vis a vis* the optimal tax collection efforts and the sizes of redistributon.[22]

The following are the range of values for the model parameters[23] as well as for the exogenously given Y_i and Y_i^*. For tractability, we assume that there are two LG$_i$'s (i=1,2) the first of which is poor region and the second is rich.

$$\alpha = 0.7; \quad \beta = 0.3; \quad c = 0.1; \quad t \in [0.1\ ;\ 0.5]; \quad A_i \in (0\ ;\ 1];$$
$$Y_1 \in [100\ ;\ 500]; \quad Y_1^* \in [\ (1.01)Y_1\ ;\ (1.1)Y_1];$$
$$Y_2 \in [1{,}000\ ;\ 30{,}000]; \quad Y_2^* \in [\ (1.01)Y_2\ ;\ (1.1)Y_2]$$

To ensure that there exists some redistribution for income compensation (i.e. TR>0), simulations take into account the constraint that the total of targeted outputs exceeds the total of actual outputs.[24] Justifications for α =0.7 and β = 0.3 can be provided based on the relative shares of state and private sectors, respectively, which the chosen figures are thought to roughly represent. For c, we use 0.1, which is an approximate figure for the case of a large developing country.[25] The policy parameters k and m are obtained as optimal solutions to an

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[22] To compare the levels of total effort, total transfers are taken the same, and to compare the size of redistribution, the levels of effort are taken to be the same across the CG and FD problems.

[23] For the choice of t, related statistics and analytical studies provide some basis: in a study of marginal income taxes, Easterly and Rebelo (1992) report that (income weighted) the rate range from as low as 0.01 (for example, Argentina and Guatemala) to 0.37 (Ireland) in the sample they considered. The "effective" tax rate, however, is lower due to exemptions, deductions and tax evasion. The effective tax rates (on labor and capital) calculated for a list of developed countries (Mendoza et al, 1994) ranged between 0.25 and 0.50 during the 1990s. Mendoza et al (1994) also report that the average tax rates are also similar for the G-7. Wolff (2005) extend the sample of Mendoza et al. to EU-25 and report lower effective capital taxes, which average less than 0.2, than labor tax, which average between 0.4 to 0.5. On the other hand, tax to GDP ratios to express the "overall tax burden" in the economy (as suggested by Wolff, 2005) and the average ratio is 0.11 for the less developed countries and 0.15 for the developed countries in the past decade. However, "overall tax burden" is only a very crude measure of average tax rate. Hence, for LDCs, as well as for the world average, one can take t to be: $0.1< t <0.5$.

[24] The income levels can be considered to be in per capita Dollar terms.

[25] The county is Turkey, which, for the lack of more knowledge regarding "c", can be considered as a representative case without loss of generality.

alternative CG problem reported in Appendix 2, where CG chooses them to maximize the overall utility given the general budget constraint.

LGs optimally select their level of tax effort given that they are informed about the redistributive rule set by CG; hence simulations are performed based on such optimal A_i's that match with the feed values used to calculate the optimal set of k and m pairs. As a result, optimal A_i pairs and the implied TR_i's are simulated (using Matlab) for the FD and FD^{Nash} procedures.[26] To be able to compare the level of transfers across the three fiscal regimes for each optimal k and m pair, we use the same set of optimal A_i pairs to calculate the optimal TR_i's for the CG problem. Next, to be able to compare the implied levels of fiscal discipline measured by the effort level under the FD and CG procedures, we take the optimal TR_i's simulated for the two alternative FD regimes and find the implied sum of A_i' s under the CG regime.

Based on he signs of the partial derivatives reported in Appendix 1, the following observations can be noted. Under FD^{Nash}, an increase in the tax rate (t) leads to an increased competition among the LGs over a greater size of redistribution (to compensate for the lower utility derived from private consumption), which has a positive effect on the level of tax effort. In this case, the redistribution rule seems to generate incentives compatible with the main fiscal policy instrument, t, as the downward portion of the Laffer curve seems to be eliminated. Under FD, however, the effect of t the tax effort is indeterminate.

Increasing the central government's share in local tax revenues (c) also leads to greater tax effort and transfers under FD^{Nash} because each LG increases its tax effort in expectation of a greater common pool. The reverse occurs under FD, however, where an increase in c implies lower tax effort and transfers; when LGs behave non-strategically, they try to

[26] The numbers of optimal k and m pairs (reported in Appendix 2) corresponding to the optimal and feed A_i's that are matching, non-negative and ranging between 0 and 1 are 19355 and 5507 for the FD and FD^{Nash} procedures, respectively.

compensate for the utility loss arising from a decrease in G_i, which decreases in c, by increasing the utility from private consumption that is negatively related with the effort level.

> **Proposition 1:** Both increasing the tax rate (t) and the extent of centralization of the tax revenues (c) leads to an increase in fiscal discipline and the size of transfers under FD^{Nash}.

The higher the weight on public consumption in the utility function (β) the lower is the tax effort and redistribution under FD^{Nash}. This is because local governments can afford to forego some transfers via increased punishment in return of additional utility received from private consumption, which increases as optimal tax effort declines. This result arises since each LG acts in consideration of a smaller common pool of revenues given that $(\partial A_i / \partial A_j) > 0$.[27] When LGs do not act strategically, however, this effect is not observed: an increase in β leads them to increase their effort in order to generate more spending for themselves, which also results in a larger common pool.

The higher the weight on private spending in the utility function (α), the higher is the tax effort under FD^{Nash}, which negatively affects the after tax income that in turn leads to lower private spending. This seemingly counterintuitive result can be explained by the income effect of an increase in α exceeding the substitution effect. Income effect arises in the form of increasing the effort, because LG can obtain the same utility with a lower private income than before. Meanwhile, the increase in the effort increases LG's utility through the public spending channel as transfers increase due to reduced punishment. Substitution effect, on the other hand, would lead LG's effort to decrease so as to increase private consumption in order

[27] The condition is $k>c$, which is met in the simulations. While increasing own tax collection effort increases the transfers received by a region, increased tax collection effort of the other region leads to reduced transfers.

to take advantage of its increased weight in utility. This complementarity between the extent of privatization of an economy and increased fiscal discipline under FD can be viewed as a challenge to Tanzi (2000) who argues FD to be a substitute for privatization. In case of FD without strategic behavior, the effects of α on both tax effort and transfers are indeterminate.

> **Proposition 2**: When local governments act strategically, the proposed redistributive mechanism leads to greater fiscal discipline under fiscal decentralization the more privatized the economy.

The positive effect of the punishment parameter (k) has the expected positive effect on the level of effort under both FD and FD^{Nash}. Transfers to the poor region are similarly affected under FD, although the effect of k on transfers is indeterminate under FD^{Nash}. The effect of the income compensation parameter (m) on tax effort is negative under both FD and FD^{Nash}. Hence, while the punishment component of the redistributive mechanism indeed works as a fiscal disciplining device, the income compensation component leads to a moral hazard problem. While m also affects the size of transfers negatively under FD^{Nash}, this effect is positive under FD; the moral hazard under FD is not sufficient to reduce the size of redistribution needed for income compensation.

> **Proposition 3**: The higher is the deviation of income from the target, the greater are transfers extended for the purpose of income compensation; under both FD and FD^{Nash}, however, this reduces the incentives for tax collection (*moral hazard*).

To investigate the fiscal disciplinary effects of the alterative fiscal schemes, we next compare the implied level of total tax efforts and size of transfers. Based on a common set of

k and m values, which also corresponds to the same set of A_i's for the FD$^{\text{Nash}}$ and CG models,[28] simulations yield the following ordering for total levels of effort and redistribution for the case of non-positive budget deficits:

$$\sum_i A_i^{FD} \quad > \quad \sum_i A_i^{FD-Nash} \; (= \sum_i A_i^{CG})$$

$$\sum_i TR_i^{FD} \; < \; \sum_i TR_i^{FD-Nash} \; (= \sum_i TR_i^{CG})$$

These results indicate that FD leads to larger total tax effort and smaller size of redistribution than CG, and under FD$^{\text{Nash}}$, in case LGs face hard budget constraints. The findings are reversed in case of positive budget deficits under FD. This is a straightforward implication of the common pool problem: FD reduces fiscal discipline when externalities are not sufficiently internalized; in this case, since FD$^{\text{Nash}}$ problem takes the balanced budget rule (the case of) as a constraint, it yields higher fiscal discipline than FD.

> **Proposition 4:** FD) leads to greater fiscal discipline than both FD$^{\text{Nash}}$ and CG in terms of higher tax collection effort. In case hard budget constraints are not imposed, however, both the size of redistribution is greater and tax effort is lower under FD than under FD$^{\text{Nash}}$ (and CG).[29]

4. Extensions

This section investigates two extensions of the above benchmark scenario of full information. Section 4.1 reports the effects of choosing equal income targets across localities in the

[28] The equality between FD$^{\text{Nash}}$ and CG arises from the fact that the budget constraint is common in the two problems.

[29] The current results are conjectured to remain when the costs of financing deficits are not fully internalized by a large number of small local governments.

redistributive rule. Section 4.2 reports the effects of local income shocks that the CG observes indirectly, through the remitted revenues. Section 4.3 reports the equity impact of redistribution under all fiscal scenarios and informational assumptions.

4.1 Equalization of Incomes across Localities

Eliminating horizontal imbalances is one of the main objectives of redistribution. Hence, this section focuses the implications of the FD, FD^{Nash} and CG schemes in case target incomes of different localities are chosen to be the same. This extension also addresses the question of whether the above results are an artifact of a particular set of income levels.

To examine this case, we choose the levels of incomes to be closer in range and income targets across localities to be the same:

$$t \in [0.1 ; 0.5]; \quad Y_1 \in [100 ; 1000] ; \quad Y_2 \in [2{,}000 ; 10{,}000]; \quad Y_i^* \in [(1.01)\mathrm{Y}_2 ; (1.1)\mathrm{Y}_2]$$

The corresponding set of (positive) k and m values that produce feasible data points (A_i values ranging between zero and one) are 39030 for the case of FD. As noted earlier, these set of simulations also indicate greater total tax effort (and smaller size of redistribution) under FD as compared to the CG problem, when the LGs face a hard budget constraint. As in the former case, FD^{Nash} and CG problems produce the same set outcomes due to the common budget-balance constraint, implying that the strategic behavior of local governments competing for a common pool produces inferior fiscal results (in terms of discipline), as compared to non-strategic ones, in case the concern for equity is integrated into fiscal policy.

Comparative statics of the both CG and FD problems based on the above range of parameter values differ in a few respects from the formerly reported ones, however. First, the formerly observed ambiguous effects of both t and α on both the level of tax effort and the size of transfers are now negative. This indicates that when the redistributive rule is adopted along with an equalization target, increasing taxes have a negative effect on fiscal discipline under FD, as viewed on the right side of the Laffer curve. Second, k has a negative effect on TR in case of FD. These results are in contrast with the findings under FD^{Nash}, the results for which are equal to those of CG, as before, due to the common budget constraint. The rest of the comparative statics yields the same signs as before, which reinforces the validity of those findings.

In a study of German fiscal system, Von Hagen and Hepp (2000) suggest that equalization across localities leads to adverse incentives for tax collection. Our findings indicate that, under the fiscal rule that is proposed in this paper, such adverse incentives may arise only in the case of soft budget constraints. Alternatively, the negative effect of privatization on fiscal discipline under equalization support the von Hagen and Hepp argument.

Proposition 5: Adoption of an equalization target along with the proposed redistributive rule renders tax increases and privatization ineffective tools of fiscal discipline.

4.2 Shocks and Asymmetric Information

So far, the model assumed that there is no uncertainty regarding the realizations of local incomes. To make the model more realistic, we consider a case where idiosyncratic shocks hitting local economies are observed perfectly by the local governments, but not by the central government. This conforms with the basic philosophy of decentralization since, as Sanguinetti and Tomassi states, "...*the whole debate over the virtues of decentralization would be a non-issue if asymmetric information was not important, since in that case a centralized system would dominate all alternative arrangements*."

When CG receives the portion of local taxes: $[(ctA_iY_i)(1+\varepsilon_i)]$, where ε_i can be positive or negative, it is not able to distinguish whether the increase or decrease in tax collection is due to a change in the local tax effort or to a shock to the income level.[30] Considering that $(1+\varepsilon_i)$ may originate from either one, CG uses the following redistributive rule:

$$TR_i = k\, t\, Y_i \sqrt{1+\varepsilon_i}\,(A_i \sqrt{1+\varepsilon_i} - 1) + m(Y_i^* - Y_i\sqrt{1+\varepsilon_i}) \qquad (11)$$

While each LG observes its own shock, it also conjectures that the CG will apply the above redistributive rule. As a result of this asymmetry, despite the fact that both CG and FD^{Nash} use the balanced budget rule, transfers and the implied effort levels differ between these two fiscal schemes also, which is contrary to the former set up where all governments had full information.

Simulations of the model are carried out assuming that the shock term follows a normal distribution. The simulations are analyzed separately for the set of positive and negative shocks that are of the magnitude of within 50 percent of the income level, that is $\varepsilon_1 \in (-0.5\ ;\ 0.5)Y_1$. The positive or negative shocks may hit either the poor or rich localities, under which the results do not differ, although one may consider that shocks to the poor locality are more likely to occur since poor regions are more often than not associated with the traditional sector that is prone to the climatic changes.[31]

Simulations under asymmetric information enable the comparison of the outcomes of FD^{Nash} and CG problems because. It is observed that both FD and FD^{Nash} generate better

[30] This is unlike the extreme cases of full or no insurance cases handled in Sanguinetti and Tomassi (2004).
[31] For the case of shocks hitting the poor locality, the usable number of observations obtained in case of FD and FD^{Nash} problems are 2215 and 6683 for the case of positive shock and 26733 and 33821 for the case of negative shock. Under the scenario of equalization, the respective data points are 39030**,** 27158, 38891 and 4261.

outcomes than both CG when LGs face hard budget constraints.[32] These findings can be summarized as follows:

$$\sum_i A_{i,LG} > \sum_i A_{i,CG} \;\; ; \text{ and } \;\; \sum_i A_{i,LG}^{Nash} > \sum_i A_{i,CG}$$

$$\sum_i TR_{i,LG} < \sum_i TR_{i,CG} \;\; ; \text{ and } \;\; \sum_i TR_{i,LG}^{Nash} < \sum_i TR_{i,CG}$$

These findings are robust across the sign of the shocks and the size of locality; the presence of equal income targets also does not affect the result.

4.3 Income Distribution Effects of Transfers under Alternative Fiscal Schemes

To evaluate the income distribution effects of the alternative fiscal schemes, we compare the pre-transfer income ratios of the localities with those after redistribution takes place. When $(Y_1/Y_2)/[(Y_1+TR_1)/(Y_2+TR_2)]$ is less than 1 (given that locality 1 is the lower income locality), redistribution is said to improve income distribution.

Simulations indicate that CG problem always yields better income distribution than the two FD regimes (except under full information where CG and FD^{Nash} are not distinguished from each other). Moreover, it is observed that income distribution may even worsen under FD or FD^{Nash} unless the equalization objective is imposed via equal income target ranges in the redistributive rule. Under the equalization scenario, however, even though income distribution improves under all the fiscal scenarios, centralized redistribution leads to greater equality than both of the FD regimes. Hence, the proposed redistributive rule works as an insurance against local shocks -- by not-worsening income distribution in case of a negative

[32] The fact that the source of the shocks is not identified by the government makes the optimal choices of the CG and FD^{Nash} different from each other. For the same reason, the budget constraint may not be met in the case of FD^{Nash}.

shock, only when the rule is combined with the objective of equalization (or convergence) across localities.

Proposition 6: Alternative fiscal institutional schemes differ in the welfare gains they yield; while CG delivers higher equity than FD (and FD^{Nash}), decentralization is superior with regards to the efficiency criterion under hard budget constraints (HBC). In case local governments face no HBC, then decentralization leads to welfare losses (both in terms of efficiency and equity).

Bouton et al. (2008) demonstrate theoretically and empirically that income distribution under FD worsens in vertical imbalances, or the size of transfers. Our findings show, however, that when the redistributive rule involves the target of convergence among local incomes, redistribution under both FD and FD^{Nash} improves income distribution, though not as much as under CG, while CG has a greater size of transfers.

5. Conclusions

This paper presents a model to analyze the efficiency and equity implications of fiscal decentralization. Fiscal decentralization is defined as the local governments' decision on their tax collection effort given the redistributive rule announced and implemented by the central government. Local governments may or may not act strategically, providing two alternative scenarios of fiscal decentralization. The transfer mechanism entails both income compensation and punishment of insufficient tax collection effort.

The main policy implications of the proposed fiscal institutional design are that i. FD has a fiscal disciplining effect because, given hard budget constraints, it yields greater efficiency (both higher total tax collection effort and lower size of redistribution) than in the case of the CG problem; when it is not, CG is more efficient. ii. The extent of privatization of the economy improves the fiscal disciplining role of FD only when local governments act strategically (FD^{Nash}). iii. Redistribution under CG leads to better income distribution than both FD and FD^{Nash}, indicating a trade-off between the objectives of efficiency and equity. Furthermore, an increase in the tax rate is observed to increase both the size of transfers and the level of tax effort in case of FD^{Nash}.

Further modifications of the model will be made by endogenizing the local output to targeted transfers and thus to local tax collection effort. Using these targeted transfers in the form of local capital accumulation necessitates a major modification that involves a dynamic solution.

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Appendix 1: Comparative Statics

Comparative statics for the unambiguous results (for $i,j=1,2$; 1 is the poor region)

FD Problem: $\partial A_i / \partial(Y_i^* - Y_i) < 0$; $\partial TR_i / \partial(Y_i^* - Y_i) > 0$

FD-Nash Problem: $\partial A_i^o / \partial A_j^0 > 0$, if $k>c$

CG Problem: $\partial TR/\partial c>0$; $\partial TR/\partial n>0$; $\partial TR/\partial t>0$; $\partial TR/\partial A_i > 0$;

$\partial TR/\partial Y_i > 0$

Simulation of the Ambiguous Comparative Statics Results -- for the LG problem:

- *Nash Solution:*

$\partial A_i^o/\partial\alpha > 0$; $\partial A_1^o / \partial\beta < 0$; $\partial A_2^o / \partial\beta = 0$; $\partial A^0{}_i/\partial k > 0$; $\partial A_i^o/\partial m < 0$;

$\partial A_i^o/\partial c > 0$; $\partial A_i^o/\partial t > 0$; $\partial A_i^o/\partial A^0{}_j > 0$ (for $k>c$); $\partial A_i^o/\partial(Y_i^* - Y_i) < 0$;

$\partial TR_i /\partial A_i > 0$; $\partial TR_i /\partial A_j < 0$; $\partial TR /\partial A_i < 0$.

$\partial TR/\partial\alpha>0$; $\partial TR/\partial\beta<0$; $\partial TR/\partial c>0$; $\partial TR/\partial t>0$; $\partial TR/\partial m<0$; $\partial TR/\partial k>0$;

$\partial TR/\partial(Y_i^* - Y_i)>0$.

Same results are obtained for individual transfers: TR_i, except for $\partial TR_2/\partial k$ *which is indeterminate.*

Non-Strategic Solution:

$\partial A_i^o/\partial\alpha = ?$; $\partial A_i^o/\partial\beta > 0$; $\partial A_i^o/\partial k > 0$; $\partial A_i^o/\partial m < 0$; $\partial A_i^o/\partial c < 0$; $\partial A_i^o/\partial t = ?$;

$\partial TR/\partial\alpha = ?$; $\partial TR/\partial\beta>0$; $\partial TR/\partial c<0$; $\partial TR/\partial t = ?$; $\partial TR/\partial m>0$; $\partial TR/\partial k>0$;

$\partial TR_i /\partial A_i > 0$; $\partial TR/\partial(Y_i^* - Y_i)>0$

The same results are obtained for individual transfers: TR_i

The above results are also summarized in Table 1 below (for $i=1,2$).

Table 1: Comparative Statics of TR, TR_i and A_i.

	α	β	c	m	k	t	A_1	A_2	$(Y_i^*-Y_i)$
LG PROBLEM:									
Strategic Solution:									
A_1	+	-	+	-	+	+	na	+	-
A_2	+	-	+	-	+	+	+	na	-
TR_1	+	-	+	-	+	+	+	-	+
TR_2	+	-	+	-	?	+	-	+	+
TR	+	-	+	-	+	+	-	-	+
Non-Strategic Solution:									
A_1	?	+	-	-	+	?	na	na	-
A_2	?	+	-	-	+	?	na	na	-
TR_1	?	+	-	+	+	?	+	+	+
TR_2	?	+	-	+	+	?	+	+	+
TR	?	+	-	+	+	?	+	+	+
CG PROBLEM:									
TR	na	na	+	na	na	+	+	+	na
TR_1	na	na	+	na	na	na	na	na	na
TR_2	na	na	+	na	na	na	na	na	na

Appendix 2: Optimal choice of *k* and *m*

For the LG problem, it is essential to know how the central government will redistribute a common pool of revenues; i.e. the set of punishment and equalization parameters corresponding to each pair (since n=2 of potential effort levels pertaining to the localities. Hence, parameters k and m are determined optimally by the CG as a solution to the problem, where CG maximizes the sum of utilities of all localities subject to the condition that the total pool of revenues is equal to the total transfers that is now expressed via the redistributive rule:

$$\max_{k,m} \sum_{i=1}^{n} \alpha \ln C_i + \beta \ln G_i$$

$$s.to \quad ct \sum_{i=1}^{n} (A_i Y_i) = \sum_{i=1}^{n} (ktY_i(A_i - 1) + m(Y_i^* - Y_i))$$

Taking the effort of each locality to range between zero and one, the optimization problem is solved for k and m.[33] The values of TR simulated for this problem are the same as the one obtained under the CG problem reported in Section 2.2 due to the left hand side of the constraint.

[33] The comparative-statics simulations of the optimal k and m yield the following results. c affects k one to one, while its effect on m is always positive; m increases in both c and t. Both optimal k and m decrease with the effort of the locality with relatively smaller income. While the impact of a larger income locality's effort is positive on the k, its impact on m is ambiguous.