Does Fiscal Decentralization Promote Fiscal Discipline?

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Key terms: Fiscal Decentralization, Fiscal Discipline, Redistribution
JEL Classifications: E62, H20, H71, H77

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1. Introduction

Fiscal decentralization (FD) is viewed as an institutional mechanism defined by the leading status of local governments over the central government in taking fiscal decisions and/or actions. This paper develops a model to address the relationship between FD and fiscal discipline, which is a public good that the government needs to deliver. We consider two aspects of fiscal discipline: the aggregate tax collection effort and the size of redistribution.

In many countries, local governments mainly depend on the transfers received from the central government for their fiscal activity. The need for transfers arises due to both vertical and horizontal imbalances. *Vertical imbalances* that result from the greater capacity of central governments in collecting revenues than local government are common.[2] So are the horizontal imbalances that result from the varying fiscal capacities across the different regions of a country. Notwithstanding these imbalances, local governments' reliance on central government may also arise from the lack of tax collection effort by local governments. Lack of local tax collection effort is a form of moral hazard and thus can be viewed as a measure of fiscal indiscipline. An increase in local tax collection effort, on the other hand, is expected to increase the size of redistribution that in turn may, if prudently managed, be used to eliminate vertical and horizontal imbalances, which would constitute a second channel to contribute to fiscal discipline.

Since both fiscal imprudence and income inequality have significant welfare implications, it is desirable that a redistributive mechanism bears the characteristics of both

[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 especially many developed countries often have less *vertical imbalances* due to federal systems (nonetheless, in Canada, Switzerland, US and Germany, for example, central government transfers still constitute 50% to 70% of local government budgets), developing countries have often much higher vertical imbalances (while 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%). See Neyapti (2005) for further discussion.

disciplining local governments while eliminating horizontal imbalances.[3] This study employs such a redistributive mechanism in a framework to analyze the role of FD on fiscal discipline.[4]

The motivation for this study stems from the review of empirical studies on the macroeconomic implications of FD that reveals a gap in the literature. While there is a growing literature on the socio-economic consequences of FD[5], which provides mixed evidence on the merits of FD, only a few studies have looked at the macroeconomic consequences of FD.[6] Among them, Neyapti (2003 and 2008) shows that especially in largely populated countries, which are likely to be associated with large degrees of heterogeneity, FD is associated with lower budget deficits. The study also indicates that higher degrees of revenue decentralization (RD) are associated with lower deficits in case of greater ethnolinguistic fractionalization. Neyapti (2004 and 2006) shows that RD is associated with better inflation and income distribution outcomes the more improved the governance. It should hence be noted that the evidence provides no support for FD to be effective in

[3] Although equality across regions is desirable from the perspective of a benevolent planner, it should be noted that it may also have costs either in the form of restricting investment opportunities in the relatively wealthier regions, which could yield positive spill-over effects in the long-run, or for those in favor of status-quo.
[4] Ma (1997) reports the characteristics of four classifications of fiscal transfer systems. In some countries (for example, 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). The first method is the most advanced one in that it addresses both vertical and horizontal inequalities in the most effective way. In terms of data requirements, however, it is also the most demanding one.
[5] Among them are: Bradhan 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).
[6] Those are Davoodi and Zou, 1998, King and Ma, 2001, Jin and Zou, 2002, Neyapti, 2004, Martinez-Vazquez and McNab, 2003 and Neyapti, 2004, 2003 and 2006.

attaining fiscal discipline without the support of appropriate structural characteristics and institutional structures.[7]

Also motivated by the question of the relationship between FD and fiscal discipline, Sanguinetti and Tomassi (2004) use a game theoretic framework to investigate the efficiency of rule-based versus discretionary fiscal transfers. The authors consider transfers as partial insurance against local shocks across regions under asymmetric information. Welfare comparisons reveal that while discretionary financing is more preferable in the event of large local shocks, rule-based transfers are preferred in case of high levels of fiscal decentralization. Stowhase and Traxler (2005) model fiscal competition under the scenario of sharing tax enforcement costs across regions, where, similar to the current paper, tax effort (in their case the rate of auditing local tax collection) becomes the strategic tool of the regions. The analysis reveals that fiscal equalization scheme, based on net revenue sharing, helps to internalize fiscal externalities. The authors concede, however, that the feasibility of the redistributive mechanism they suggest to improve the efficiency in tax collection is questionable due to informational asymmetries.[8]

The current paper investigates the implications for fiscal discipline of two alternative schemes of redistribution. First, given a pre-announced redistributive mechanism, local governments optimally select their tax collection efforts, which we call as the fiscal decentralization (FD) outcome. We argue that the degree of effort spent in tax collection also indicates the degree of efficiency of local fiscal activity in general. Supposing that taxes are optimally determined for the society, less than full tax collection effort of a local government,

[7] Here, the relevant institutions are local elections, central bank independence and governance measures.

[8] As in the current model, the authors consider a fixed statutory tax rate. Their model is based on internalizing the costs of tax auditing, which is argued to be practically problematic as it poses problems of measurement. The current paper approaches to inefficiency in public good provision from a more practical perspective that is in terms of deviation from revenue capacity (target revenue), which can be computed as product of average tax and tax base. Though the redistributive mechanism suggested in this paper resembles that of Stowhase and Traxler (2005)'s net revenue sharing, the current paper also considers the equalization aspect of redistribution.

given its capacity of tax collection, reflects a moral hazard problem, which is a transaction cost and indicates economic inefficiency. Since all local governments benefit from spending, such costs may arise in case of either informational aysmmetries between the central and local governments or inadequate incentive mechanisms faced by the local governments that result in an unfair redistribution of a common pool. In the second scheme, the central government (CG) decides on the level of transfers, without pre-announcing a redistribution rule. We consider that total tax collection effort and the size of transfers constitute significant aspects of fiscal discipline.[9]

The basic features of the model are as follows. A common income tax rate is announced by the central government, to be collected by the local governments. The proportion of local tax revenues to be collected in a general pool is also announced by the central government.[10] The pre-announced redistributive rule is composed of both the punishment of less than full tax collection effort and; income compensation, for the deviation of income of each locality from a target level.[11] We consider two problem settings for the local governments (LGs): one with and one without strategic interaction labeled as FD, FD^{Nash} respectively, in each of the cases localities optimally selecting their tax collection effort.[12] The comparison of the outcomes of FD, FD^{Nash} and the CG problems with regards to the

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[9] The comparison of central and local government decisions is similarly done in both Boadway at al (2001) and ST.

[10] Existing studies that investigate the redistributive role of the government are usually fit in the optimal tax literature that emphasizes 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 with a focus on migration across regions.

[11] One may consider punishment as a second type of tax that the central government imposes on local governments in case of insufficient tax effort. The scheme mainly draws on Neyapti (2005) who suggests that horizontal imbalances can be eliminated by estimating both expenditure needs and collection capacities of the localities on the basis of various socio-economic indicators; accordingly a pool of resources can be allocated across localities. An additional mechanism, called the *dynamic correction factor* that is based on performance indicators of the local gocernment, can be utilized to avoiding the moral hazard.

[12] FD^{Nash} corresponds to a case where each LG thinks that others' actions will affect its own welfare whereas FD may be in case of many small local governments, each of which does not have any significant effect on the rest.

overall tax collection effort and the size of redistribution leads to policy advice with regards to the design of fiscal institutions.

Simulation analyses of the model results reveal that under the proposed redistributive rule, FD achieves greater fiscal discipline under no strategic behavior among the LGs, implied by a greater total tax collection effort than the alternative procedure. Nonetheless, the size of the redistribution is also higher in the case of FD. From the perspective of fiscal discipline, non-cooperative strategic interaction among the LGs (FD^{Nash}) leads to the same set of outcomes as for the CG problem, which is due to fully internalized externalities in both of these cases.[13]

Some of the additional policy implications of the paper are as follows. First, the greater the extent of privatization of the economy, the greater the fiscal discipline associated with FD. Second, the greater the competition among the localities, the more beneficial the centralization of the revenues. Third, the greater the competition among the localities, the higher the moral hazard due to both higher income compensation component of redistribution and the higher the share of utility due to public spending. Forth, an increase in the tax rate increases both the size of transfers and the level of effort. Finally, an increased punishment for insufficient tax effort only reduces transfers to the richer region under the strategic behavior of the LGs.

The issue addressed by the current model is rich of potential extensions that call for further research. In one such extension, the government aims to equalize income levels across regions by imposing equal income targets in the redistribution rule. The simulations of the

[13] The implication of the current model for *fiscal-illusion* would be interesting to explore, though this requires modification of the current model to explicitly incorporate the burden of spending in the FD problem. Fiscal illusion, also referred to as the common pool problem, arises since localities internalize only a part of the fiscal burden while they get the whole benefit of spending. In the current model, fiscal illusion can be said to occur if FD leads to lower fiscal discipline. Given that the current model employs a redistributive rule with a punishment component that already acts as a mechanism to internalize the burden of low tax effort, however, FD may not be expected to be associated with fiscal illusion.

model outcomes with this alternative parametrization provide support for the above reported findings, indicating that the findings are not an artifact of particular choice of parameter values. The rest of the paper is organized as follows: In Part 2, we present the basic features of the model. Part 3 reports the redistributive outcomes of the different fiscal procedures in a comparative way, where the model is simulated. Part 4 concludes.

2. The Model

Tax rate (t) is given exogenously by the central government. For the purpose of simplicity, we assume it to be of one type: that on income, which is exogenously given by the endowments of productive factors in each region that are all subject to the same production function.[14] Taxes are collected by the local governments whose tax collection efforts vary across localities.[15] Each local government *i* has an *effective tax rate* (t_i) which is the product of their effort (A_i) and t (i.e. $t_i = t.A_i$). The portion *(1-c)* of these revenues is spent by the local government, constituting part of its expenditures (G_i), while a "*c*" proportion is 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:

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

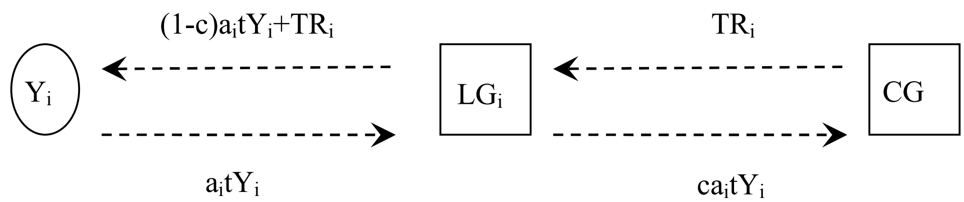
[14] Here, we assume that the levels, not the relative magnitudes of productive factors may vary across regions, indicating different output levels. A natural extension of this model is to introduce heterogeneity across regions in terms of output variability across regions and over time, by allowing 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 explained later.

[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 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.

where Y_i is the local income produced, and; the level of private spending C_i is given by[16]:

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

The total size of the transfers (*TR*) made by the central government is the sum of revenues collected in the common pool: $TR = c\Sigma\, t_iY_i$, as other forms of financing do not exist. Hence, the underlying transactions of the model can be depicted as follows:



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 (FD)

Under FD, two cases are considered: no strategic interaction among the local governments (LGs); and the Nash solution, that is strategic but non-cooperative behavior of the LGs. The two alternative fiscal decision processes are labeled as FD and FD^{Nash}. FD^{Nash} scheme is relevant especially for the case of a small number of LGs and/or polarization among LGs that lead LGs to consider others' decision to significantly affect its own welfare. Acting strategically may otherwise simply not pay off. Sections 2.1.1 and 2.1.2. report the respective solutions of FD and FD^{Nash}.

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

[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, $Y_i = C_i+G_i+$ "net transfers", where "net transfers" are given by*:* $(TR_i - ct_iY_i)$.

The procedure of FD is identified by an optimization problem where the local government (LG) maximizes its utility subject to a redistribution rule. Due to the non-strategic nature of the problem, LGs are assumed to be identical to each other. Each LG chooses the level of *tax collection effort* A_i (where $0<A_i\leq 1$ since if $A_i=0$).[17] Effectiveness in tax collection, measured by A_i, is also considered to reflect the ability of local government to attain efficiency in public good provision.

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

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

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

where i denotes each of the n local governmental units (regions) and C_i , G_i , TR_i , Y_i and Y_i^* are all expressed in per capita terms. α and β are parameters representing the relative weights of private and government spending in utility (such that $[\alpha+\beta]=1$). Equation (2) is the rule for determining the amount of transfers for locality i (supposing that $A_i \neq 0$). Y_i^* is some exogenously given target of Y_i.[18] k and m are the parameters that stand for the extent that less than full tax collection effort $(A_i - 1)$ is punished; and income deviation from a target is compensated, respectively. Hence, the redistributive rule enables us to address both

[17] Alternatively, one can think of a case where each local government takes as burden a share of overall size of redistribution ($\sum TR_i$). This case can be analyzed by adding this new argument (with the negative sign) to the objective functions. The solution of this problem, however, turns out to be rather complicated , whose results are therefore not currently available.

[18] We take the total of income deviations from target levels to be negative so that there will be some redistribution for the purpose of income compensation, even if all regions spend full tax effort. This target level can be thought of as the average income. However, when explicitly modeled, this leads to the result of non-positive total transfers, which we do not desire to obtain in the current model that is set up to investigate the problem of redistribution.

efficiency and equity objectives, as in an extension we take Y_i^* 's to be the same across localities.[19]

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

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

which results in the optimal total transfers *(TR)* of:

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

2.1.2. *Nash Solution to the LG Problem* (FD[Nash])*:*

Here, it is considered that each LG views its transfers to 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:

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

Given the redistributive rule (2), the optimal level of effort by each LG_i (where $i \neq j$) thus depends on the others' optimal efforts:

$$TR_i = TR - \sum_j TR_j = c\, t \sum_i A_i Y_i - \sum_j ktY_j(A_j - 1) + m(Y_j^* - Y_j)$$

The optimization problem then yields:

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

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

[19] In a survey of nine developed countries, Ma (1997) reports fiscal rules in practice that focus on either efficiency or equity objectives or both. The most advanced approach is to focus on both objectives, as is practiced in countries such as Australia, Germany, Japan, Korea and UK.

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

2.2 Central Government's Problem:

The central government (CG) is assumed to be benevolent and chooses the level of transfers that maximizes the overall welfare of the society subject to the constraint that indicates that transfers are equal to the revenues collected in the common pool[20]:

$$\max_{TR_i} \sum_{i=1}^{n} [\alpha \ln C_i + \beta \ln G_i] \qquad (5)$$

$$\text{subject to} \quad \sum_{i=1}^{n} TR_i = ct \sum_{i=1}^{n} A_i Y_i \qquad (6)$$

The solution to the problem is:

$$TR_i = (t/n) \sum_{i=1}^{n} (A_i\, Y_i) - (1-c)t\, A_i Y_i \qquad (7)$$

which implies that redistribution is made in such a way that local government spending in each locality is equal to the average effective tax revenue across the regions.

Based on the above solutions, we next provide the comparative statics of *TR* and TR_i's for each of the above procedures, and of A_i's for the FD procedure. This enables us to investigate the differences resulting from the two procedures. Part 3 reports these results.

3. Implications

In order to derive policy implications regarding the fiscal institutions as defined in the current study, we perform a comparative static analysis. Since the signs of some of the derivatives can not be explicitly obtained for many model parameters, we also perform a

[20] This way, this paper chooses not to address the financing issue, which is planned to be one of the future extensions of the current model.

simulation analysis assuming values for α, β, k, m, t, c, Y_i and Y_i^* (where i=1,2) within reasonable levels or intervals. Next, we compare the total optimal tax collection efforts resulting from the alternative FD and the CG problems. Likewise, we compare the alternative fiscal procedures with regards to the implied sizes of redistribution. Section 3.1 first reports the unambiguous results of the comparative statics and in subsection 3.1.1 the simulation results for ambiguous results are reported. Section 3.2 compares the redistributive and disciplining aspects of the two procedures.

3.1. Comparative Statics

This section reports the partial derivatives of the individual and total transfers obtained as solutions to the alternative fiscal procedures, and of the optimal efforts resulting from the two alternative FD schemes. Only some of these partial derivatives are unambiguous, however, necessitating a simulation analysis for the interpretation of the ambiguous results, which are reported in subsection 3.1.1. Appendix 1 reports all the comparative statics results.

The unambiguous results yield signs in the expected directions: in case of central governments' optimization, we observe that c, t, A_i and Y_i all have positive effects on total transfers. Under the FD problem the effect of income deviation on both the level of effort and transfers are negative and positive, respectively. All the remaining partial effects are ambiguous, and are reported as simulation results in the next subsection.

Proposition 1: When transfers are centrally decided, the higher is the tax rate, the higher is the tax collection effort, the higher the income level, and the higher the share of taxes collected by the central government, the higher are the resulting size of transfers.

3.1.1 Simulations of Comparative Statics Results:

Since many of the partial derivatives of the above FD and FD^{Nash} problems do not yield explicit results, we perform a simulation analysis by assigning the following range of values for the model parameters[21], as well as for Y_i and Y_i^*. For tractability, we assume that there are two LGs (that is, i=1,2) for two localities, the first of which is poor and the second is rich.

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

To ensure that there exists some redistribution for purposes of income compensation (i.e. $TR > 0$), simulations take into account the constraint that total targeted level of output exceeds the total of actual output levels. The above income levels can be thought of as in per capita Dollar terms. Justifications for $\alpha = 0.7$ and $\beta = 0.3$ can be provided based on the share of state and private sectors in the economy, which the chosen figures are thought to roughly represent. For c, we took the approximate figure for Turkey. The policy parameters k and m are obtained as the optimal solutions to an alternative CG problem reported in Appendix 2. Simulations of the optimum k and m pairs are also performed in view of the above set of model parameters.

The LGs are informed about the redistributive rule and optimally select their level of tax effort. To achieve consistency among the simulation results, we select the pairs of optimal

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[21] 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, 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: $0.1 < t < 0.5$.

A_i values obtained in the FD^{Nash} problem that match with the A_i values used initially as the feed values in the CG problem to calibrate the optimal k and m.[22] To be able to compare the level of total effort and transfers across the three fiscal regimes, we use this set of k and m to also calculate the optimal A_i's resulting from the FD problem.[23]

The results of the simulated partial derivatives are reported in Appendix 1. Both tax collection efforts (A_i's) and transfers (TR) under the FD and FD^{Nash} problems are positively related with α, k (except for TR_2 in FD^{Nash}) and t. In both problems, A_i's are negatively affected by m and TRs are positively related with the deviation of own income from target. With regards to the rest of the parameters, different signs of comparative statics for FD and FD^{Nash} problems are obtained however: while both A_i's and TRs are negatively related with β and positively related with c under FD^{Nash}, these results are reversed for the FD regime. Also, TRs are negatively related with m in the FD^{Nash} problem, but this effect is positive in the FD problem. We also observe that LGs' efforts are positively related to each other under FD^{Nash}. Interestingly, however, increasing both own and others' effort decreases transfers. The following explanations can be made, followed by the propositions that emerge based them.

Under FD^{Nash}, an increase in the tax rate (t) leads to an increased competition among the LGs over a greater size of redistribution, which has a positive effect on the level of tax efforts. Under FD, despite the lack of strategic behavior, t is still positively related with the tax effort since punishment also increases in t. The redistribution rule is thus confirmed to give the incentives compatible with the expected function of the main fiscal instrument.

[22] The number of such k and m pairs is 184.
[23] In case of the non-strategic FD problem, optimal values of A_i do not necessarily match with those used in the CG problem that were used to find that the optimal k and m pairs.

Proposition 2: In the case of both FD and FD^{Nash}, higher tax rate (t) leads to higher tax effort and higher size of redistribution.

Under FD^{Nash}, the central government leads to both greater tax effort and greater size of transfers by increasing its share from the local tax collection (c) since, in expectation of a greater common pool, each LG increases its tax effort in tandem. The reverse occurs under FD, however, where an increase in c implies both lower tax effort and transfers; non-strategically acting LGs compensate for the utility loss arising from a decrease in G_i, which decreases in c, by increasing the utility form private consumption, which is negatively related with the effort level.

Proposition 3: Centralization of revenues through increasing c leads to an increase in both fiscal discipline and size of transfers under FD^{Nash}, but it does not suffice to give incentive for increasing tax effort under FD, leading to a decreased size of overall transfers.

Considering that the punishment part of the redistributive rule as a second type of tax that is imposed on LGs in case of less than full tax collection effort, an increase in tax collection effort reduces this tax and thus the overall size of redistribution.

Proposition 4: In case of non-cooperative strategic behavior among the LGs (FD^{Nash}), increasing tax collection effort in one locality leads to an increase in the tax collection effort in the other locality (for $k>c$) due to their competition for the common pool. However, an increase in the tax collection effort decreases transfers since punishment declines[24]

[24] Note that $\partial TR_i / \partial A_i < 0$ when $[(\alpha+\beta)c/\alpha]<(k-c)^2$, which holds given the current simulations This result derives from the fact that when the tax collection effort of a locality increases, this leads to an increase in local tax revenue component of G_i, which is overcompansated by reduced transfers to equate local public spending across localities.

The higher the weight on public consumption in the utility function (*β)* the lower is the tax effort and redistribution under FD^{Nash}. This implies that the local government can afford to forego some of the transfers, in the form of punishment, in return of additional utility to be 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 they follow each other in deciding on the tax effort (ie. $\partial A_i /\partial A_j > 0)$. When the 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.

Proposition 5: Under FD, both the optimal tax effort and size of redistribution increase in the weight given to public spending (β). The reverse results when LGs compete (under FD^{Nash}) for a common pool of revenues, which leads them to increase the utility from private spending in order to compensate for the loss of utility due to reduced transfers via punishment.

On the other hand, the higher the weight on private spending in the utility function (α), the higher is the tax effort, which negatively affects the after tax income that in turn leads to lower private spending. This result obtains under both FD and FD^{Nash}. 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 to a decrease in

LG's effort, so as to increase private consumption in order to take advantage of its increased weight in utility.

Under both FD and FD^{Nash}, the optimal tax effort increases in the share of utility received from private consumption (α). Though increased effort decreases private consumption, the benefit of increased effort in the form of higher benefit from increased G_i and reduced punishment, overcompensates for the loss. This complementarityness between the extent of privatization of an economy and fiscal discipline under FD can be viewed as a challenge to Tanzi (2000) who argues FD to be a substitute for privatization.

Proposition 6: The proposed redistributive mechanism is conducive to higher 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 and transfers under both FD and FD^{Nash}, except for the transfers of the rich region under FD^{Nash}. This can be explained by, given the positive effect of punishment on A_i, additional pool of transfers from rich to the poor region for the purpose of income compensation.

The effect of income compensation parameter (m) on both the tax effort and size of transfers are negative under FD^{Nash}, implying a moral hazard effect. This can be explained as follows. Given the local income levels, higher income compensation generates disincentive for LGs to spend tax effort (ie. increased transfers due to income compensation compensate for the loss of transfers due to the punishment of lower effort collection). Under FD, however, the moral hazard is not sufficient to reduce the size of redistribution.

Proposition 7: While the punishment component of the redistributive mechanism indeed works as a fiscal disciplining device, equalization component leads to a moral hazard problem manifested in the form of lower tax effort. The greater the competition among the LGs, the higher the moral hazard effect of income compensation component of the redistributive rule, leading to lower size of redistribution.

Proposition 8: The higher is the deviation of income from the target, the greater are the transfers for purposes of income compensation, which reduces the incentives for tax collection effort only under FD. Under FD^{Nash}, competition for transfers prevents LGs from reducing their effort in case of an increase in income deviation, unlike the case of an increase in m.

The level of effort is positively affected by income deviation from the target under FD^{Nash}, while the effect is negative under FD.

Proposition 9: Competition among LGs leads to higher fiscal discipline, under this redistributive rule, the higher the deviation of incomes from targets.

To investigate the relationship between FD and fiscal discipline, given the suggested redistributive mechanism, we also compare the total level of tax effort implied by the three alterative problems. Based on a common set of k and m values, which correspond to the same set of A_i's for the FD^{Nash} and CG models, simulations yield the following ordering for total effort levels and size of redistribution:[25]

[25] Of the optimal A_i values resulting from the FD^{Nash} that converge to the initial A_i values used as "feed"s to compute the optimal k and m values in the CG problem (reported in Appendix 2), only 184 are found feasible, or non-negative. In order to obtain comparable solutions across the problems, we use the corresponding set of 184 optimal k and m values to calculate the optimal A_i's in the non-strategic problem solution of the LGs.

$$\sum_i A_{i,LG} > \sum_i A_{i,CG} \quad (= \sum_i A_{i,LG}^{Nash} \text{ , by construct })$$

$$\sum_i TR_{i,LG} > \sum_i TR_{i,CG} \quad (= \sum_i TR_{i,LG}^{Nash} \quad)$$

where LG and CG subscripts stand for the outcome of the LG and CG problems, respectively. The results reveal that FD, without strategic interaction among the LGs, leads to greater total effort and also to a larger size of redistribution than both the FD^{Nash} and CG problems.

Proposition 10: FD leads to greater fiscal discipline in terms of higher total tax collection effort than both the centralized fiscal decision making and FD^{Nash}. It also leads to greater size of redistribution.

4. Extension: The Case of Equalization

Improving income distribution is one of the main objectives of governments' redistributive efforts. This section explores the outcome of pursuing income distribution goal across localities. To this end, we perform simulations to investigate the implications of the FD, FD^{Nash} and CG problems in case incomes of the localities are targeted to be the same. This exercise also responds to the possibility that the above results may be an artifact of the choice of parameter values. We thus modify our model parameters such that the levels of income are now closer in range and income targets across localities are the same:

t € [0.1 ; 0.5]; Y_1 €[100 ; 1000] ; Y_2 €[2,000 ; 10,000]; Y_i^* €[(1.01)Y_2 ; (1.1)Y_2]

For purposes of comparison, the set of *k* and *m* values are kept as in the above analysis.

Comparative statics of the both CG and LG problems based on the above range of parameter values yield the same signs as for the above case, which strengthens the findings of the study reported above. We also observe, however, that under this parametrization, efforts decline with the deviation of incomes from targets under both FD and FD^{Nash}, which was the case only under FD in the case of different targets.

As compared with the findings reported above, the case of equalization reveals a few ambiguous results in case of FD problems. These ambiguities arise in the response of transfers to punishment parameter under both FD and FD^{Nash}, and in the response to *t* of the transfers flowing to the poor region, though its positive effect on overall transfers remain as before. In addition, the weight on the utility share of the private sector has an ambiguous effect on both the level of tax effort and the size of transfers received by the poorer region.

In a study of German fiscal system, Von Hagen (2000) suggests that equalization across localities leads to adverse incentives for tax collection. Though the level of total efforts calibrated for the two sets of parameter values used in Sections 3 and 4, which are distinguished on the basis of income realizations and targets, can not be compared due to the resulting differences in optimal policy parameters *k* and *m*, the ranking of total efforts and size of redistributions across the FD, FD^{Nash} and the CG problems are the same under both sets of parameter values, confirming that the findings are not simply the artifact of the parameter selection.

5. Conclusions

This paper presents a model to analyze the implications of fiscal decentralization for fiscal discipline. We measure fiscal discipline via total tax collection effort. The model evaluates the relative outcome of fiscal decentralization by comparing the solution to the problem of local governments, which may or may not be acing strategically, to that of the central government. The transfer mechanism considered has an income compensation and punishment components, the latter of which particularly enables one to address the fiscal discipline aspect of redistribution.

The evaluation of the model solutions indicates that, under the proposed redistribution mechanism i. FD, without strategic interaction among localities, has a fiscal disciplining effect as it implies higher total tax collection effort than in the case of the CG problem. ii. FD is also associated with greater size of redistribution. iii. FD is associated with greater fiscal discipline the greater the extent of privatization of the economy. iv. The greater the competition among the localities over a common pool of revenues, the more beneficial the centralization of the revenues for redistribution purposes. v. The greater the competition among the localities over a common pool of revenues, the greater the moral hazard induced by the income compensation parameter.

Various extensions of the paper are still in order: first, modification of the FD scheme to incorporate a "fiscal burden", in the form of a disutility derived by an LG from a share of the total size of redistribution. Further modifications of the model can be in the form of i. alternative games between the LGs and the CG; ii. endogenizing the local output to government spending and thus to local tax collection effort and; iii. introducing heterogeneity among the localities due to different shocks, which may be structural.

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Appendix 1: Comparative Statics Results

a) *Comparative statics for the unambiguous results (for $i=1,2$)*

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

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

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

- *Nash Solution:*

$\partial A_i^o / \partial \alpha > 0$; $\partial A_i^o / \partial \beta < 0$; $\partial A^0{}_i / \partial k > 0$; $\partial A_i^o / \partial m < 0$; $\partial A_i^o / \partial c > 0$; $\partial A_i^o / \partial t > 0$

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

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

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

Same results are obtained for individual transfers: TR_i, except for $\partial TR_2/\partial k < 0$.

- *Non-Strategic Solution*:

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

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

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

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 with respect to model parameters and variables reported columnwise.

	α	*β*	*c*	*m*	*k*	*t*	*Ai*	*(Yi*-Yi)*
LG PROBLEM:								
Strategic Solution:								
A1	+	-	+	-	+	+	na	+
A2	+	-	+	-	+	+	na	+
TR1	+	-	+	-	+	+	-	+
TR2	+	-	+	-	-	+	-	+
TR	+	-	+	-	+	+	-	+
Non-Strategic Solution:								
A1	+	+	-	-	+	+	na	-
A2	+	+	-	-	+	+	na	-
TR1	+	+	-	+	+	+	+	+
TR2	+	+	-	+	+	+	+	+
TR	+	+	-	+	+	+	+	+
CG PROBLEM:								
TR	na	na	+	na	na	+	+	na
TR1	na	na	+	na	na	na	na	na
TR2	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, the parameters *k* and *m* are determined optimally by the CG as a solution to the problem, where the CG maximizes the sum of utilities of all the 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:

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

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

This optimization problem is solved for k and m, given that the effort of each locality ranges between zero and one.[26] (The values of TR resulting from this calibration are the same as the one obtained under the CG problem reported in Section 2.2.)

[26] The calibration results for the comparative statics of the optimal *k* and *m* are observed as follows. Parameter *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 a locality with relatively smaller income. While the impact of the effort of a larger income locality is positive on the *k*, its impact on *m* is ambiguous.