Does Fiscal Decentralization Promote Fiscal Discipline?

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Abstract

This study models the behavior of a government that faces the problem of redistributing a common revenue pool efficiently and equitably. We specifically consider such a rule that takes into account both local governments' tax collection effort and the deviation of local incomes from their targets. By comparatively analyzing alternative fiscal procedures led by the central and local governments, the model suggests that, given the proposed redistributive mechanism, fiscal decentralization plays a disciplinary role.

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

Fiscal decentralization (FD) is viewed as an institutional mechanism defined by the leading status of the 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 we consider to be 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. The latter is a relevant aspect of fiscal discipline, since, though not explicitly addressed in the current version of the paper, it has implications for deficit financing and thus macroeconomic stability.

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.[3] So are horizontal imbalances that result from the varying fiscal capacities across the different regions of a country.

Besides the existence of such imbalances between the central and local governments and across the local governments, the reason for local governments' reliance on the central government can be related with the local ability of, or effort spent for, collecting taxes. As

[3] 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).

both fiscal imbalances and income inequality have significant welfare implications, it would be desirable that the design of a redistributive mechanism bears the characteristics of disciplining governments while eliminating horizontal imbalances.[4] This study employs such a redistributive mechanism in order to address the role of FD on fiscal discipline, which has not yet been addressed in the literature.[5]

The motivation for this study emerges from an overview of empirical studies on the macroeconomic implications of FD. While there is a growing literature on the socio-economic consequences of FD[6], which however provides mixed evidence on the merits of FD, only a few studies have looked at the macroeconomic consequences of FD.[7] Among them, Neyapti (2005a) provides a cross-section study that demonstrates that FD reduces budget deficits mainly in cases of large population size and good governance. In addition, Neyapti (2004) shows that revenue decentralization is associated with lower inflation in the presence of high central bank independence and local accountability, indicating that FD can be considered as a fiscal disciplining device. Neyapti (2006) shows that revenue decentralization

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[4] Although equality across regions is desirable from the perspective of a benevolent planner, it has its costs in terms of either depriving the relatively wealthier regions from investments that would have otherwise yielded positive spill-over effects in the long-run, or for those in favor of status-quo, or simply in the form of transactions costs. Nonetheless, this paper simply focuses on the benefits of equalization.

[5] 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.

[6] 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).

[7] Those are Davoodi and Zou, 1998, King and Ma, 2001, Jin and Zou, 2002, Neyapti, 2004, Martinez-Vazquez and McNab, 2003 and Neyapti, 2004, 2005a and 2006.

(RD) is also associated with better income distribution in cases of good governance. Since inflation, as a taxation device whose incidence falls disproportionately on lower income groups, is also likely to worsen income distribution, both of the latter two results may as well be interpreted as to indicate that RD can improve income equality. Without the support of appropriate institutional structures[8], however, neither the evidence nor the current paper claims that FD would be effective in attaining fiscal discipline.

In this paper, we model fiscal activity in such a way that local government units decide on their tax collection effort given a redistributive rule. The basic features of the model are as follows. The redistributive rule is such that both "less than full tax collection effort" is punished and the deviation of income of each jurisdiction (or region) from a target level is compensated for.[10] Besides, the central government sets both a common tax rate to be implemented by localities and a proportion of tax revenues to be collected in a general pool, both of which help determine the size of the redistributable pool of revenues. The local government choice of the optimal effort levels constitutes the procedure of fiscal decentralization (FD). In the alternative fiscal procedure, the central government optimally chooses the level of transfers.

The above outlined two alternative types of fiscal procedures (FD versus central government's optimization) define the type of "fiscal institution" we propose in this paper. This set up enables us to investigate the implications of FD on fiscal discipline. We

[8] Here, the relevant institutions are local elections, central bank independence and governance measures.
[10] Redistributive rules are generally much simpler than this, especially in less developed countries. In Turkey and many others, for example, transfers are distributed simply on "per capita" basis. A redistributive scheme to eliminate horizontal imbalances with regards to various socio-economic indicators has been suggested in Neyapti (2005b).
[12] In current model fiscal burden can be measured by the extent of the lack of fiscal discipline.

demonstrate that under the proposed redistributive rule, FD indeed achieves higher fiscal discipline (greater tax collection effort) than the alternative procedure.

One relevant question that arises here is what this model implies for *fiscal-illusion* (as in von Hagen-Harden, 1995): since local governments obtain benefit from spending in their own jurisdictions, one would expect that the implied size of redistribution under FD would exceed that of the central government's. 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.[12] In the current model, fiscal illusion can be said to occur if FD leads to lower fiscal discipline. Since the punishment mechanism in the redistributive rule acts as a device to internalize the burden, FD may not necessarily be associated with fiscal illusion outcome, however.

Different from the current set-up, the existing studies that investigate the redistributive role of the government focus on 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. The authors obtain optimal decentralization outcomes from different strategic interactions between the central and regional governments and the private agents, where migration leads to externalities across regions.

Also motivated by the question of the relationship between FD and fiscal discipline, Sanguinetti and Tomassi (ST, 2004) use a game theoretic framework to investigate the impact of FD on reducing asymmetric shocks across regions, against which transfers are viewed as insurance. In ST, regions only differ in ex-post shocks, and transfers are decided either under a rule-based or discretionary schemes, under the latter of which the common pool problem is observed. Their model differs from the current one in terms of mechanisms of transfer decision, and thus leads to different implications regarding fiscal discipline than the current one.

Different from the above studies, the current paper investigates the effect of a pre-announced redistributive mechanism, given a revenue collection capacity, for achieving fiscal discipline. With this objective, we focus exclusively on the analysis of local versus central government optimization problems, with a specific attention on their implications for fiscal discipline (ie. total tax collection effort and the size of transfers).[13]

Utilizing simulation analysis, the model indicates that the case of FD is associated with both a greater size of redistribution and higher fiscal discipline, measured in aggregate tax effort. Although the fiscal discipline implication of the transfer size is not sufficiently addressed in the current set up, FD as a fiscal institution appears to therefore dominate fiscal centralization with regards to fiscal discipline.

Comparative static analysis also yields various policy implications. The findings indicate that, under FD, increased tax rate lowers total transfers. On the other hand, it increases the size of transfers in the case of CG's optimization. Average tax collection effort under FD increases with the number of localities, a result that seems to be in contradiction with fiscal illusion. The results for FD also indicate, however, that total size of redistribution increases with the number of localities.

The issue addressed by the current model is rich of potential extensions that call for further exploration. In one such extension, the government tries to equalize income levels across regions. The policy implications of this investigation are that while increasing the share of the centralized revenue pool increases fiscal discipline, increasing tax rates has a reverse impact.

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

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

This paper assumes that the tax rate (t) is given exogenously by the central government. For purposes of simplicity, we assume that there is one type of tax: 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 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:

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

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

[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.

$$C_i = (1 - t_i)Y_i$$ [16]

The total size of the transfers (*TR*) made by the central government is the sum of revenues collected in the common pool: $TR = c\Sigma\, t_i Y_i$, as 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

The procedure of FD is identified by an optimization problem where local government (LG) maximizes its utility subject to a redistribution rule. Hence, LG chooses the level of *tax collection effort* A_i (where $0 < A_i \leq 1$ since if $A_i = 0$, there would be no redistribution).[17]

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

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

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

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 $\alpha + \beta = 1$).[19] Equation (2) is the redistribution rule that determines the amount of transfer locality i receives. Y_i^* is some exogenously given target of Y_i.[20] *k* and *m* are the parameters that indicate the extent the

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

[17] Alternatively, one can think of a case where each local government takes as burden 1/n share of overall size of redistribution ($\sum TR_i$). This case can be analyzed by adding the burden (with the negative sign) to the objective functions. The solution of this problem, however, turns out to be rather complicated , however, whose results are therefore not currently available.

[19] We will separately investigate the case of $(\alpha + \beta) > 1$.

[20] 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

government punishes less than full tax collection effort *(A_i -1)*, and compensate income deviation from a target, respectively.

The solution of the LG problem is obtained as:

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

which yields the optimal total transfers *(TR)* of:

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

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, which indicates that transfers are equal to the revenues collected in the common pool[21]:

$$\underset{TR_i}{Max} \quad \sum_{i=1}^{n} [\alpha \ln C_i + \beta \ln G_i] \tag{5}$$

$$subject\ to \quad \sum_{i=1}^{n} TR_i = ct\sum_{i=1}^{n} A_i Y_i \tag{6}$$

The solution to the problem is:

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

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. We then simulate the

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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.

[21] 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.

comparative static results for $n = 2$, given $\alpha, \beta, k, m, t, c$ Y_i and Y_i^* (where i=1,2) that we set at some reasonable levels or intervals. 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 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 simulation analysis. Next, we compare the total optimal tax collection efforts resulting from LG and the CG problems. Likewise, we compare the two 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 two alternative fiscal procedures, and of the optimal efforts resulting from the FD procedure. Only some of these partial derivatives are unambigous, 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 results are mostly expected: in case of central governments' optimization, we observe that c, t, A_i and Y_i all have positive effects on total transfers.[22] In addition, the LG

[22] Note, however, that $\partial TR_i / \partial A_i < 0$ when $(1/n) < (1-c)$, which is generally the case. This result derives from the fact that when the tax collection effort of a locality increases, local tax revenue component of G_i increases, which is then balanced with reduced transfers to equate local public spending across localities.

problem yields an interesting result regarding the effect of income deviation on the level of effort and transfers, where the sign of the first is negative and the second is positive. All the remaining partial effects are ambiguous, and thus are not reported.

Proposition 1: In the procedure of fiscal decentralization, an increase in the deviation of actual output from its target generates a disincentive for a locality to spend tax effort because the deviation increases transfers due to the income compensation component of the redistribution rule.

Proposition 2: Under FD, average tax effort increases with an increase in the number of localities. This is likely to be due to an increased number of localities competing for the pool of tax revenues. Hence, under the current redistributive mechanism, FD leads to greater fiscal discipline the greater the value of n, indicating that FD is likely to be more efficient in case of large countries, a finding that is empirically supported (Neyapti, 2006).

3.1.1 Simulation Results for Comparative Statics:

Since the partial derivatives of the optimization problems mostly yield ambiguous results, we perform a simulation analysis by assigning the following range of values for the model parameters[23], as well as to Y_1, Y_2, Y_1^* and Y_2^*:

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[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, 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

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

We set the target levels of incomes such that the total of targeted output exceeds the total of actual output levels. This way we ensure that there exists some redistribution for purposes of income compensation (i.e. $TR > 0$). These 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 average shares of state versus private sector in the economy. For c, we took the approximate figure for Turkey.

In addition to the above values, the values of *k* and *m,* which are crucial for policy purposes, are needed. We obtain *k* and *m* as optimal solutions to an alternative CG problem where the central government chooses them to maximize its objective function. This problem is reported in Appendix 2. The LGs are informed about the redistributive rule and perform their optimization accordingly.

The partial derivatives obtained though simulations[24] indicate that tax efforts are negatively affected by α, *m* and the deviation of own income from the target, while they are positively related with β, *k* and *c*. The signs of the derivatives can be explained as follows.
The higher the utility weight given to private consumption, which is equal to the after tax income, the lower is the tax effort that negatively affects the after tax income. By contrast, the weight on public spending, which includes transfers, is positively related with the optimal tax effort. In addition, we observe that, for a given level of transfers, an increase in *c* implies higher tax effort, reflecting localities' competition for a larger collected pool of revenues. The higher is the deviation of income from the target, the greater are the transfers for purposes of income compensation, which reduces the incentive for tax collection effort. Likewise, the

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only a very crude measure of average tax rate. Hence, for LDCs, as well as for the world average, we take t to be: $0.1 < t < 0.5$.

[24] The number of data points generated is 40,493.

greater the income compensation parameter, the lower is optimal effort. On the other hand, the higher the punishment parameter, the higher is the optimal effort, indicating that the proposed fiscal rule fulfils its institutional role of inducing greater fiscal discipline.

The sign of the derivative of *TR* with respect to *t* is observed to be the opposite of the CG problem; FD leads to lower total transfers when tax rate is higher. In addition, the higher the weight on income compensation (*m*), the higher are total transfers, even though m has a negative effect on the effort level. Indeed, because higher m results in higher *TR*, the model yields the lower tax effort reported earlier. The sign of the partials of TR_i (for i=1 and 2) are the same as those for TR. One exception is that only low income locality gets higher transfers in case of higher c, which is the same finding as in the CG problem[25].

Proposition 3: In the case of FD, higher tax rate (*t*) leads to lower size of redistribution. This finding is in support of the (falling portion of) the Laffer curve. This observation may be linked with the positive association of the optimal m with the tax rate (see Appendix 2): as t increases, since the optimal income compensation parameter increases with it, this may induce lower incentives on tax collection effort.

Proposition 4: An increase in the number of localities (n) increases the total size of redistribution for the case of FD, a result that is consistent with the fiscal illusion concept in case this implies additional financing.

3.2 Redistribution and Fiscal Discipline : Comparing the two procedures

In view of the foregoing problems, we can now investigate the relationship between FD and fiscal discipline, given the suggested redistributive mechanism. To compare the total

[25] Simulations are also performed for the solution of the CG problem, based on 139,298 data points.

level of tax effort implied by the two problems, we first assume that CG pre-announces the redistribution rule. The optimal values of k and m, which are found as the solution of the CG problem stated in 3.1.1. , are simulated given the level of effort ranging between 0 (exclusive) and 1 (inclusive). These values are then used to simulate the optimal solution for A_i resulting from the FD procedure. Next, we compare these values to those in the CG problem that are initially used to generate the corresponding optimal k and m values. Simulations yield the following ordering for total effort levels and size of redistribution, respectively:

$$\sum_i A_{i,LG} > \sum_i A_{i,CG}$$

$$\sum_i TR_{i,LG} > \sum_i TR_{i,CG}$$

where LG and CG subscripts stand for the outcome of the LG and CG problems, respectively.

Proposition 5: FD leads to greater fiscal discipline in terms of higher total tax collection effort. It also leads to greater size of redistribution, whose implication for fiscal discipline is subject to further investigation.[26]

4. Extension: The case of Equalization

Improved income distribution is one of the main objectives of governments' redistributive efforts. This section explores the role of the two fiscal procedures in improving income distribution across regions. To this end, we perform simulations to investigate the implications of the LG and CG problems in case incomes of the localities are targeted to be the same. We thus modify our model parameters such that the levels of income are now closer in ranges and income targets are the same:

[26] One way of investigating this implication is to incorporate into the LG problem the size of redistribution, such that each LG will get a share of total transfers as the burden. The rationale for this is that TR may lead to inflationary financing.

t € [0.1 , 0.5]; Y_1 €[100 , 1000] ; Y_2 €[2,000 , 10,000]; Y_i^* €[1.01 xY_2 , 1.1 xY_2]

Based on 57,460 data points generated, the comparative statics of the CG problem yield the same signs as for the above case, which strengthens the findings of the study reported above. In additon, however, we observe that setting equal targets imply that transfers to the higher income locality is now unambiguously negatively related with the tax rate and the own effort level.

In case of the LG problem, we observe the following based on simulations using 20, 821 data points. As different from the above case, the case of equalization implies that the level of effort increases in *c* and decreases in *t* only the high income locality. Compared with the earlier results, this indicates that while the effect of c on low income region disappears, t becomes a factor that negatively influences the optimal effort in the rich region. In a study of German fiscal system, Von Hagen (2000) provides empirical support for this finding by stating that equalization has led to adverse incentives for tax collection.

We further observe that the only difference in the comparative statics of transfers, as compared to the results of the earlier section, is that it is the rich region, instead of the poor region, whose transfers increase with c, thorough its impact on optimal effort level. The remaining of the signs reported in the foregoing section are further confirmed by these simulations.

Proposition 6: Setting equal income targets (equalization) can render centralization of tax revenues, i.e. increasing c, more effective; but higher taxes less effective, where effectiveness is in terms of inducing incentives for rich regions, measured by their optimal effort.

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 of the local government problem to that of the central government. The transfer mechanism considered has an income compensation and punishment components, the latter of which particularly enables us to address the fiscal discipline aspect of redistribution.

The evaluation of the model solutions indicates that i. fiscal decentralization leads to an increase in transfers in response to an increase in the deviation of actual output from its target, which in turn reduces local tax effort. ii. FD appears to have a disciplining effect as it implies higher total tax collection effort than in the case of the CG problem. iii. FD is also associated with greater size of redistribution. iv. The suggested redistributive rule leads to a positive association between the average tax effort and the number of localities for the case of FD, which runs in contrast to the predictions of fiscal illusion,. On the other hand, increasing number of localities increases the total size of redistribution in the case of FD. v. The greater the rate of taxation, the lower the size of redistribution in the case of FD. This occurs due to the reduced incentives for local governments to increase the tax collection effort.

In an extension of the model, we investigate the case of choosing equal income targets for the regions. As different from the original model, this modification leads lower fiscal discipline in higher income regions in response to a tax increase. Centralization of revenues appears to be a better alternative to increase fiscal discipline in this case.

Various extensions of the paper are still in order: first, we will modify the optimization problem of the LGs to incorporate the “fiscal burden”, which is in the form of a disutility derived from the share of the total size of redistribution accruing to an individual LG. Fiscal burden can be thought of as additional financial requirement in this setup. Further modifications of the model will be in the form of i. endogenizing the local output to government spending and thus to local tax collection effort; ii. introducing heterogeneity among the localities due to different shocks that can be structural.

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Appendix 1: Comparative Statics Results

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

$$\text{LG Problem:}\quad \frac{\partial A_i}{\partial (Y_i^* - Y_i)} < 0,\ \frac{\partial TR}{\partial (Y_i^* - Y_i)} > 0,\ \partial\left(\left(\sum_{i=1}^{n} A_i\right)/n\right)/\partial n > 0$$

$$\text{CG Problem:}\quad \frac{\partial TR_i}{\partial c} > 0,\ \frac{\partial TR_i}{\partial n} < 0\,,\ \frac{\partial TR}{\partial c} > 0,\ \frac{\partial TR}{\partial t} > 0,\ \frac{\partial TR}{\partial A_i} > 0,\ \frac{\partial TR}{\partial Y_i} > 0$$

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

$\partial A_i^o/\partial\alpha < 0$; $\partial A_i^o/\partial\beta > 0$; $\partial A_i^o/\partial k \geq 0$; $\partial A_i^o/\partial m \leq 0$; $\partial A_i^o/\partial c \geq 0$; $\partial A_i^o/\partial(Y_i^* - Y_i) \leq 0$

$\partial TR/\partial\alpha < 0$; $\partial TR/\partial\beta > 0$; $\partial TR/\partial m > 0$; $\partial TR/\partial(Y_i^* - Y_i) > 0$; $\partial TR/\partial t < 0$; $\partial TR/\partial n > 0$

The same results are obtained for individual transfers: TR_i. In addition, $\partial TR_1/\partial c \geq 0$.

The results can be summarized as follows: (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***	***n***	***Yi*-Yi***	***Ai***
LG PROBLEM									
TR	-	+	+	+	-	-	+	+	na
A1	-	+	+	-	+	-	na	-	na
A2	-	+	+	-	+	-	na	-	na
CG PROBLEM									
TR	na	na	+	na	na	+	-	na	+
TR1	na	na	+	na	na	na	-	na	na
TR2	na	na	+	na	na	na	na	na	na

Appendix 2: Optimal choice of k and m

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 *(i.e.* $ct\Sigma A_i Y_i$*)* 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, for given effort levels for the two localities.[27] The resulting TR is the same as the one obtained under the CG problem reported in Section 2.2.

[27] The calibration results for the signs of the comparative statics of the optimal levels of k and m are observed as follows. Parameter c affects k one to one, while its effect on m is always positive; the optimal income compensation parameter increases with both c and t. Optimal values of both k and m decreases 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 optimal punishment parameter, its impact on m is ambiguous.