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An Examination of Unintended Consequences of Intergovernmental Equalization Programs

Dmitry V. Shishkin

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The author of this dissertation is:

Dmitry Shishkin
980 Walther Boulevard, Apt.2535
Lawrenceville GA 30043

The director of this dissertation is:

Jorge L. Martinez-Vazquez
Economics Department
14 Marietta St. NW Atlanta GA 30303

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An Examination of Unintended Consequences of Intergovernmental Equalization Programs

By

Dmitry Shishkin

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree
of
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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

Dissertation Chair: Jorge L. Martinez-Vazquez

Committee: James R. Alm
Roy W. Bahl
John L. Mikesell
Andrey N. Timofeev

Electronic Version Approved:
Roy W. Bahl, Dean
Andrew Young School of Policy Studies
Georgia State University
August 2007

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OF INTERGOVERNMENTAL EQUALIZATION PROGRAMS

By

Dmitry Shishkin

August 2007

Committee Chair: Dr. Jorge L. Martinez-Vazquez

Major Department: Economics

While the major goal of intergovernmental equalization transfers is the pursuit of equity, there is also a number of unintended consequences produced by equalization programs. In this dissertation we analyze the negative effect of equalization on the size of factors that are either used to measure the equalized jurisdictions' fiscal capacity in gap-filling equalization programs or are taxed with the purpose of further redistribution among jurisdictions in tax base sharing programs.

We propose a theoretical framework in which the comparative statics analysis shows how equalization programs can induce substitution effect in the representative individual's consumption bundle via changes in the perceived price of the good that is associated with the size of the factor used to measure the equalized jurisdictions' fiscal capacity or taxed with the purpose of further redistribution among the jurisdictions. As the representative individual changes consumption of this good, the size of the factor also changes, resulting either in a reduction of the budget revenue collections or in the size of tax bases in the equalized jurisdictions.

In the empirical part of this dissertation we examine the existence and economic significance of these effects using two cases of equalization programs. First, we examine the adverse effect of the equalization programs on revenue collections in Russia's regions where regional governments redistributed resources among their constituent municipalities based on the size of their actual revenue collections. Second, we examine the adverse effect of the tax base sharing program in the Twin Cities Metropolitan area of Minnesota on the size of commercial and industrial property where this property is taxed at a uniform rate and then reassigned to the municipalities in the inverse proportion to the size of their per capita real property. In both cases our empirical results support the hypothesis that the equalization programs adversely affect the size of the factors that are used to measure the equalized jurisdictions' fiscal capacity or that are taxed with the purpose of further redistribution among jurisdictions in tax base sharing programs.

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CHAPTER 1

INTRODUCTION

Intergovernmental equalization transfers are an important part of the fiscal decentralization system in many countries in the world. They are present both in federations and unitary states,[1] and affect regional as well as local governments. The major drive behind these programs is the pursuit of equity, which means that the resources are redistributed from better-off to worse-off jurisdictions to make sure that they all have comparable fiscal capacities to provide a given level of public service.[2] Another justification of equalization is that it can eliminate inefficient migration in decentralized fiscal systems.

Equalization is known to produce two types of unintended effects: it might affect the tax rates imposed by equalized jurisdictions, and it might affect their revenue collection effort or their willingness to attract and maintain the tax bases.

In this dissertation we address the latter set of problems, i.e., disincentives that negatively affect the size of factors that are used to measure equalized jurisdictions' fiscal capacity or are taxed with the purpose of further redistribution among jurisdictions in tax base sharing programs. We propose a theoretical framework in which the comparative statics analysis shows how these disincentives take place. We use this framework to show how gap-filling equalization grants can change the relative prices of the goods that are associated with the size of factors used to measure jurisdictions' fiscal capacity as these

[1] For example, such federations as Australia, Belgium, Canada, Germany, Russia, and Spain, and such unitary states as Japan, Scandinavian countries, and Ukraine extensively use equalization programs. Some supranational organizations like European Union also redistribute resources from its more economically prosperous to its less developed members.

[2] There is a close analogy between these programs and redistribution of income between individuals.

prices are perceived by the residents of the jurisdictions, and how these changes in perceived prices can induce substitution effects in the residents' consumption bundles. We also use this framework to show how tax base sharing programs produce similar substitution effects in the residents' consumption bundles reducing the size of the factors that are taxed with the purpose of further redistribution among jurisdictions.

In the empirical part of this dissertation we examine the existence and economic significance of these effects using two cases of equalization programs: first, the equalization programs in Russia's regions where regional governments redistribute resources among their municipalities based on the size of their actual revenue collections, and, second, the case of tax base sharing program in the Twin Cities Metropolitan area in Minnesota where commercial and industrial tax bases are taxed at a uniform rate and proceeds are redistributed in the inverse proportion to the size of their per capita real property values.

In both cases our empirical results support the hypothesis that the equalization programs adversely affect the size of the factors that are used to measure the equalized jurisdictions' abilities to raise budget revenues, or which are taxed with the purpose of further redistribution among jurisdictions in tax base sharing programs.

The study of these disincentives and their economic significance is important because, as fiscal decentralization initiatives continue to spread across developing and transitional countries in all regions of the world, there are more and more countries that are introducing or seek to introduce equalization transfers to address the problems of horizontal fiscal imbalances generated in their decentralization systems. If equalization induces economically significant effects in the size of factors used as measures of

jurisdictions' fiscal capacity and/or taxed for the purpose of further redistribution, these can have negative consequences on the delivery of the publicly provided goods and on overall revenue mobilization, as well as on local development and overall economic growth, and can in general create welfare losses. These welfare losses could be measured and compared to the welfare gains resulting from equalization programs, using a methodology similar to those in Watson (1986) and Wilson (2003); however, this kind of analysis is left for future research.

For the purpose of this work we define an equalization scheme as a flow of money that is provided to jurisdictions in an inverse proportion to some measure of their ability to raise budget revenues, which may or may not be normalized by their expenditure needs. In other words, if jurisdictions A and B have identical expenditure needs, the one with a smaller ability to raise budget revenues would receive a larger amount of equalization transfers. Also, if jurisdictions A and B have identical abilities to raise budget revenues, the one with larger expenditure needs would receive a larger amount of equalization transfers.

CHAPTER 2

LITERATURE REVIEW

Although there is a sizable literature on equalization grants and measurement of fiscal capacity (Martinez-Vazquez and Boex 2002), there is a much smaller literature on the disincentive effects of equalization and even fewer papers that have investigated the central issue of this dissertation: how equalization schemes may affect the variables or bases used to measure fiscal capacity[3] of the equalized jurisdictions.

One of the most known and intuitive effects resulting from equalization is a negative effect on the revenue collections that takes place when equalization is based on these as a measure of jurisdictions' fiscal capacity. Martinez-Vazquez and Boex (2001) argue that in 1990s the equalization transfers that were provided to Russia's regions according to current or base year revenue collections as a measure of fiscal capacity reduced their incentives to collect revenues. According to Martinez-Vazquez and Boex (2001), this effect was even stronger at the local level where local governments routinely saw a large percentage of additional revenues clawed back by regional governments,[4] which encouraged them to hide fiscal resources rather than to increase tax collections.

Similarly, Baretti (2002) et al. show that the equalization system in Germany that distributes transfers among the states based on their actual revenue collections (i.e., providing larger transfers to the states that collect smaller amounts of tax revenue) works as a tax on a state's tax revenue. They introduce a concept of a marginal tax rate of this

[3] Following Martinez and Boex (2002) I define fiscal capacity as the potential revenues that can be obtained from the tax bases assigned to the subnational government if an average level of effort (by national standards) is applied to those bases.

[4] As we show later in this dissertation, revenue clawback (i.e. the offsetting changes in the size of equalization transfers in response to the changes in the size of jurisdictions' own revenues) is an inevitable result of equalization based on actual revenue collections as a measure of fiscal capacity.

kind, defining it as the fraction of additional tax revenue in the state taken away from the region there, and show that higher marginal tax rates encourages German states to reduce their tax enforcement activity, which leads to lower tax revenues.

Equalization systems that are carefully designed, such as the representative tax system, can be free from this kind of disincentives as it estimates fiscal capacity of the equalized jurisdictions to raise budget revenues not according to the amounts of their actual tax collections, but according to the size of their tax bases multiplied by appropriate average tax rates (Martinez-Vazquez and Boex 2002). In fact, switching to another set of parameters raises the question of whether in their own turn these parameters could be affected by the policies of the governments or by the behavior of the residents of the equalized jurisdictions.

Addressing this question, Courchene and Beavis (1973) evaluate the "new" federal-provincial equalization program in Canada[5] that distributed transfers based on the size of provinces' tax bases and the average tax rates for sixteen provincial revenue sources.

They show that this kind of equalization system encourages provinces to change their tax rates up or down depending on the relative size of their per capita tax bases: the provinces that have larger than average per capita tax base for some revenue source are encouraged to lower their tax rates imposed on this tax base, and the provinces that have smaller than average per capita tax base for some revenue source are encouraged to raise their tax rates imposed on this tax base. By doing so the jurisdictions affect the average

[5] This equalization program replaced the one that was in use in Canada in 1962-67.

tax rates and increase the size of the transfers that they are receiving. This effect is stronger for those provinces that have a larger share in the national-wide tax base.

Also Courchene and Beavis show that the equalization system would have punished some Canadian provinces if the size of their tax bases had increased. For example, according to their estimations if Nova Scotia increased its tax base in 1968-69 by five percent, it would have lost $1,582 million in transfers while only gaining $1,467 in own revenues, suffering not only a decrease in the amount of transfers, but also a decrease in the total amount of revenues.

Courchene and Beavis offer some options to modify the equalization program to reduce the opportunity for provinces to affect the amount of transfers that they receive, but they neither provide a formal model to show how the opportunities could be transformed into changes in the provinces' policy decisions nor explain what mechanisms provinces could use to affect the size of their tax bases.

In a later work, Courchene (1994) argues that equalization might discourage recipient jurisdictions from developing new revenue sources, as additional revenues are implicitly taken away through the equalization process. Dahlby and Wilson (1994) take into account the possible elasticity of tax bases with respect to the changes in the tax rates as they are concerned with equalization of the social marginal cost of raising revenue across all revenues (the Ramsey rule for the nation) and show how this goal could be achieved with optimal equalization grants.

In a very important work for the topic of this dissertation Smart (1998) shows that under conditions of representative system of taxation the equalized jurisdictions have an incentive to suppress the size of their tax bases and increase the amount of equalization

transfers by raising their tax rates. Smart not only points to the opportunity for the equalized jurisdictions to affect the amount of transfers that they receive when the size of their tax bases changes, but also refers to a particular mechanism that they could use (i.e., imposing higher tax rates) and presents a formal model that shows how these incentives transfer into changes of the jurisdictions' behavior.

In a later work, Smart (2002) says that, despite the potential importance of these incentives, there is little hard evidence that equalization programs have actually influenced provincial decisions about tax rates and tax bases. Smart refers to an anecdotal evidence of the protracted negotiations over development of the Voisey's Bay nickel deposit as an illustrative example of equalization affecting provincial policy decision. According to this evidence, the government of Newfoundland and Labrador were not willing to allow the project to get started as the equalization formula effectively eliminated the benefit that they would receive from the royalties paid by the project.

The latter example refers to a different mechanism that jurisdictions can use when facing disincentives produced by equalization programs, i.e., exercising a direct control over tax bases. Accordingly, in his survey of the role of intergovernmental equalization transfers, Boadway (2004) considers two sorts of ways that regions can affect the size of their tax bases: one, by imposing high tax rates that would suppress the size of relatively elastic tax bases, and, another, by directly controlling their tax bases, like for example in the resource sector where regions can affect the extent of resource development, the latter effect, he argues, being even more powerful than the former.

There is a number of articles that study another type of equalization programs–so-called tax base sharing, which is more common in the U.S. at local level (Fischel 1975,

1976; Reschovsky 1980, 1982; Fox 1982). Tax base sharing differs from the representative tax system as it does not employ the gap-filling mechanism–rather it pools the revenues from particular tax bases of the jurisdictions involved into the program and then redistributes the revenues among them according to some formula, but its major purpose is the same–to redistribute resources from municipalities with larger tax bases to municipalities with smaller tax bases. Thus, potentially the program could negatively affect the size of the tax bases in the equalized jurisdictions.

The largest program of this kind both in terms of geographical area covered and the amount of tax base that is shared is the fiscal disparities program that shares commercial-industrial tax base within the Twin Cities metropolitan area of Minnesota, and not surprisingly it has been scrutinized by researchers.

The first time the effect of tax base sharing on the size of the equalized jurisdictions' tax bases was addressed by Fischel (1975, 1976). While analyzing fiscal and environmental considerations in the location of firms in suburban communities, he argues that the sharing of commercial and industrial tax bases of each community with other communities throughout the metropolitan area will result in a situation when communities are less willing to permit businesses to locate inside their borders, which eventually reduces metropolitan output, employment and income.

Fischel (1975) presents a model of a market for business location based on the exchange between residents of communities and firms, and discusses the effect that the sharing of commercial and industrial tax bases performed by a metropolitan government would have on this exchange mechanism. Fischel argues that the tax base sharing as well

as the centralization of local services would result in a reduction of number of firms located in the localities.

In a later work, Fischel (1976) discusses the economic consequences of the metropolitan tax base sharing, using the example of the "Metropolitan Fiscal Disparities Act" that was passed by the Minnesota State Legislature in 1971. This act applies to communities in seven counties of the Twin Cities Metropolitan Area and provides that forty percent of the increase in commercial and industrial property over those in 1971 should be withdrawn from the tax base of local municipalities and transferred to a metropolitan authority that taxes it at a uniform rate and redistributes the revenues among communities in grants with the amounts inversely related to the per capita market value of real property in the communities.

To analyze the effect of the tax base sharing plan, Fischel considers a simplified model of it: a scheme that withdraws taxing authority over all existing and future commercial and industrial property in the community, taxes the property at a uniform rate and redistributes the revenues among the communities on an equal dollar per capita basis.

According to Fischel, the market for the business location would not work under the assumptions of this model because they eliminate the fiscal benefits that represent the shadow price of the environmental quality of the neighborhood that is reduced by the presence of the firms. Following the same logic, he says that despite the fact that the Fiscal Disparities Act leaves some fiscal benefits to residents, it still reduces the price of environmental quality inducing the residents to increase its consumption. The increased consumption of the environmental quality would reduce the presence of the firms in the communities.

The major insight of Fischel's work for this dissertation is that it provides a model of business location which is the basis for the analysis in the theory section. There, we elaborate on his argument related to the effect of tax base sharing on the number of firms located in the equalizing area, providing a more formal explanation, and test empirically the effect of the tax base sharing on the size of the tax bases in the Twin Cities Metropolitan area.

There are several other works that study the consequences of the Twin Cities Fiscal Disparities program. Reschovsky (1980) concludes that tax base sharing is unlikely to have a significant effect on metropolitan development patterns, which in his interpretation means that it is unlikely that the plan would stimulate new commercial-industrial growth in the central cities. This dissertation concentrates on a different aspect of potential changes in metropolitan development patterns resulting from tax base sharing: we study its effect on the shared tax bases inside the metropolitan area visa-vis tax bases outside its borders. Our findings are in agreement with Fox (1981) who argues that income redistribution within the metropolitan area might push citizens and business firms outside its borders as they would try to avoid the redistribution.

Besides the negative effect on the size of the tax bases resulting from the equalization transfers formula, there is always a possibility that the taxes needed to raise resources for redistribution in the form of transfers will suppress the tax bases even further. For example, in the case of Twin Cities Fiscal disparities program the area wide taxation of commercial and industrial property tax bases is a part of the tax base sharing program.

Watson (1986) and Wilson (2003) measure welfare losses and compare them with welfare gains resulting from equalization programs. The results of this dissertation could be used to enhance this kind of studies, as we put forward a more elaborate research related to the potential welfare losses from equalization. These authors make a rather crude assumption about welfare losses resulting from equalization taking into account only administrative cost and deadweight loss resulting from taxation that is necessary to finance the equalization programs.

There are two other works that do not directly address the incentive effects of equalization, but are important for our empirical analysis of equalization on the incentives of municipalities in Russia's regions. These are Zhuravskaya (2000) and Alexeev and Kurlyandskaya (2002) who estimate fiscal incentives faced by municipalities in Russia, associating these incentives with the offsetting effect of the changes in regional transfers in response to the changes in the municipalities' own revenues (clawback.) These two works are important for my research because they address the issue of fiscal disincentives in Russia's regions, which according to our view are produced by equalization practices of regional governments toward their municipalities. Both works show that fiscal incentives faced by municipalities in Russia were rather weak, which we interpret as a sign of extensive equalization practices.

A main problem with these two works is that the term "own revenues" is defined differently and neither of the authors presents a clear argument why own revenues should be defined in a particular way. In the empirical section of this dissertation we show the problems that are associated with either approach and develop an approach of our own that allows us to measure fiscal incentives consistently when the sharing rates from

shared revenue sources assigned to equalized jurisdictions' budgets are not fixed and change from year to year. We use this approach further in the dissertation to estimate fiscal incentives faced by municipalities in Russia's regions and show how these incentives affect the tax effort in the regions.

CHAPTER 3

THE THEORETICAL MODEL

The objective of the model is to uncover the fundamental conditions under which gap-filling equalization mechanisms (including "incentive compatible" ones, based on fiscal capacity as opposed to actual revenue collections) as well as the tax base sharing schemes may induce unwanted substitution effects on the factors that are used as measures of equalized jurisdictions' fiscal capacity or as shared tax bases.

The key point of the theoretical analysis in this section is the notion that most of the parameters that could be used to estimate a jurisdictions' ability to raise budget revenues, including most importantly the size of their tax bases, are not exogenously determined. Rather, they either represent goods that are consumed by residents directly (e.g., publicly provided goods or private housing) or are factors that produce externalities that affect the size of the consumed goods (e.g., businesses with positive or negative externalities). Similarly, the tax bases that are shared through the tax base sharing programs are not exogenously determined, but directly or indirectly relate to the goods consumed by the residents.

If the residents' choices related to consumption of these goods could be affected by the elements in an equalization program, then the resulting changes in the residents' consumption will change the size and composition of those factors.

In this dissertation we consider the following scenarios regarding the possible choices of factors that could be used as measures of fiscal capacity or as shared tax bases:

1. Residential tax base that is directly related to the residents' consumption of housing and could be used both as a measure of fiscal capacity or as a shared tax base.
2. Actual revenue collections that are directly related to the residents' consumption of publicly provided goods and could be used as a measure of fiscal capacity in incentive incompatible equalization programs.
3. Commercial and industrial tax bases that relate to the residents' consumption of environmental quality that is affected by positive or negative externalities produced by the presence of these businesses.

Theoretical analysis of these scenarios is important for our empirical work as we consider unintended consequences of Russia's regional equalization programs and of the Twin Cities Fiscal Disparities program in Minnesota. In Russia's regions equalization grants are distributed among municipalities based on the size of their actual revenue collections, which makes the second scenario relevant to that case. The Twin Cities Fiscal Disparities program taxes commercial and industrial tax bases in municipalities and then redistributes the proceeds in the inverse proportion of their per capita residential and nonresidential property values, which makes the first and third scenarios relevant to that case.[6]

By definition, an equalization program redistributes resources from jurisdictions that are better off to jurisdictions that are worse off according to some parameters. This redistribution could be done in many different ways, but in this dissertation we limit our

[6] In the empirical part of this dissertation when considering the Twin Cities Fiscal disparities program we focus on its effect on commercial and industrial property, leaving the analysis of its effect on other types of real property for future research.

analysis to two stylized equalization mechanisms: 1) a gap-filling program that collects a head tax from the residents of all jurisdictions and then distributes the proceeds to fill the gap between the area-wide standard of per capita expenditure needs and per capita fiscal capacity of each jurisdiction; 2) a tax base sharing program that taxes a particular tax base at a uniform area-wide tax rate and then distributes the proceeds as a uniform per capita grant among all jurisdictions in the area.

An equalization program will usually combine the elements of both of these equalization mechanisms, but treating them separately allows us to highlight the substitution effects produced by the expenditure components of equalization programs (i.e., by formulas that assign equalization grants to jurisdictions) and by their revenue components (i.e., by taxes that contribute to equalization by taking more from jurisdictions with larger tax bases and less from jurisdictions with smaller tax bases.)

Even though these two types of the equalization programs have been treated separately in the literature, there is a close resemblance of the equalization effect that they produce and they could be considered as mirror images of each other: the tax base sharing program takes more from better off jurisdictions and keeps the distributional part neutral, while the gap-filling program keeps the revenue side neutral, but gives more to poorer jurisdictions and less to richer ones when distributing the money. The following analysis shows that these two programs tend to produce similar substitution effects on the goods that are related to factors that are used either as measures of fiscal capacity or as shared tax bases.

The gap-filling equalization program collects the head tax *H* from each resident in all jurisdictions and redistributes the proceeds in the form of a per capita transfer according to the gap-filling formula:

$$Tr_i = b(N - C_i) \tag{3.1}$$

where N–the area-wide standard of per capita expenditure needs for equalized budgets, set by the equalizing government;

C_i –per capita fiscal capacity of jurisdiction *i* that shows its ability to raise budget revenues in per capita terms. As explained above, we will consider three scenarios of measuring fiscal capacity in per capita terms: by residential tax base, by actual revenue collections, and by commercial and industrial tax base;

b–degree of equalization ($0 \le b \le 1$.)

Given *N* and C_i the equalizing government can choose either *H* or *b*. If it chooses *H*–deciding how much revenues it is willing to collect from the residents of the area to spend on equalization–then the degree of equalization *b* is determined according to the following formula:

$$b = \frac{\sum_i^n (pop_i) \cdot H}{\sum_i^n pop_i (N - C_i)}, \tag{3.2}$$

where pop_i –population of jurisdiction *i*;

n–is a number of jurisdictions in the equalized area;

$\sum_i^n pop_i$ –population of the area included in the equalization program.

If the government sets the head tax *H* high enough, it could achieve a complete equalization by filling the gap between the area-wide standard of per capita expenditure needs *N* and per capita fiscal capacity C_i for each jurisdiction.

The equalizing government might choose the degree of equalization *b* instead, and then determine the size of the head tax that is necessary to provide a desired degree of equalization:

$$H = \frac{b\sum_{i}^{n} pop_i (N - C_i)}{\sum_{i}^{n} pop_i}$$

(3.3)

The tax base sharing equalization program taxes the bases in each jurisdiction in the area at a uniform tax rate *t* and then redistributes the proceeds as a per capita grant *h* among residents of the area. In per capita terms the amount contributed by jurisdiction *i* to the program is:

$$T_i = tB_i \tag{3.4}$$

where B_i–per capita tax base,

t–the area-wide tax rate imposed on the tax base according to the program.

The size of per capita grant *h* is determined by the amount of the tax collections divided by the size of total population in the area:

$$h = \frac{\sum_{i}^{n} pop_i tB_i}{\sum_{i=1}^{n} pop_i} \tag{3.5}$$

In per capita terms each jurisdiction contributes the amount of $T_i = tB_i$ in taxes and receives the amount of h in grants.

In this case the equalizing government can either choose the tax rate *t* and then the size of per capita transfer *h* will be determined according to the formula above, or choose the size of per capita transfer *h* and then determine the required tax rate *t*:

$$t = \frac{h\sum_{i=1}^{n} pop_i}{\sum_{i=1}^{n} B_i} \tag{3.6}$$

We show how these two equalization programs change budget constraint faced by the representative individual in the equalized jurisdiction and produce the substitution effects that tend to encourage the representative individual to reduce her consumption of the goods that are related to the factors that are used as either as the measure of fiscal capacity in the gap-filling equalization program or as a shared tax base in the tax base sharing program.

There are four major simplifying assumptions used in the theoretical model:

1. The model is static, which means that all adjustments take place immediately (or in other words, we allow in the analysis for an extended period of time so that all processes have enough time to come to equilibrium.)

2. We assume that the population of the jurisdictions is homogeneous, which allows us to consider the representative individual and analyze her behavior in order to predict how the whole jurisdiction would react.

3. The population is not mobile, so we should not worry about residents of the jurisdictions moving from one jurisdiction to another as well as outside of the equalized

area when an equalization program is introduced. This assumption also allows us to leave outside of the model the capitalization effect resulting from the changes in the effective prices of goods that are related to factors used as measures of fiscal capacity or as shared tax bases.

4. Also for simplicity, the model does not distinguish between private and public goods because in the totally homogeneous communities taxes work like user fees. In such a situation the representative individual gets from government what she pays for, and in this sense the way she chooses the desired amount of public good is similar to the way she chooses the desired amount of private good.

Using the Residential Tax Base as a Measure of Fiscal Capacity in the Gap-Filling Equalization Program or as a Shared Tax Base in the Tax Base Sharing Program

First, we consider a scenario in which the residential tax base is used as a measure of fiscal capacity in the gap-filling equalization program or as a shared tax base in the tax base sharing program.

As explained above, we assume that the population of each jurisdiction is homogeneous and all residents of the jurisdiction follow the representative individual in her choices. Suppose that the representative individual consumes housing X and all other goods (money) Y. Given that she has income I, her choice of the amount of housing and all other goods will be determined as a solution of the following utility maximization problem:

$$\begin{aligned} &Max\, U(X,Y) \\ &s.t.\ p_x X + Y = I \end{aligned} \tag{3.7}$$

The solution of this problem is determined by the standard first order conditions.

Using the Residential Tax Base as a Measure of Fiscal Capacity in the Gap-Filling Equalization Program

Now, suppose that the gap-filling equalization formula described above is introduced. In formula (3.1) that determines the size of the equalization grant, fiscal capacity *C* is measured by the residential property values multiplied by the standard tax rate:

$$C = tp_x X \tag{3.8}$$

Accordingly, the transfer formula takes the following form:

$$Tr = b(N - tp_x X) \tag{3.9}$$

The representative individual also has to pay the head tax *H*. After adding the amount of per capita transfer determined by formula to the budget constraint, subtracting the amount of the head tax from it and rearranging the terms, we receive the new budget constraint that the representative individual is facing after the equalization program is introduced:

$$p_x(1+bt)X + Y = I + bN - H\,. \tag{3.10}$$

The first thing to notice here is that the change in the budget constraint resulting from the introduction of the gap-filling equalization program changes the effective price of the good consumed by the representative individual: the price of housing as the representative individual perceives it increases from p_x to $p_x(1+bt)$. Intuitively, the presense of the gap-filling equalization program increases the opportunity cost of one unit of housing as in this case the representative individual should take into account not only

the price she must pay to get one more unit of housing, but also the decrease in the amount of equalization transfers that goes down as the size of housing goes up.

As housing becomes more expensive, the substitution effect takes place that moves the representative individual's consumption away from housing–this is the major point of our model.

Another effect of the program on the budget constraint is that the representative individual's income changes by the amount of $bN - H$. This change in income also affects consumption of housing: because housing is a normal good, an increase in income will increase and a decrease in income will reduce its consumption. The income effect resulting from redistribution of resources among jurisdictions can either encourage or discourage residents of the jurisdictions from consumption of housing, reinforcing or offsetting the substitution effect.

We can specify the conditions under which the ultimate effect will be positive or negative referring to the compensated law of demand. The compensated law of demand tells us that if an increase in the price from p_x to $p_x(1+bt)$ is compensated by the amount of btp_xX that makes the initial consumption just affordable at a new price, then the consumption of *X* should unambiguously decrease. Because housing *X* is a normal good, we know that the consumption of *X* should unambiguously decrease if the compensation is smaller than btp_xX , but if the compensation is larger than btp_xX then we can not say with certainty how the representative individual will change her consumption of *X* as the income effect may or may not overpower the price effect.

To find out the effect of the equalization program on consumption of housing *X* by the representative individual, we can compare the amount of income that is necessary

to exactly compensate the representative individual for the change in the price $btp_x X$ with the income effect of the program that the representative individual is facing. Accordingly, assuming that housing is a normal good, we can claim that if $bN - H \leq btp_x X$, then the change in the representative individual's income is not enough to compensate her for the price increase, and her consumption of housing *X* will unambiguously decrease. If $bN - H > btp_x X$, then we can not say with certainty whether consumption of X will go up or down because the income effect might overpower the price effect.

Note that the above conditions define net donors and net recipients of the program: we can rearrange $bN - H \leq btp_x X$ into $b(N - tp_x X) \leq H$, which defines the effect of the program on the representative individual residing in the net donor jurisdiction, and $bN - H > btp_x X$ into $b(N - btp_x X) > H$, which defines the effect of the program on the representative individual residing in the net recipient jurisdiction. According to the argument presented above, the representative individuals in the net donor jurisdictions should unambiguously decrease their consumption of housing, and the representative individuals in the net recipient jurisdictions could either decrease or increase their consumption of housing depending on whether the income effect of the program overpowers its price effect.

Using the Residential Tax Base as a Shared Tax Base in a Tax Base Sharing Program

Now, suppose that instead of the gap-filling equalization program a tax base sharing program is introduced. The tax base sharing program taxes residential property values in the jurisdiction at an area-wide tax rate *t* and then redistributes the proceeds of

taxation among its residents as per capita grant *h*. It means that in per capita terms each jurisdiction contributes the amount of $tp_x X_i$ to the program and receives the amount of *h*.

The budget constraint that the representative individual is facing now takes the following form:

$$p_x(1+t)X + Y = I + h \tag{3.11}$$

Similar to the case of a gap-filling equalization program, the major point here is that the tax base sharing program increases the effective price of housing as the representative individual perceives it: the price goes up from p_x to $p_x(1+t)$ - this is a standard result in the analysis of the effect of taxation. Intuitively, the presence of the tax base sharing program increases the opportunity cost of one unit of housing as the representative individual should take into account not only the price she must pay to get one more unit of housing, but also an increase in her tax payments as these go up as the size of housing goes up.

Accordingly, this increase in price results in a substitution effect that encourages the representative individual to decrease consumption of housing.

Also, similar to the case of a gap-filling equalization program, there is a change in the representative individual's income as she receives the per capita transfer *h*. We can show that the ultimate effect of the program on consumption of housing by the residents depends on whether they live in net donor jurisdictions or in net recipient jurisdictions. The representative individual residing in a net donor jurisdiction will unambiguously decrease her consumption of housing *X*, while the representative individual residing in a net recipient jurisdiction the effect is uncertain as the income effect could overcome the income effect.

Using the Size of Actual Revenue Collections as a Measure of Fiscal Capacity in the Gap-Filling Equalization Program

To show the effect of equalization on the size of revenue collections when these are used as a measure of jurisdictions' fiscal capacity, we just need to notice that budget revenues are spent for publicly provided goods:

$$R = p_G G \tag{3.12}$$

where *R*–actual revenue collections to the jurisdiction's budget,

G–the amount of publicly provided goods,

p_G –prices of the publicly provided goods.

This equality between the revenue collections and the expenditures holds as long as there is no substantial borrowing for a long period of time, which is a reasonable assumption in many cases. Assuming that the prices of publicly provided goods do not change, there is a direct proportion between the amount of publicly provided goods G, expenditures for these goods $p_G G$, and, most importantly for our analysis, actual revenue collections *R*.

Accordingly, if we can analyze how equalization affects the representative individual's consumption of publicly provided goods *G*, then we can argue that the changes in the consumption of these goods will transfer proportionally into the changes in actual revenue collections.

Suppose that the representative individual spends her income *I* on publicly provided good *G* that is priced at p_G and all other goods (money) *Y*. We assume the benefit taxation scenario, which means that the representative individual is aware of the

true cost of publicly provided good *G* and which allows us to leave distortionary taxation outside of the model.

The jurisdiction's government follows the representative individual's decision about the amount of publicly provided good that she chooses to consume as it collects the amount of revenue *R* that is sufficient to finance the provision of the chosen amount of the good.

Without equalization the representative individual's consumption is determined as a solution of the following utility maximization problem:

$$\begin{aligned} &Max\, U(G,Y) \\ &s.t.\ p_G G + Y = I \end{aligned} \tag{3.13}$$

The solution of this problem is determined by the standard first order conditions.

Now, suppose that an equalization program is introduced that includes a per capita equalization grant distributed according to the gap-filling equalization formula (3.1) where fiscal capacity is measured by actual revenue collections *R*:

$$Tr = b(N - R) \tag{3.14}$$

As we substitute $p_G G$ for *R* in the transfer formula, it takes the following form:

$$Tr = b(N - p_G G) \tag{3.15}$$

The representative individual also has to pay the head tax *H*, determined according to formula (3.3.) Adding these two additional elements to the budget constraint that the representative individual has been facing before the equalization program was introduced and rearranging the terms, we receive the following expression for the new budget constraint:

$$p_G(1+b)G + Y = I + bN - H \tag{3.16}$$

The change in the budget constraint resulting from the introduction of the gap-filling equalization program is very similar to the scenario where fiscal capacity is measured with the size of residential property values: in this case we also can see that the price of the publicly provided good *G* as it is perceived by the representative individual increases from p_G to $p_G(1+b)$, resulting in a substitution effect as the representative individual reduces consumption of the good that became more expensive. Intuitively, the presense of the gap-filling equalization program increases the opportunity cost of one unit of publicly provided good because in this case the representative individual should take into account not only the price she must pay to get one more unit of publicly provided good, but also the decrease in the amount of equalization transfers that goes down as the amount of revenue collections that are used to buy more publicly provided good goes up.

Note, that an increase in the price of publicly provided good is larger, larger is the degree of equalization *b*, which means that a larger degree of equalization produces a larger substitution effect.

The income effect of the program is exactly the same as in the case above because the representative individual's income also changes by the amount of $bN - H$. Following the same steps as above we can show that the income effect either reinforces or offsets the substitution effect depending on whether the representative individual resides in a net donor or in a net jurisdiction recipient.

As we pointed out above, because the amount of publicly provided good is proportional to the amount of actual revenue collections we can extend the results of our analysis in this case towards the effect of equalization on the amount of actual revenue collections. Thus, we conclude that using actual revenue collections as a measure of

fiscal capacity in the gap-filling equalization program results in a substitution effect that decreases the actual revenue collections, and the income effect can either reinforce or offset the substitution effect.

Using the Size of Commercial and Industrial Tax Bases as a Measure of Fiscal Capacity or as a Shared Tax Base

In this section we consider the effect of equalization on the size of commercial and industrial tax bases when these are used as a measure of fiscal capacity or as a shared tax base. Commercial and industrial tax bases can include any tax bases that are related to economic activities in jurisdictions. For example, in the case of the Twin Cities Fiscal Disparities Program, which is considered in the empirical part of this dissertation commercial and industrial property values are used as both a shared tax base and as a measure of fiscal capacity.

The model that we present here is based on the model of business locations developed by Fischel (1975), who argues that under certain conditions businesses that produce negative externalities have to compensate residents of the jurisdictions where they want to locate for the loss of environmental quality caused by these externalities. In such a case the market for business location develops where jurisdictions sell their environmental quality supplying locations for businesses and businesses purchase the environmental quality as they demand the locations. We extend this model considering a situation when positive externalities such as commuting and shopping conveniences produced by businesses exceed negative externalities resulting in a net positive effect. The key point of our analysis is that in both cases (i.e., whether businesses produce net positive or net negative externalities) an equalization program changes the effective price of environmental quality as perceived by the representative individual creating a substitution effect that tends to decrease the presence of businesses in the jurisdictions. The income effect resulting from redistribution of resources among jurisdictions can

either encourage or discourage residents of the jurisdictions from accepting the businesses inside their borders, reinforcing or offsetting the substitution effect.

The Presence of Businesses Produces Net Negative Externalities

Suppose that the representative individual's income is *I* and she consumes environmental quality *E* and all other goods (money) *Y*. Similar to the previous scenarios, we assume that all residents in the jurisdiction are identical and follow the representative individual in her choices. The environmental quality is a pure public good, so each resident consumes the same amount of it.

The amount of environmental quality that the representative individual consumes is determined by the following formula:

$$E = E_0 + \alpha F \tag{3.17}$$

where E_0 is the original endowment of environmental quality in the jurisdiction, and F is some measure of economic activity in the jurisdiction that affects the amount of environmental quality according to parameter α.

For simplicity, we assume that *F* is the number of firms located in the jurisdiction and that it accurately measures the level of economic activity there, in which case parameter α shows how the number of firms affects the environmental quality in the jurisdiction. Assuming that businesses produce negative externalities (noise, pollution, traffic, etc), parameter α is negative and as the representative individual allows more firms in her jurisdiction the amount of environmental quality that she consumes goes down from the original level of E_0. Of course, to be able to regulate the amount of environmental quality in their jurisdictions this way residents should have some instruments to keep the businesses out of their jurisdiction or let them in when they

choose to do so. We assume that for this purpose they can use zoning control or some other forms of regulation.

As the presence of firms decreases the amount of environmental quality, consumed by the residents, the residents will only allow businesses to locate in their jurisdiction if the businesses compensate them for the loss of environmental quality by making some form of payment. We assume that the compensation is made by means of direct cash payments to the local government that divides the total amount equally among residents–this is what Fischel (1975) calls the direct payment system of compensation.

The residents are assumed to be immobile, while businesses are mobile. Firms can shop around for business locations and the interaction of supply and demand results in a competitive equilibrium with the price per unit of the environmental quality p_E.

Under these assumptions the representative individual's choice of the amount of environmental quality and all other goods will be determined as a solution of the following utility maximization problem:

$$\begin{aligned} &Max\, U(E,Y) \\ &s.t.\ p_E E + Y = I \end{aligned} \tag{3.18}$$

The solution of this problem is determined by the standard first order conditions. The level of consumption of environmental quality determines the number of firms located in the jurisdiction according to formula (3.17).

Now, suppose that a gap-filling equalization program is introduced. This program includes per capita equalization grant distributed according to formula (3.1) where fiscal capacity is measured with the size of commercial and industrial tax bases in the jurisdiction multiplied by standard tax rate *t*. In the simplest case of that kind, fiscal capacity could be measured by the number of firms located in the jurisdiction multiplied

by the standard tax rate:[7]

$$Tr = b(N - tF) \tag{3.19}$$

We can rearrange formula (3.17) to express the number of firms as a function of environmental quality:

$$F = \frac{E - E^0}{\alpha} \tag{3.20}$$

After we substitute this expression in transfer formula (3.19), it takes the following form:

$$Tr = b\left(N - t\frac{E}{\alpha} + t\frac{E^0}{\alpha} \right) \tag{3.21}$$

Similar to the cases above, we add the transfer and the head tax *H* to the budget constraint, rearrange the terms and receive the following expression for the new budget constraint:

$$\left(p_E + \frac{bt}{\alpha} \right) E + Y = I + bN + \frac{bt}{\alpha} E^0 - H \tag{3.22}$$

As in the scenarious that we consider above (i.e. when fiscal capacities of jurisdictions are measured by the size of residential tax bases or by the size of revenue collections), in this case the key point is also that the change in the budget constraint resulting from the introduction of the gap-filling equalization program changes the effective price of the good consumed by the representative individual: the price of environmental quality as the representative individual perceives it changes from p_E to $p_E + \frac{bt}{\alpha}$.

[7] Of course, in this case t is not a conventional tax rate applied to a tax base, but a dollar amount charged from each firm.

Because we assumed that parameter α is negative (i.e., the presence of businesses reduces the amount of environmental quality in the jurisdiction), the price of environmental quality goes down. Intuitively, the gap-filling equalization program decreases the opportunity cost of environmental quality as in this case when the representative individual increases its consumption, the decrease in the payments resulting from the decrease in the number of businesses is partly compensated by the increase in the equalization transfers.

As the price of environmental quality goes down, the representative individual is encouraged to consume more of it and, accordingly, to allow fewer businesses inside the borders of the jurisdiction. Thus, also as in the scenarios considered above, the substitution effect of the equalization program tends to reduce the size of the factor that is used as a measure of fiscal capacity.

Also as above, the introduction of the equalization program changes the representative individual's income, in this case by the amount of $bN + \frac{bt}{\alpha}E^0 - H$. The income effect either reinforces or offsets the substitution effect depending on whether the representative individual resides in a net recipient or in a net donor jurisdiction.

Now, suppose that instead of a gap-filling equalization program a tax-base sharing program is introduced. This program taxes commercial and industrial tax bases according to formula (3.4) where *B* is measured by the number of firms *F* located in the jurisdiction in per capita terms:

$$T_i = tF_i \tag{3.23}$$

The total amount collected in taxes is redistributed as per capita grant *h*. As we substitute F using expression (3.20) in the tax formula, it takes the following form:

$$T = \frac{t}{\alpha}(E - E^0)$$

(3.24)

After subtracting the amount of the tax from the budget constraint, adding the amount of per capita grant *h* and rearranging the terms, we receive the new budget constraint faced by the representative individual:

$$\left(p_E + \frac{t}{\alpha}\right)E + Y = I + \frac{t}{\alpha}E^0 + h \qquad (3.25)$$

In this case we can see familiar changes in the budget constraint as the price of environmental quality *E* as it is perceived by the representative individual decreases by the amount of $\frac{t}{\alpha}$ (assuming that parameter α is negative) and the representative individual's income changes by the amount of $\frac{t}{\alpha}E^0 + h$. (Note, that because parameter α is negative the change in income could be either positive or negative.) Accordingly, the reduction in the price encourages the representative individual to consume more of environmental quality, allowing fewer firms to locate in the jurisdiction, while the change in income might reinforce or offset the substitution effect.

The Presence of Businesses Produces Net Positive Externalities

To analyze the case when businesses produce net positive externalities we just need to notice that the sign of parameter α will be positive in this case and follow the same steps as above. As we can see from formula (3.17), when α is positive the amount of environmental quality increases as the number of businesses *F* goes up. Because the presence of businesses produces environmental quality consumed by residents, residents

are willing to pay businesses to attract them into their jurisdictions, and a market for business location develops where jurisdictions purchase net positive externalities produced by businesses.

Because now parameter α is positive, the change in the price of environmental quality from p_E to $p_E + \frac{bt}{\alpha}$ resulting from the introduction of the program means that environmental quality becomes more expensive, which results in a substitution effect reducing its consumption. This result is an inverse of what we have received when considering the case of net negative externalities produced by the presence of businesses, but because the relationship between the amount of environmental quality and the number of firms in this case is proportional, the change in the price for environmental quality produced by the program results in a decrease of the number of firms located in the jurisdiction as well. Also as above, the income effect of the program can either reinforce or offset the substitution effect.

In the case of tax base sharing program the change in the sign of parameter α produces a similar effect, leaving the major results of our analysis unchanged. As in the case when the presence of businesses produces negative externalities, an introduction of the tax base sharing program produces a substitution effect that decreases the number of firms located in the jurisdiction, while the income effect of the program might either reinforce or offset the substitution effect.

Table 1 summarizes the scenarios considered in the theoretical section of this work and demonstrates the substitution and the income effects that gap-filling and tax base sharing equalization program might produce on the factors that are used as a measure of fiscal capacity or as a shared tax base.

Table 1
The Substitution and the Income Effects of Gap-Filling and Tax Base Sharing Equalization Programs on the Factors that are Used as a Measure Fiscal Capacity or as a Shared Tax Base

Factor	**Good**	**Substitution effect on the good**	**Substitution effect on the factor**	**Income effect on the factor for recipient jurisdictions**	**Income effect on the factor for donor jurisdictions**
Residential tax base	Housing	Negative	Negative	Negative	Positive
Actual revenue collections	Publicly provided good	Negative	Negative	Negative	Positive
C/I tax base with negative externalities	Environ-mental quality	Positive	Negative	Positive	Negative
C/I tax base with positive externalities	Environ-mental quality	Negative	Negative	Negative	Positive

CHAPTER 4

EMPIRICAL ANALYSIS

To test empirically the hypothesis that equalization programs produce disincentives that negatively affect the size of the factors used to measure fiscal capacity or taxed with the purpose of further redistribution of resources, we study two cases. The first is a case study of the effect of equalization practices in Russia's regions towards their constituent municipalities. As the regions distribute transfers among municipalities based on the size of their actual revenue collections, the expected effect of equalization is a reduction in revenue collections in those regions where the degree of equalization is higher. The second case investigates the effect on the tax-base of the tax sharing program in the Twin Cities Metropolitan Area, Minnesota. This program taxes commercial and industrial properties in seven central counties of the metro area at a uniform tax rate and redistributes the proceeds among municipalities in direct proportion to the size of their population and in inverse proportion to the size of their per capita real property values. The expected disincentive effects that we empirically test should negatively affect the size of commercial and industrial property in the metropolitan area.

The Case of Russia

The equalization programs implemented by the regional governments in the Russian Federation vis-à-vis their local governments were (and in many cases they continue to be so) based on the revenues actually collected by the jurisdictions the year prior to the implementation of the equalization scheme (Martinez-Vazquez and Boex 2001). The theoretical model developed in the previous section shows that the equalization programs based on actual revenue collections produce a substitution effect

that decreases consumption of publicly provided goods and, consequently, reduce the size of budget revenue collections in the equalized jurisdictions. Accordingly, in this section we test the proposition that regional equalization programs negatively affected the size of revenue collections in the municipalities and that these effects have been more pronounced in those regions where the equalization schemes have been more aggressive (i.e., where the degree of equalization has been higher).

Estimating the Degree of Equalization Faced by Municipalities in Russia's Regions

The first step in our analysis is to estimate the degree of equalization that municipalities were facing in different regions as represented by parameter *b* in equation (3.14) in the previous section. As explained in the theoretical section, the larger the degree of equalization *b*, the larger the change in the price of the publicly provided good as the representative individual perceives it, and, accordingly, the larger the expected substitution effect produced by the equalization program that reduces consumption of the publicly provided good and, consequently, the size of budget revenue collections.

As the mechanisms that guide redistribution of resources among municipalities in Russia's regions are very complicated and lack transparency,[8] this task could not be done by direct analysis of those mechanisms to derive the degree of equalization in the regions. One can not look at the equalizing effect of regional grants in local budgets in per capita terms either because most regions measure municipalities' expenditure needs not by the size of their population, but by the size of their local infrastructure, which most of the

[8] See for example Bahl et al. (1999) for a description of mechanisms used to redistribute grants among municipalities in Leningrad oblast.

time is distributed quite unevenly among municipalities.[9] Instead we use the fact that parameter *b* in (3.14) could be interpreted as defining the rate of revenue clawback resulting form the equalization mechanism in which the size of equalization transfer *Tr* is determined by (3.14):

$$dTr/dR = -b \qquad (4.1)$$

As this expression shows, for the purpose of our analysis we do not need the information about the way the per capita expenditure needs *N* are measured in equation (3.14). What matters is how the size of regional transfers changes in response to changes in the size of actual revenue collections to municipalities' budgets. In reality, the system of shared taxes with variable sharing rates (which receive the name in Russia of "regulating rates") makes measuring the offsetting effect of regional transfers to municipalities a complicated task. In the following two sections we develop a new approach to this problem building on previous works by Alexeev and Kurlyandskaya (2003) and Zhuravskaya (2000).

Measuring Fiscal Incentives Faced by Municipalities in Russia

Revenue clawback occurs when changes in regional transfers partially or fully offset changes in the municipalities' own revenues. As explained above, the revenue clawback is an inevitable result of an equalization program that redistributes funds via equalization grants based on municipalities' actual revenue collections. This relationship

[9] This practice in some cases could still result in an equalization of locally provided services in per capita terms, in particular, if we take into account a common practice when schools and hospitals that are financed by one municipality serve residents of nearby localities, which makes them more of region-wide service providers rather than local entities.

allows us to estimate the degree of equalization by measuring the budget revenue collections clawback faced by the equalized jurisdictions.

Since changes in regional transfers might have not only offsetting, but also matching effects vis-à-vis municipalities' own revenues, we will use the more general term of "fiscal incentives." When changes in regional transfers offset changes in municipalities' own revenues, these fiscal incentives are negative (the clawback case), and when changes in regional transfers match changes in municipalities own revenues these fiscal incentives are positive (the matching case).

In the previous literature (Zhuravskaya 2000, Alexeev and Kurlyandskaya 2003), fiscal incentives are associated with the offsetting effect of changes in regional transfers in response to the changes in the municipalities' own revenues. The problem is that in these two works the term "own revenues" is defined differently and neither of the authors presents a clear argument why own revenues should be defined in a particular way. Zhuravskaya (2000) defines own revenues as the revenues from sources assigned to local budgets by federal laws, while Alexeev and Kurlyandskaya (2003) also include in this category revenues from shared regional taxes.

A natural question for us to ask is: what approach should we follow? To answer this question we analyze and compare these two approaches and then develop our own.

There is a difference in the samples of municipalities that the authors analyze, which might justify the differences in their approaches. Zhuravskaya's sample includes large cities from different regions of Russia with developed economies and relatively large tax bases. These municipalities retained relatively small shares of regional taxes and faced frequent changes in those shares from year to year.

In contrast, Alexeev and Kurlyandskaya's sample includes poorer municipalities from one region (Rostovskaya oblast), which retained the entire regional shares of major shared taxes for the period of time for which the data are available. The difference in these two approaches could be explained by the stability of sharing rates–as municipalities in Zhuravskaya's sample were facing frequent changes in the sharing rates, it might seem reasonable to consider the receipts from sharing taxes as an actively used tool of adjusting municipalities' revenues. In contrast, in Alexeev and Kurlyandskaya's sample the sharing rates are fixed at the maximum level and stay intact for three years, which makes it reasonable to consider the proceeds from shared taxes as "own revenues."

Zhuravskaya's approach reflects more orthodoxy in fiscal decentralization theory and practice, where revenue sharing is considered generally a transfer. Moreover, Zhuravskaya's approach is more sound from the point of view of the stability of sharing rates as the retention rates of municipalities' federally assigned own revenues could not be varied among local budgets according to the federal law.

In contrast, Alexeev and Kurlyandskaya's approach is less conventional, and from the point of view of the stability of sharing rates it is less secure because potentially no municipality could be absolutely sure that the region would not change its sharing rates at some point. Another problem with their approach is that they could only apply it to 46 out of 55 municipalities in Rostovskaya oblast because only those 46 municipalities were facing stable sharing rates during the period of observation.

Why bother at all by including shared revenue sources in the category of own revenues and making some assumptions about stability of sharing rates? Why limit the sample of municipalities to make sure that their sharing rates are unlikely to change?

There should be some serious advantage of including sharing revenues in the category of own revenues when the sharing rates are stable, or, equivalently, some serious disadvantage of including them in the category of transfers.

Alexeev and Kurlyandskaya do not elaborate on these questions–they just argue that because for those municipalities that were facing stable sharing rates only regional grants were used to offset changes in revenue collections it makes it relatively easy to separate own revenues from transfers by putting the proceeds from shared revenue sources in the category of own revenues.

We provide further support to the intuition behind Alexeev and Kurlyandskaya's approach by arguing that when a substantial portion of shared taxes is assigned to a local budget and the sharing rates do not change over a significant period of time, the revenues from these sources can be interpreted to become similar to the revenues from the federally assigned sources. Local governments can not change the tax rates for shared revenue sources, but they might be able to affect the size of the tax bases that most of the time are closely correlated with the tax bases for federally assigned own revenue sources, also local governments can influence tax administrators. From this angle when the sharing rates are stable it makes sense to put revenues from the shared sources in the same category as federally assigned own revenues.

Even though formally the revenues from the shared taxes in this case remain to be transfers, we should recognize the fact that these transfers are assigned to local budgets in a specific way–in direct proportion to the size of their tax bases. Conceptually, these are much closer to the federally assigned own revenues than to the regional grants (or direct subsidies as Alexeev and Kurlyandskaya call them), and should be treated as the revenues

that are subject to offset, not as the revenues that are used as the instrument of offset by regions.

This argument also provides us with an answer to another question–what is the disadvantage of including the proceeds from shared sources in the same category as grants when sharing rates are stable? Because we know that as long as the sharing rates stay unchanged only grants are used to offset changes in municipalities' revenues, putting proceeds from shared sources and grants in the same category will obscure our purpose–figuring out to what extend regions offset the changes in municipality's revenues. Thus, for municipalities that are facing stable sharing rates Alexeev and Kurlyandskaya's approach is more suitable than Zhuravskaya's method.

However, despite its advantage in terms of treating proceeds from shared sources when sharing rates are stable, Alexeev and Kurlyandskaya's approach has some serious problems as well.

Alexeev and Kurlyandskaya's reliance on the stability of sharing rates raises a number of questions. First, to what extent should a municipality be sure that, on the margin, the changes in collections of these taxes would not lead to changes in the sharing rates to justify the treatment of municipalities' shared revenues as their own revenues? Put differently, how large should the "cushion" of grants be to make sure that there is enough of them to be taken away by the region in response to an increase in the municipality's collections before the cuts in the sharing rates become likely?

There is little doubt that the municipalities that retained the entire regional shares of major shared taxes for a number of years and for which grants accounted for well over the half of their total revenues from Alexeev and Kurlyandskaya's sample can be quite

sure that they could go a long way in raising their collections before the region will consider cutting the sharing rates. But what if the share of grants in the municipality's total revenues is not over 50%, as in Alexeev and Kurlyandskaya' sample, but is about 20% or 10%? Would local government feel secure about their sharing rates being stable at 20% and not secure at 10%? And if so, where is the line that separates the secure zone of the share of grants in municipalities' total revenues from non-secure one? The fact is that conceptually it is impossible to draw such a line here, and potentially no municipality could be absolutely sure that the regional government will not cut its sharing rates if the municipality's collections rise high enough.[10]

How should we treat the proceeds from the shared taxes for those municipalities that are facing changes in sharing rates? Should we immediately switch to Zhuravskaya's approach, i.e., excluding all proceeds from shared revenue sources from the category of own revenues when we observe that a municipality experienced a change in its sharing rates however small that change was? What if a municipality retained the entire share of shared taxes for a number of years and then just in one year the region took away say 5% of the revenues from the shared sources–should we treat the entire proceeds from the shared revenue sources as transfers for all period of observation in this case?

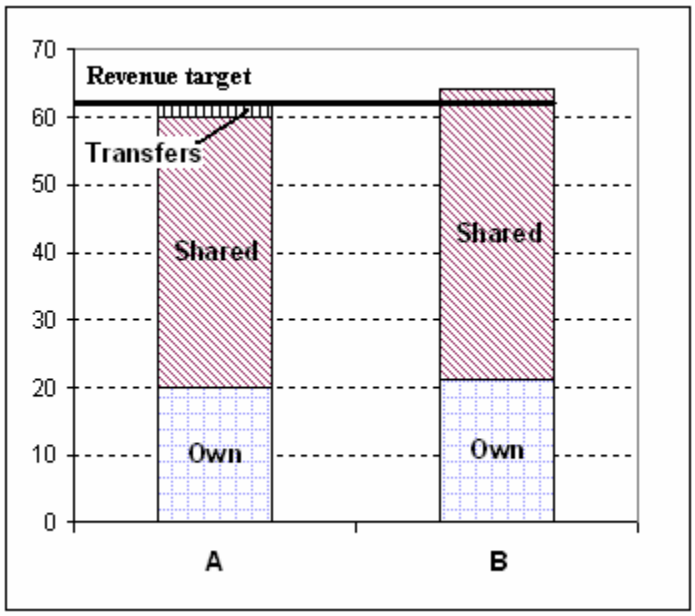
The following example shows that when municipalities retain a large portion of revenues from shared revenue sources this kind of triggering approach might be a source

[10] In fact, even having a substantial share of grants in a municipality's revenues does not guarantee that the sharing rates will not be cut, as some regions (e.g., Tyumenskaya oblast in late 1990s-early 2000s) preferred to provide its municipalities with grants even though it was possible to increase their sharing rates instead. Regional administration explained this policy by the fact that the municipalities' collections from the tax bases were very unstable and unpredictable, and the regional grants secured more stability in local budget revenues.

of inconsistency as in this case there would be apparent lack of continuity in treating municipalities with slightly different revenue structure.

Consider for example Figure 4.1, which shows the composition of per capita revenues for two municipalities. Both municipalities are very similar in terms of per capita revenues, but municipality A is a little bit poorer while municipality B is a little bit richer: when both municipalities retain the entire share of shared taxes municipality A collects 60 thousand rubles and municipality B collects 64 thousand rubles in revenues per capita. Suppose that the regional government sets the revenue target at 62 thousand rubles per capita, and, accordingly provides municipality A with 2 thousand rubles per capita in transfers, and cuts the sharing rates for municipality B in such a way that both municipalities exactly meet the revenue target of 62 thousand rubles per capita.

Figure 4.1: An Illustration of Triggering Approach When Separating Own and Shared Revenues for Two Municipalities with Similar Revenue Structure



Suppose than that per capita revenues of municipality A fluctuate just a little bit below the revenue target, so it keeps receiving regional transfers to close the gap, while per capita revenue of municipality B (if it retained the entire share of the shared taxes) fluctuate a little bit above the revenue target, so it keeps maintaining smaller than a 100% share in shared taxes. In such a case we will observe that municipality A is facing "stable sharing rates" while municipality B is not, and we will have to treat the shared revenues received by municipality A as its own revenues, and the shared revenues received by municipality B as regional transfers. Switching such a big chunk of revenues from one category to another based on such a small difference in sharing rates demonstrates the lack of continuity that presents a serious problem.

This analysis shows that not only the application of Alexeev and Kurlyandskaya's is limited to analysis of fiscal incentives faced by poor municipalities, but it is also quite problematic to combine Alexeev and Kurlyandskaya's approach with Zhuravskaya's

method to have a universal method of measuring fiscal incentives for all municipalities in Russia without exceptions.

Thus, given the two approaches used in the existing literature to measure fiscal incentives faced by municipalities that receive revenues from shared sources, we have two options: first, is to limit our analysis to municipalities that satisfy Alexeev and Kurlyandskaya's criteria of stable sharing rates, and, second, is to use Zhuravskaya's approach applying it universally to all municipalities for which the data are available.

As explained above, Zhuravskaya's approach is not suitable to analyze fiscal incentives of municipalities that were facing stable sharing rates for a long period of time.

Limiting our sample of municipalities to those that satisfy Alexeev and Kurlyandskaya's criteria of stable sharing rates means considering only poor municipalities that not only had the entire sharing rates of regional shared taxes assigned to their budgets for a long period of time, but also had a substantial share of grants in their revenues to make sure that they would not face changes in sharing rates in case their revenues increase. Even though the number of such municipalities in Russia is substantial, especially in the poorer regions (e.g., in1996-98 in Rostov oblast, considered by Alexeev and Kurlyandskaya, more than 80% of municipalities satisfied these criteria), their tax bases comprise rather small portion of the regions' total as most of them are represented by rural rayons whose agricultural economies do not generate enough revenues to cover local governments' expenditure needs.

By any means, applying a method that limits our analysis to a particular sample of municipalities is not a desirable thing to do. Alexeev and Kurlyandskaya admit that their

results can not be meaningfully compared with Zhuravskaya's results because the characteristics of municipalities included in their analysis are very different.

As we are facing two possible approaches to measure fiscal incentives faced by municipalities, neither of which is free from problems, we develop our own, more general approach. This approach incorporates Alexeev and Kurlyandskaya's as their approach is a special case of our method, while Zhuravskaya's approach could be considered as an approximation of our method when municipalities' sharing rates are actively used by the regional government to offset changes in local revenues.

The core of our approach is the notion that the changes in proceeds from shared revenue sources could be separated into two components: one component resulting from changes in the size of tax bases and fiscal discipline in the municipality, and another component resulting from the changes in sharing rates. We attribute the first component to the same category as changes in municipalities' federally assigned own revenues, considering it as the subject of offset by regional government, and attribute the second component to the same category as the changes in regional grants received by municipalities, considering it as the instrument of offset used by regional government.

For example, if the sharing rate for some revenue source had been reduced from the previous year, the revenues from this source would go down, other things being equal, but we do not want to count this decrease as the one that the regional government might offset with changes in grants because that decrease was the result of its own decision. Quite to the contrary, we want to put the changes in shared revenues resulted from the changes in sharing rates together with the changes in monetary transfers and

separate them from the changes in shared revenues that result from the changes in the size of the tax bases and in fiscal discipline.

More formally, if we define the revenues from shared tax *j* of municipality *i* in year *t* as

$$SR_{ij}^{t} = C_{ij}^{t} S_{ij}^{t}, \tag{4.1}$$

where *C* represents the collections of the tax that are split between local and regional budgets according to sharing rate *S* (the share received by local budget of municipality *i*), then the change in these revenues could be separated in two components:

$$SR_{ij}^{t} - SR_{ij}^{t-1} = S_{ij}^{t-1}(C_{ij}^{t} - C_{ij}^{t-1}) + C_{ij}^{t}(S_{ij}^{t} - S_{ij}^{t-1}). \tag{4.3}$$

or in a shorter notation:

$$\Delta SR_{ij}^{t} = S_{ij}^{t-1}\Delta C_{ij}^{t} + C_{ij}^{t}\Delta S_{ij}^{t} \tag{4.4}$$

The first component, $S_{ij}^{t-1}\Delta C_{ij}^{t}$, represents the change in municipalities' revenues from shared taxes resulting from the change in the size of collections, given that the sharing rate is fixed. These changes in the revenues could be affected by local governments, assuming that they have tools to influence the size of local tax bases and tax administration effectiveness in their municipalities.

The second component, $C_{ij}^{t}\Delta S_{ij}^{t}$, represents the change in municipalities' revenues from the shared tax resulting from the change in the sharing rate, given that the amount of collections from this revenue source does not change. The sharing rate is changed by the region and can not be affected by local government, similar to the change in the size of grant from regional budget.

We put the changes in the federally assigned revenues together with the first component and call these the changes in the "assigned revenues":

The change in the assigned revenues from the previous year is:

$$\Delta AR_{ij}^{t} = \Delta FAR_{i}^{t} + \sum_{j} S_{ij}^{t-1} \Delta C_{ij}^{t}, \tag{4.5}$$

where ΔFAR_{ij}^{t} denotes the changes in federally assigned own revenues of the municipality, and $S_{ij}^{t-1}\Delta C_{ij}^{t}$ is defined above. The summation over *j* is made over the five major taxes that are commonly shared with local budgets in Russia (VAT, personal income tax, enterprise profit tax, enterprise asset tax, and excises).

We put the changes in regional transfers together with the second component and call these changes in "transfers":

The change in the transfers from the previous year is:

$$\Delta Tr_{i}^{t} = \Delta M_{i}^{t} + \sum_{j} C_{ij}^{t} \Delta S_{ij}^{t} \tag{4.6}$$

where ΔM_{i}^{t} denotes the changes in the amount of regional grants (monetary transfers), and $C_{ij}^{t}\Delta S_{ij}^{t}$ is the change in revenues resulting from the change in the sharing rate for five shared revenue sources.

Similarities and Differences between Our Approach and the Ones Used by Zhuravskaya (2000) and by Alexeev and Kurlyandskaya (2003)

We can compare this approach with the ones used by Zhuravskaya (2000) and Alexeev and Kurlyandskaya (2003)[11] by looking at equations (4.5) and (4.6) and the equations below that describe assigned revenues and transfers according to these authors[12]:

In Zhuravskaya, changes in own revenues are:

$$\Delta AR_i^t = \Delta FAR_i^t , \tag{4.7}$$

and changes in transfers are:

$$\Delta Tr_i^t = \Delta SR_i^t + \Delta M_i^t = \sum_j S_{ij}^{t-1} \Delta C_{ij}^t + \sum_j C_{ij}^t \Delta S_{ij}^t + \Delta M_i^t . \tag{4.8}$$

In Alexeev and Kurlyandskaya, changes in own revenues (assuming that $\Delta S_{ij}^t = 0$) are:

$$\Delta AR_i^t = \Delta FAR_i^t + \Delta SR_i^t = \Delta FAR_i^t + \sum_j S_{ij}^{t-1} \Delta C_{ij}^t \tag{4.9}$$

and changes in transfers are:

$$\Delta Tr_i^t = \Delta M_i^t \tag{4.10}$$

Here, (in Shishkin) changes in own revenues are:

$$\Delta FAR_i^t + \sum_j S_{ij}^{t-1} \Delta C_{ij}^t \tag{4.11}$$

and changes in transfers are:

$$\Delta M_i^t + \sum_j C_{ij}^t \Delta S_{ij}^t \tag{4.12}$$

Table 2 and Figure 4.2 summarize the difference between these three approaches:

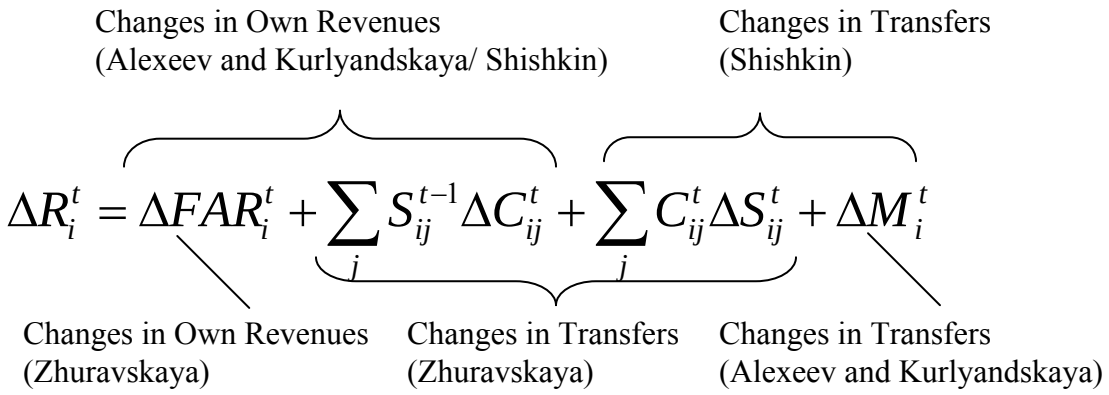
[11] In their work Alexeev and Kurlyandskaya (2003) enhance their approach by using planned figures of municipalities' revenues, but we represent the one where they use actual numbers as it makes it more comparable to our approach.

[12] The size of municipalities' population and year dummies are omitted from the equations.

Table 2
Summary of Three Approaches to Measure Fiscal Incentives Faced by Russia's Municipalities

	Changes in Assigned Revenues, ΔAR_i^t	Changes in Transfers, ΔT_i^t
Zhuravskaya (2000)	ΔFAR_i^t	$\Delta M_i^t + \sum_j S_{ij}^{t-1} \Delta C_{ij}^t + \sum_j C_{ij}^t \Delta S_{ij}^t$
Alexeev and Kurlyandskaya (2003)	$\Delta FAR_i^t + \sum_j S_{ij}^{t-1} \Delta C_{ij}^t$	ΔM_i^t
Shishkin (2007)	$\Delta FAR_i^t + \sum_j S_{ij}^{t-1} \Delta C_{ij}^t$	$\Delta M_i^t + \sum_j C_{ij}^t \Delta S_{ij}^t$

Figure 2: Summary of Three Approaches to Measure Fiscal Incentives Faced by Russia's Municipalities



The first thing we can notice is that when applied to the sample of municipalities considered by Alexeev and Kurlyandskaya, our approach produces identical results as their approach. The formulas used to calculate changes in assigned revenues are the same in both cases, and formulas used to calculated changes in transfers differ by the element

$\sum_j C_{ij}^t \Delta S_{ij}^t$, which is equal to zero when sharing rates are stable. Instead of separating this element from total changes in the proceeds from shared taxes as we do in our approach, Alexeev and Kurlyandskaya just exclude from their sample those municipalities that were facing changes in sharing rates, basically filtering this element away together with these municipalities. Thus, our approach is more general and it includes Alexeev and Kurlyandskaya's as a particular case.

The comparison also shows that changes in the assigned revenues defined according to our approach differ from the changes defined by Zhuravskaya by component $\sum_j S_{ij}^t \Delta C_{ij}^t$ - the changes in collections from shared revenues, given that sharing rates are fixed. Thus, these two formulas will produce identical results when municipality *i* retains none of shared taxes or when there is not changes in revenue collections, which makes this element equal to zero in our formula. Otherwise as long as the changes in the collections of federally assigned revenues and sharing taxes have the same sign,[13] the changes in the assigned revenues defined according to our method will always exceed the changes defined according to Zhuravskaya (in absolute values.) The difference would be the larger the larger is the sharing rate retained by a municipality.

The changes in transfers defined according to our approach differ from the changes defined by Zhuravskaya by the component $\sum_j S_{ij}^{t-1} \Delta C_{ij}^t$ as well. Assuming that the regions tend to offset changes in federally assigned revenues and in revenues from shared taxes with the changes in the sharing rates and in the amount of monetary

[13] This should be the case most of the time as both federally assigned revenues and shared taxes are linked to the same economic base.

transfers, the total change in transfers according to our approach should also be larger than the one defined according to Zhuravskaya (in absolute values.)[14]

The Data Sources Used to Estimate the Fiscal Incentive Coefficients

To calculate the changes in the assigned revenues according to formula (4.5), and the changes in the transfers according to formula (4.6) that are used to estimate fiscal incentives that municipalities were facing in different regions, we need the following data:

1) federally assigned own revenues,
2) collections of shared revenues,
3) sharing rates,
4) monetary transfers from regional budgets to localities.

Federally assigned own revenues and monetary transfers data are available from the Center for Fiscal Policy's database, which contains individual municipalities' budget data for a number of regions from 1995 to 2001. Sharing rates are retrieved from the regional budget laws, available on the Internet.[15]

To adjust the data for different years, we follow Alexeev and Kurlyandskaya's suggestion to adjust the data by the ratio of the region sum of municipal total revenues for the relevant years instead of using the price index. They argue that using this kind of adjustment instead of the price index might make more sense because there is a number of factors besides the change in the general price level in the region that affect regional

[14] The fact that both components are larger in my case should not be confusing if we keep in mind that we are talking about absolute values here. As we expect the offsetting effect from one component on another, the sum of the changes in nominal values should be the same whether we use Zhuravskaya's approach or mine.

[15] Accessed 1 June 2007, available from www.budgetrf.ru

budgets and their ability to provide municipalities with transfers in particular. According to Alexeev and Kurlyandskaya, in this case revenues of municipality *i* in year *t* would be multiplied by the ratio of the sum of municipal revenues in the region in year *t* to that of *t-1*:

$$\gamma = \frac{\sum_{i}^{n} R_i^{t-1}}{\sum_{i}^{n} R_i^{t}} \tag{4.13}$$

where R_i^t –total revenues (including assigned revenues and monetary grants from regional budget) of municipality *i* at year *t*,

R_i^{t-1} –total revenues of municipality *i* at year *t-1*,

n–the number of municipalities in the region,

Thus, adjusted revenues for municipality *i* from revenue source *j* in year *t* would be calculated as:

$$\hat{R}_{ij}^t = \gamma \cdot R_{ij}^t \tag{4.14}$$

I use a similar technique, but instead of multiplying revenues of municipality *i* in year *t* by the ratio of the sum of municipal revenues in the region in year *t* to that of *t-1* I multiply it by the ratio of the sum of municipal revenues in the region in year *t* to that of year *T*, where *T* indicates the first year for which the data are available for this particular region:

$$\delta = \frac{\sum_{i}^{n} R_i^{t}}{\sum_{i}^{n} R_i^{T}} \tag{4.15}$$

where R_i^T –total revenues of municipality *i* at year *T*,

Accordingly, adjusted revenues for municipality *i* from revenue source *j* in year *t* are calculated as:

$$\hat{R}_{ij}^{t} = \delta \cdot R_{ij}^{t} \tag{4.16}$$

It makes the sum of adjusted total revenues of all municipalities in a region in each year equal to their revenues in the base year. This adjustment eliminates all shifts in municipalities' total revenues that could have resulted from different factors that affected all municipalities as a whole (e.g., reassignment of expenditure responsibilities) and only leaves year to year variations in municipalities' revenues relative to each other.

One of the greatest challenges for our empirical analysis is the fact that the data for revenue collections from the territory of each municipality are not available. Thus, we need to find some proxy to estimate these collections. For this purpose I use the data on revenues received by local budgets and their retention rates for shared revenue sources. For federally assigned own revenue sources the relationship between the amount of collections and the amount of revenues is straightforward as either all collections or a certain proportion of the collections from those revenue sources that is uniformly determined for all municipalities in Russia by federal law are supposed to end up in the local budgets as their revenues.

For shared revenue sources the relationship between the amount of collections and the amount of revenues received by local budgets is also straightforward as long as the local budget retains 100% of the collections.[16] When the sharing rate is less than 100%, we should realize that the revenues received by the local budget from this revenue source represent only a fraction of total collections (i.e., the collections that are split

[16] As in Alexeev and Kurlyandskaya's sample of municipalities.

between local and regional budgets), and this fraction is determined by the size of the sharing rate:

$$R_{ij}^{t} = S_{ij}^{t} C_{ij}^{t} \tag{4.17}$$

When we know the share of collections that municipality *i* was supposed to retain for revenue source *j* in year *t*, S_{ij}^{t}, and the size of revenues from this source, R_{ij}^{t}, we can estimate the size of collections by rearranging this formula and presenting it in the following form:

$$C_{ij}^{t} = R_{ij}^{t} / S_{ij}^{t}, \tag{4.18}$$

The relationship between the size of collections and the sharing rate is inverse because the smaller municipality's sharing rate, the larger is the portion of collections retained by regional budget. Thus, given the amount of revenues received by local budget, the smaller its sharing rate, the large is the amount of revenues received by the regional budget from this revenue source from the territory of the municipality, and, accordingly, the larger the total collections from this revenue source.

Accordingly, the changes in municipalities' revenues from shared taxes resulting from the change in the size of collections, given that the sharing rate is fixed, can be calculated as

$$S_{ij}^{t-1} \Delta C_{ij}^{t} = S_{ij}^{t-1} \left(\frac{R_{ij}^{t}}{S_{ij}^{t}} - \frac{R_{ij}^{t-1}}{S_{ij}^{t-1}} \right), \tag{4.19}$$

The changes in municipalities' revenues from the shared tax resulting from the change in the sharing rate, given that the amount of collections from this revenue source does not change can be calculated as:

$$C_{ij}^{t}\Delta S_{ij}^{t}=\frac{R_{ij}^{t}}{S_{ij}^{t}}\Delta S_{ij}^{t}. \tag{4.20}$$

As we can see from formula (4.18), we can not estimate the amount of collections from a shared revenue source when the sharing rate S_{ij}^{t} is zero: as the local budget receives nothing of total collections from this revenue source we can not use its revenues as an indicator of how much revenues from this source have been collected on its territory. All revenues from this revenue source go into the regional budget, and as we do not have the information on how much revenues have been collected in the regional budget from each municipality, we can not estimate the amount of revenue collections in this case.

For our purposes, it is not a problem when a sharing rate in the previous year S_{ij}^{t-1} is equal to zero because in this case the left side of equation (4.19) is equal to zero. The following rearrangement of equation (4.19) clarifies this observation:

$$S_{ij}^{t-1}\Delta C_{ij}^{t}=S_{ij}^{t-1}\frac{R_{ij}^{t}}{S_{ij}^{t}}-R_{ij}^{t-1} \tag{4.21}$$

All elements in this formula both in the left side and in the right side are equal to zero (the amount of revenues R_{ij}^{t-1} is naturally equal to zero when the sharing rate is set to zero).

Intuitively, when the sharing rate in the previous year is zero, changes in the amount of collections do not affect the changes in the amount of municipality's revenues given that the sharing rate is unchanged.

When sharing rates both in the current and in the previous year are set to zero, this is not a problem either because in such a case we know that the municipality received

none of revenues from this shared source and its revenues were not affected neither by changes in its collections as calculated by formula (4.19) nor by changes in its sharing rates as calculated by formula (4.20). In other words, we just set both elements calculated by formulas (4.19) and (4.20) to zero.

When the sharing rate in the current year, S_{ij}^{t}, is set to zero, and the sharing rate in the previous year, S_{ij}^{t-1} is not, we can not receive meaningful results using formulas (4.20) and (4.21) as S_{ij}^{t} is present in the denominators in both formulas.

There are very few instances of this kind, and in such a case we can assume that the sharing rate in the previous year was also zero, reducing this case to the previous one.[17]

Estimating Municipalities' Fiscal Incentives

The Center for Fiscal Policy's budget database provides the data on individual municipalities' revenues from 1995 to 2001 for a number of regions with some gaps. There are also some gaps in the budget laws of the regions (some laws are not available and some budget laws miss appendixes with sharing rates). The analysis of the data has shown that the data on municipalities' revenues for 1995 and 1996 are not reliable, and because of it I limit the use of the data for years 1997-2001.

The available data allow us to get 123 estimates of municipalities' fiscal incentives in 47 regions over a period of 4 years. The general estimation form is given by

$$\Delta Tr_i^t = a + k \cdot \Delta AR_i^t + b \cdot Pop_i + e_i^t, \qquad (4.22)$$

[17] To treat this case more accurately we can extrapolate the amount of collections in the pervious year to the current year, assuming that they grew at the same rate as the federally assigned own revenues of the municipality.

These estimates are presented in Appendix I.

The major conclusion that we can make looking at this table is that most of the time (93 out of 123 estimates) municipalities were facing negative fiscal incentives (i.e., clawbacks). Another observation is that there is a limited number of regions where municipalities were facing strictly negative or strictly positive fiscal incentives for all years for which the data are available: for municipalities in 18 regions the estimates of fiscal incentives are strictly negative and for municipalities in 2 regions the estimates are strictly positive. For municipalities in the other 27 regions the estimates of fiscal incentives are zigzagging from positive to negative and back.

The presence of gaps in the panel does not allow us consistently to compare fiscal incentives that municipalities were facing in different regions. For example, of those 18 regions where municipalities were facing negative fiscal incentives in each year for which the data are available, only 7 have four or three years of observations. All others have two years or even only one year, as for example, Arkhangelskaya oblast. We can only guess which sign the estimates of fiscal incentives would have in the years for which the data are not available.

Those regions with strictly negative estimates of fiscal incentives and at least three years of observations are Buryatia republic, Amurskaya oblast, Rostovskaya oblast (used by Alexeev and Kurlyandskaya in their analysis), and Sakhalinskaya oblast (four years of observations), Kurskaya oblast, Leningradskaya oblast, and Sverdlovlskaya oblast (three years of observations).

There are two regions that have positive fiscal incentives coefficients for all years for which the data are available: Krasnoyarskiy krai (2000 and 2001) and Ivanovskaya oblast (1998 and 1999.)

The range of the fiscal incentive coefficients stays in a reasonable range: for the time period from 1998 to 2001 it varies from 1.25 for Kurganskaya oblast in 1999 to -1.3[18] for Tomskaya oblast in 2001.

The Effect of Municipalities' Fiscal Incentives on Tax Effort in Regions

In the theory section of this work we show that equalization programs based on actual revenue collections might create a substitution effect that discourage municipalities from consuming publicly provided goods, and, accordingly, collect smaller amounts of their own revenues, other things being equal, when the degree of equalization is higher. But for the amount of actual revenue collections to change when the degree of equalization increases it is not enough for municipalities to be facing certain disincentives–they also need to be able to change the amount of revenue collections according to these disincentives.

Thus, a critical question that we should ask before putting forward a hypothesis that will be tested empirically is whether Russia's local governments have any instruments that allow them to affect the amount of budget revenues collected on the territories of their jurisdictions if fiscal incentives or disincentives induce them to do so. We argue that, despite the fact that all taxes in Russia are collected by the federal Ministry and neither regional nor local governments have any formal power that allows

[18] When the estimate of fiscal incentives is less than one, like in this case, it means that for one ruble increase in revenues, municipalities in this region on average lose more than one ruble in transfers or in revenues from shared sources.

them to affect the administrative effort of revenue collections, their informal powers were quite substantial, especially in those days when tax arrears were rampant and extracting taxes from corporate taxpayers sometimes became more a political issue rather than an administrative one.[19] In accord with this view, Shleifer and Treisman (2000), Treisman (2000), and Cai and Treisman (2004) argue that regional administrations shielded firms in their regions from the federal tax collectors as they could influence local branches of federal courts and tax collection agencies. This argument could be extended to the local governments as well.

Even more relevant to our discussion is the argument that has been put forward by Bahl and Wallich (1995) and Martinez-Vazquez et al. (2006), that out of three tiers of Russia' government (federal, regional, and local) territorial subdivisions of the federal Ministry of Taxation are most strongly influenced by local authorities.

In particular, there are several tools that could be used by local authorities to manipulate the tax burden carried by businesses inside their borders. The practice when taxpayers were allowed to defer their tax obligations for a number of years and had been relieved of any penalties if they promised to start paying current obligations is one example. In this case municipalities can directly affect the amount of tax revenues collected in their budgets.

Another possibility for local governments to decrease tax burden on local businesses is to turn a blind eye on underground economy, and to discourage local tax police from being too eager when uncovering those businesses that choose to stay in

[19] For example, numerous Provisional Emergency Commissions for Enforcing Tax Discipline that were active in Russia in 1990s invariably included the heads of local administrations of those jurisdictions where persistent tax avoiders resided.

shadow. The estimates of the underground economy in Russia in 1990s vary from 20% to 27% of GDP,[20] which gives local governments plenty of room for manipulation of the size of their legal tax revenues as they decide how hard they should squeeze the informal sector. In this case municipalities can indirectly affect the amount of tax revenues collected in their budgets as the taxpayers who leave the shadow economy have to pay taxes to all levels of the government, including local budgets.

The latter instrument might not allow local governments to affect the mix of tax revenues collected from the taxpayers located in their jurisdictions (e.g., the local shares of federal taxes could not be paid to local budgets without regional and federal shared taxes being paid as well), but it might let them affect the flow of tax collections as a whole, i.e., the proceeds to the consolidated budget of the Russian Federation from the territory of the municipality. In this case those municipalities that are facing stronger disincentives resulting from the revenue clawback will be encouraged to reduce collections to their budgets, and they might be able to do it only by affecting the collections from all levels of the budgetary systems: local, regional, and federal.

The empirical hypothesis in this case should be that in those municipalities that are facing stronger revenue clawbacks (i.e., weaker fiscal incentives) resulting from regional equalization programs, revenue collections to the consolidated budget of the Russian Federation should be smaller.

An ideal way to test this hypothesis would be to regress the size of the budget revenues collected into consolidated budget of the Russian Federation in individual municipalities on fiscal incentives that they were facing and a set of control variables that

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[20] See for example Schneider and Enste (2000)

characterize each municipality. The magnitude of the fiscal incentives would not vary across municipalities inside regions, but only across the regions themselves because of the assumption that all municipalities in a particular region are facing the same fiscal incentives being exposed to the same equalization program. However, as neither statistical data nor the data on tax collections are available at the local level, we need to rely on the data that are aggregated at the regional level and modify the above hypothesis to test the following one: the size of tax and non-tax revenues of the regions' consolidated budgets, all other things being equal, is smaller in those regions where municipalities are facing lower fiscal incentives (i.e., higher revenue clawbacks). The idea is that the effect from individual municipalities being less interested in more effective revenue collections in their borders will sum up and will produce the aggregate effect on the regional level.

When using this aggregation, we should assume that the willingness of the regions themselves to collect more or less revenues into their budgets is not correlated with the degree of equalization in the region. If those regions that pursue stronger equalization and, accordingly, expose their municipalities to higher revenue clawbacks are also more protective towards their businesses and are more willing to cover their shadow economy from federal tax collectors, then the reinforcing bias will be present in our estimates as the lower level of tax collections resulting from the effect of equalization on behavior of the municipalities will be reinforced by the regions' actions. We do not see why this kind of correlation should take place, and rather would worry about the opposite effect–that those regions that take more aggressive approach to equalization could compensate the negative incentives resulting from lower fiscal incentives with

higher effort to collect revenues into the consolidated budget of the Russian Federation, making sure that both local and regional budgets receive enough revenues. If this effect is taking place then our analysis will not show the positive relationship between the level of fiscal incentives and consolidated revenues of regional budgets.

Another omitted variable in our model is the level of tax relief provided both by local and by regional governments. As always in the case of omitted variables, it is important that they are not correlated with the explanatory variable of interest, i.e., that tax relieves are not correlated with the degree of equalization in the regions.

Having all these considerations in mind, we proceed to the estimation of the following empirical model:

$$\begin{aligned} ln(Effort_{t,i}) = a + b_1*FI_{t,i} + b_2*OIL_{t,i} + b_3*URBAN_{t,i} + b_4*POP_{t.i} \\ + b_5*FC_{t,i} + b_6*DEN_{t,i} + b_7*TRANS_{t,i} \\ + b_8*Y1999 + b_9*Y2000 + b_{10}*Y2001 + e_t \end{aligned} \quad (4.23)$$

where $Effort_{ti}$–the ratio of tax and non-tax revenues of consolidated regional budget to the measure of fiscal capacity of the region (see below the explanation how fiscal capacity is measured).

FI_{ti}–the estimate of fiscal incentives for municipalities *k* from equation (4.22);

OIL_{ti}–the ratio of monetary value of oil and gas extracted in the region (i.e., the amount of oil and gas extracted in the region multiplied by current price of oil) to its gross regional product.

POP–population of the region, in thousands of people.

FC–the size of fiscal capacity of the region as calculated for the purpose of distribution of federal equalization grants among the regions.

Fiscal capacity shows how much revenues should be collected in a region given its structure of gross regional product. The idea is that the value added in different industries brings different amounts of tax revenues (e.g., in Russia agricultural output is taxed much lighter than the output of the oil extracting and oil refining industries). Fiscal capacity is a more accurate estimate of the ability of the regions to collect taxes and using this parameter instead of simple gross regional product improves the significance of our estimates.[21]

URBAN–share of urban population.

DENS–size of population of the region divided by the size of its territory (people per sq. km).

TRANSF–transfers from the federal to regional budget, including all monetary grants (resources from the fund of financial support of the regions, earmarked subsidies, etc.)

Indexes *t* and *i* indicate year *t* and region *i*.

We use ordinary least squares estimation method as well as fixed and random effect models to estimate parameters in equation (4.23).

Table 3 shows the estimates of the coefficients of the variables in equation (4.23).

[21] For a detailed explanation of how fiscal capacity of the regions are calculated see Appendix II.

Table 3
Estimation Results for Equation (4.23)

Independent variables	OLS	Fixed Effect	Random Effect
Fiscal incentives	0.075* (0.03)	0.050 (0.026)	0.052* (0.03)
Oil	0.001 (0.003)	-0.02 (0.01)	-0.005* (0.003)
Share of Urban Population	-0.01* (0.002)	-	-0.006* (0.003)
Population	0.0001* (0.00002)	0.003 (0.002)	0.0001* (0.00003)
Fiscal Capacity per capita	0.001 (0.0005)	0.01 (0.01)	0.002* (0.0005)
Population Density	0.002* (0.001)	-	0.001 (0.001)
Transfers from federal budget	0.0001* (0.00003)	0.0001 (0.001)	0.0001* (0.0001)
Y1999	-0.36* (0.05)	-0.35* (0.04)	-0.37* (0.03)
Y2000	-0.39* (0.05)	-0.32* (0.06)	-0.39* (0.04)
Y2001	-0.59* (0.06)	-0.52* (0.09)	-0.61* (0.05)
Constant	-1.74* (-11.52)	-7.79* (3.95)	-1.70* (0.22)

Notes: Standard errors are in parentheses.
*The coefficient is different from zero at the 5% significance level.

The results related to the estimates of the coefficients of the control variables on the tax effort are not easy to interpret, even though most of them are statistically significant at the 5% level. The negative sign of the estimate for the coefficient that shows the effect of the oil and gas extraction in the region is rather puzzling. It might mean that the affluent firms involved into oil and gas business in 1990s and early 2000s were successful in avoiding tax payments. A lower level of tax effort in the regions with

a larger share of urban population is also counterintuitive as we would expect the tax administrators to be more efficient in urban areas. Regions with larger population seem to produce a larger tax effort as does population density (which is not quite consistent with the negative effect of share of urban population on tax effort). The size of per capita fiscal capacity also positively affects the level of tax effort in the regions as well as the share of transfers from the federal budget in regional budgets.

The estimates for the coefficient of the variable of interest, fiscal incentives, are in agreement with our hypothesis that in those regions where municipalities are facing higher fiscal incentives the level of revenue collections is higher as indicated by the positive sign of the coefficient.

For all but one specification of the model, we can not reject the hypothesis that the fiscal incentives faced by municipalities in the regions positively affect the size of the regions' consolidated revenue collections as share of adjusted fiscal capacity (i.e., tax effort). The fixed effect specification of the model does not provide an estimate that is significant at a 5% significance level, but the point estimate is still positive.

The estimates of coefficient b_1 in equation (4.23) that measures the effect of fiscal incentives on the size of revenue collections as share of adjusted gross regional product (i.e., tax effort) vary from 0.075 in the OLS specification to 0.052 in the random effect specification.

The magnitude of the estimate is rather small: according to random effect model, which is favored by the Hausman test, it is equal to 0.052 or 5.2%. Because in our model we use the logarithm of dependent variable, the coefficient b_1 measures the semi-elasticity of tax effort with respect to fiscal incentives, which means that as fiscal

incentives change by one unit (e.g., from 0 to 1), the tax effort in a region changes by 5.2%. Note that a one unit change in fiscal incentives is a substantial change because it could mean a change from complete equalization (fiscal incentives equal to -1, i.e., complete revenue clawback) to no equalization at all (fiscal incentives equal to 0, i.e., no revenue clawback at all).

The positive sign of the coefficient tells us that higher fiscal incentives–larger in absolute value when positive and smaller in absolute value when negative–result in a higher revenue collections given the size of the region's fiscal capacity, which is consistent with our hypothesis.

There are two important implications of this result. First, it is consistent with our theoretical model that shows that equalization programs that are based on actual revenue collections might make consumption of publicly provided goods relatively more expensive and create a substantial effect that discourages equalized municipalities from consuming publicly provided goods and, accordingly, reduce local governments' effort in enhancing revenue collections in their municipalities. Second, this result is consistent with our argument that, despite the lack of formal administrative powers toward territorial subdivisions of the federal Ministry of Taxation, local governments still might have the necessary tools and effective mechanisms that allow them to influence the size of revenue collections in their municipalities.

The Case of the Twin Cities Metropolitan Area Fiscal Disparities Program

The tax base sharing program established in the Twin Cities metropolitan area taxes a certain portion of commercial and industrial properties and redistributes the proceeds among municipalities in direct proportion to their population size and in inverse proportion to their real property (which includes commercial and industrial property as well as residential property). The theoretical model developed earlier shows that the equalization programs of this kind produce a substitution effect that decreases presence of businesses in the equalized area, consequently reducing the size of commercial and industrial property in the jurisdictions that are subject to equalization. Accordingly, in this section we test the proposition that the fiscal disparities program negatively affected the size of commercial and industrial property in the municipalities that are included in the tax base sharing program.

Description of the Program

The official statutory name of the program is the Charles R. Weaver Metropolitan Revenue Distribution Act, but it is often referred to by its nickname, the "fiscal disparities program." It was enacted in 1971, but court challenges prevented the program's implementation until 1975. This program is codified in Minnesota Statutes, chapter 473F, and it affects all taxing jurisdictions (i.e., counties, cities, towns, schools districts, and special taxing districts) located in the Twin Cities Metropolitan area.

Originally, the objectives of the program included six components, three of which emphasized the goals of sharing, help, and establishing incentives for all parts of the area to work for the growth of the area as a whole. Two others focused on a reduction of fiscal considerations on the location of businesses and protection of the environment, and one

objective declared that resources should stay at the local level when redistributed. Later, these objectives were reconsidered, and currently they include two major goals: 1) promoting more orderly regional development, and 2) improving equity in the distribution of fiscal resources.

The program works as if 40 percent of all commercial-industrial (C/I) property that developed in the jurisdiction since 1971[22] was removed from local taxing authority (contributed tax base), accumulated in a pool, and then redistributed among jurisdictions in direct proportion to the size of their population and in inverse proportion to their per capita real property (distributed tax base).

Contributions to the Areawide Tax Base

The fiscal disparities law requires that each taxing jurisdiction to contribute 40 percent of the growth in its C/I property tax base since the 1971 assessment to an areawide pool. C/I property includes all businesses, offices, stores, warehouses, factories, gas stations, parking ramps, etc. It also includes public utility property and vacant land that is zoned commercial or industrial, but most personal C/I property is exempt from taxation under the program. The growth in property includes the total net change in net tax capacity since 1971, including the effects of new construction, inflation, demolition, revaluation, appreciation, and depreciation.

A property's net tax capacity is determined by multiplying the property's taxable market value by the relevant class rate or rates. Class rates are set by statute, vary by property type, and are uniform statewide.

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[22] Even though the program was implemented in 1975, the 1971 assessment remains the benchmark year.

From the net tax capacity of the industrial and commercial parcel j in the area V_j its net tax capacity in the base year of 1971, V_{0j}, is subtracted.

The leftover, $V_{1j} = V_j - V_{0j}$ is the change in the net tax capacity since 1971 for the parcel j.

The net tax capacity in the base year of 1971, V_{0j}, and 60% of the change in the net tax capacity since 1971, V_{1j}, are taxed by the local government at a local rate t_i.

40% of the change in the net tax capacity of parcel j since 1971, V_{1j}, is assigned to the areawide base.

The tax capacity contributed by jurisdiction i to the areawide base is $C_i = \sum_{j=1}^{m} 0.4 \cdot V_{1j}$, where m is the number of C/I parcels in the jurisdiction.

Total size of the areawide tax base in the metro area is determined as the sum of all jurisdictions' contribution: $C = \sum_{i=1}^{n} C_i$

Distribution from Areawide Tax Base

Each locality is assigned a share s_i in the area wide base C:

$$s_i = \frac{I_i}{\sum I_i}, \tag{4.24}$$

where $I_i = pop_i \frac{\overline{FC}}{FC_i}$,

where pop_i–is the population of the locality i,

FC_i–its per capita fiscal capacity,

$\overline{FC}$ - the average across the area per capita fiscal capacity. Fiscal capacity is the market value of real and personal property within a locality. It is important to note that the fiscal

capacity here includes not only the industrial and commercial property but other types of property as well.

The dollar value of the share in the area wide base *C* assigned to the jurisdiction *i*: $D_i = s_i \cdot C$. Thus the revenues that a locality receives after the tax base sharing: $R_i = t_i(V_{0i} + 0.6 \cdot V_{1i} + D_i)$, where the first two components in parentheses represent the revenues that come from taxing C/I property in the locality, and the third component represents the revenues that come from taxing a jurisdiction's share in the areawide tax base *C*.

Impact on Individual Parcels

As each jurisdiction applies to its distribution net tax capacity D_i its local tax rate t_i, its levy on it is $L_i = t_i D_i$.

The total areawide levy is $L = \sum_i^n L_i$, and the areawide tax rate is $t_{a/w} = \frac{L}{C}$.

Each C/I parcel's net tax capacity is split into an areawide portion and a local portion according to the following ratio:

$$s_i^{a/w} = \frac{C_i}{Total\_CI\_Tax\_Capacity_i},$$

where C_i is the tax capacity contributed by jurisdiction *i* as defined above, and $Total\_CI\_Tax\_Capacity_i$ is total C/I tax capacity in jurisdiction *i*.

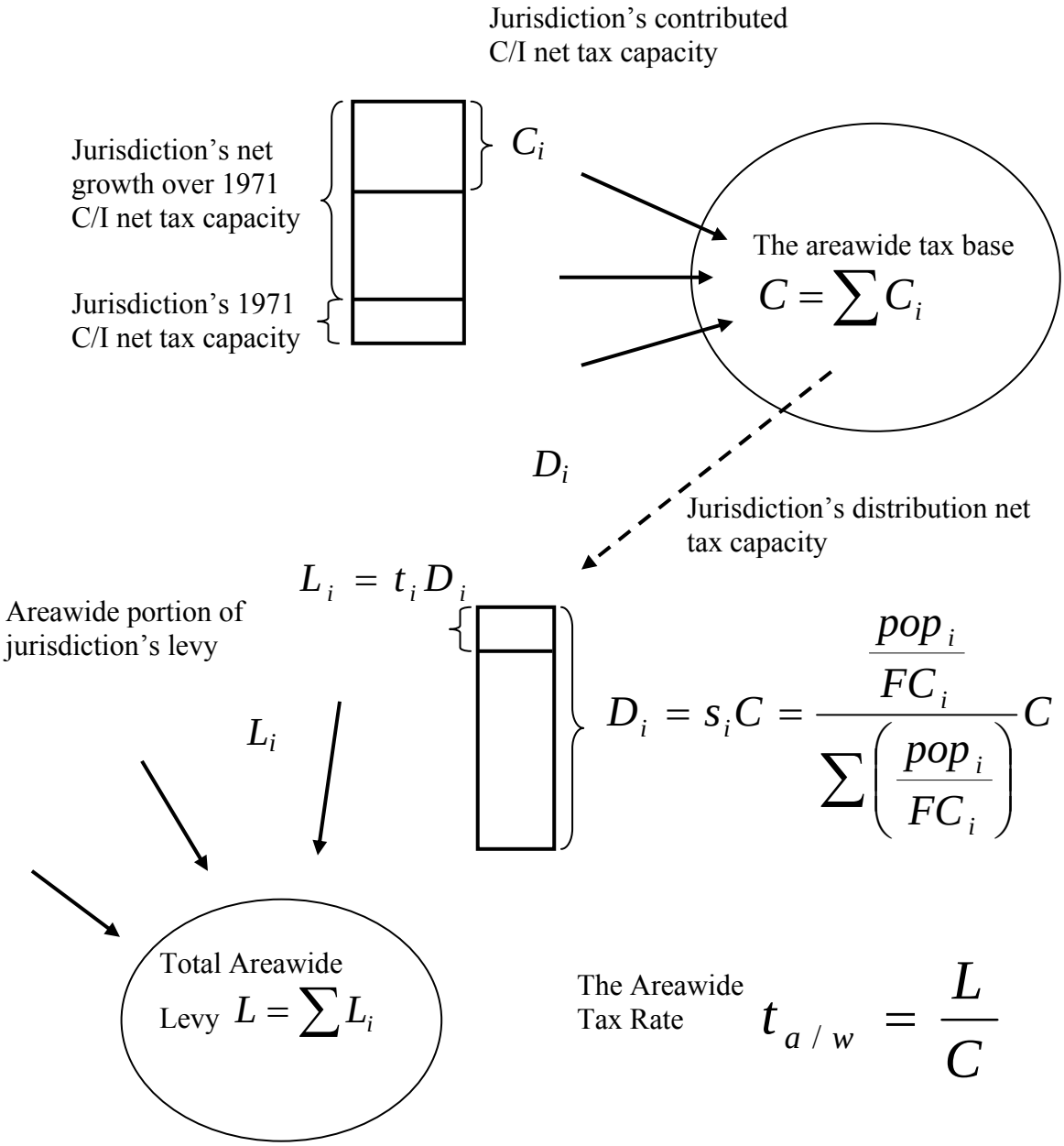
This ratio determines the portion of each C/I parcel's net capacity that pays a tax determined by the areawide tax rate $t_{a/w}$. The rest of the parcel's net tax capacity pays a tax determined by the local tax rate t_l.

Thus, $s_{a/w}$ is the areawide portion of property tax paid by the C/I parcel, and

$(1 - s_{a/w})$ is the local portion of property tax paid by the C/I parcel.

Figure 4.3 illustrates how the tax base sharing mechanism works.

Figure 3: Graphical Illustration of the Fiscal Disparities Program



Apparently the provision that instead of sharing some specific portion of commercial and industrial property in the metropolitan area, the difference between the current tax capacity and the tax capacity in the benchmark year (1971) should be shared has been implemented in the program to allow it to gain its effect gradually as the tax bases grow due to inflation, growth in property values, and economic development of the area. For the purpose of our analysis it would have been more desirable if the program had taken full effect as soon as it was introduced. We should be careful in interpreting the results of our empirical analysis because, besides the effect of the tax base sharing program that has been gradually increasing in its magnitude since 1974, some other factors could have been introduced that affected the distribution of C/I property inside and outside of the metropolitan area.

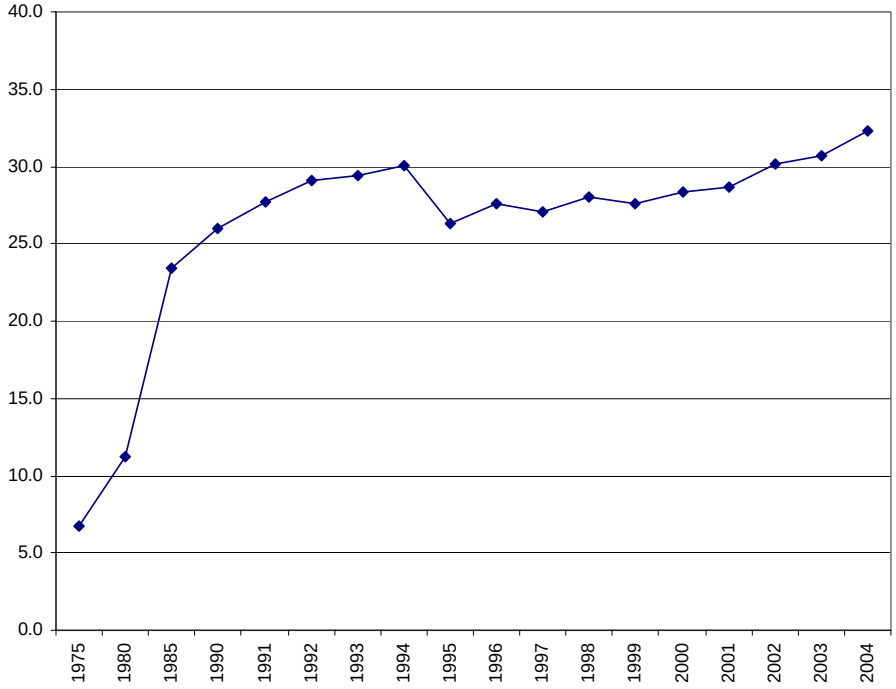
Figure 4 and Table B1 in Appendix III show how metro areawide tax base was growing in 1975-2004 as a percentage of total metro commercial and industrial tax bases.

In 1975 the share of the area wide pool in total metro commercial-industrial tax base was only about 7 %, ten years later in 1985 it reached 24 %, by 1995 it was at the level of 26 %, and currently it exceeds 32 %. Accordingly, it means that currently more than 80 % of the existing commercial and industrial tax bases in the Twin Cities Metropolitan area represents the increase in the value since 1971, and is being shared according to the program. (0.80*0.40=0.32). What is important for the purpose of our analysis is that for more than ten years about a third of all commercial and industrial property in the Twin Cities area has been taxed at a uniform areawide tax rate and the revenues redistributed among jurisdictions in the area. Effectively, it means that in our

theoretical model the tax rate at which the property is taxed for further redistribution should be adjusted according to this ratio (i.e., the effective tax rate will be 32% of the actual areawide tax rate).

A decrease in the share of the area-wide pool in total metro C/I tax bases in mid-1990s resulted from a slump in C/I real estate values in that period of time.

Figure 4: Percentage of Total Metro Commercial and Industrial Tax Base Comprised by the Area-Wide Pool, 1975-2004



On the expenditure side this program adjusts per capita amount of commercial and industrial tax bases assigned to a municipality in inverse proportion to the municipality's per capita size of real property.[23] We rearrange equation (4.24) to show more explicitly the relationship between the size of per capita commercial and industrial tax base that is assigned to a municipality and the size of its per capita real property:

[23] All real property includes residential homes, town homes, condominiums, apartments, commercial and industrial property, and vacant land.

$$y_i = \frac{C}{FC_i \sum_{j \neq i}^{N-1} \left(\frac{pop_j}{FC_j} \right) - pop_i} \tag{4.25}$$

where FC_i is the municipality's per capita size of real property (fiscal capacity,) pop_j is jurisdictions' population size, and

N is the total number of jurisdictions participating in the program.

Formula (4.25) shows that the larger per capita real property in a municipality, the smaller is the size of commercial and industrial tax base assigned to the municipality according to the program. It results in a tax base clawback effect as the increase in own per capita real property brings a decrease in the size of per capita assigned commercial and industrial tax bases. Similar to the gap-filling equalization scheme described in the theoretical section, this kind of equalization formula would also result in a substitution effect encouraging municipalities to reduce the presence of commercial and industrial firms inside their borders.

The clawback effect on the municipalities' per capita real property resulting from the distributional formula could be estimated by differentiating the formula with respect to the size of fiscal capacity of the municipalities:

$$\frac{dy_i}{dFC_i} = -\frac{C}{\left[FC_i \sum_{j \neq i}^{N-1} \frac{pop_j}{FC_j} + pop_i \right]^2} \sum_{j \neq i}^{N-1} \frac{pop_j}{FC_j} \tag{4.26}$$

The negative sign of equation (4.26) shows that the size of per capita commercial and industrial tax base assigned to a municipality and its fiscal capacity move in the opposite directions, i.e., as per capita real property in a municipality increases, the size of per capita commercial and industrial property redistributed to this municipality goes

down and vise versa. Moreover, this inverse relationship is larger for municipalities with lower per capita real property: as fiscal capacity goes down, the magnitude of the clawback goes up in the quadratic proportion.

For municipalities with a very low level of fiscal capacity, increasing its size could be even self-defeating if the magnitude of clawback is larger than unity, which means that the gain in their own fiscal capacity will result in a larger decrease in the shared tax base that is assigned according to the program. In other words, for municipalities with very small fiscal capacity a decrease in per capita redistributed commercial and industrial property overcompensates for the increase in per capita real property when the latter goes up.

The condition for this situation is presented by the following expression:

$$FC_i < \frac{\sqrt{C\sum_{j\neq i}^{N-1}\frac{pop_j}{FC_j}} - pop_i}{\sum_{j\neq i}^{N-1}\frac{pop_j}{FC_j}} \tag{4.27}$$

In such a case, unless some other considerations induce them to do otherwise, municipalities with low per capita real property will be discouraged from allowing their per capita real property to grow (e.g., by tightening their zoning laws). Moreover, they might be even encouraged to suppress their per capita real property (e.g., by tightening loval regulations and by increasing local tax burden on businesses located inside their borders) because, if the magnitude of the clawback is larger than unity, a decrease in their own per capita real property will be more than compensated by the increase in per capita commercial and industrial property that is shared with them.

We estimate the magnitude of this disincentive effect using data for year 2003 for a sample of 138 cities in the Twin Cities Metropolitan. The disincentives measured by absolute value of (4.26) vary from 0.005 for the richest city in terms of per capita property tax base (Woodland, $3,360 in total tax capacity per capita) to 3.323 for the poorest city in terms of per capita property tax base (Landfall, $144 in total tax capacity per capita). The latter is the only city that according to the simulation has the magnitude of disincentive larger than 1. Figure 5 shows the level of disincentives that the cities were facing according to the simulation:

Figure 5: Disincentives Faced by Cities in Seven-County Twin Cities Metropolitan Area (Simulation), 2003

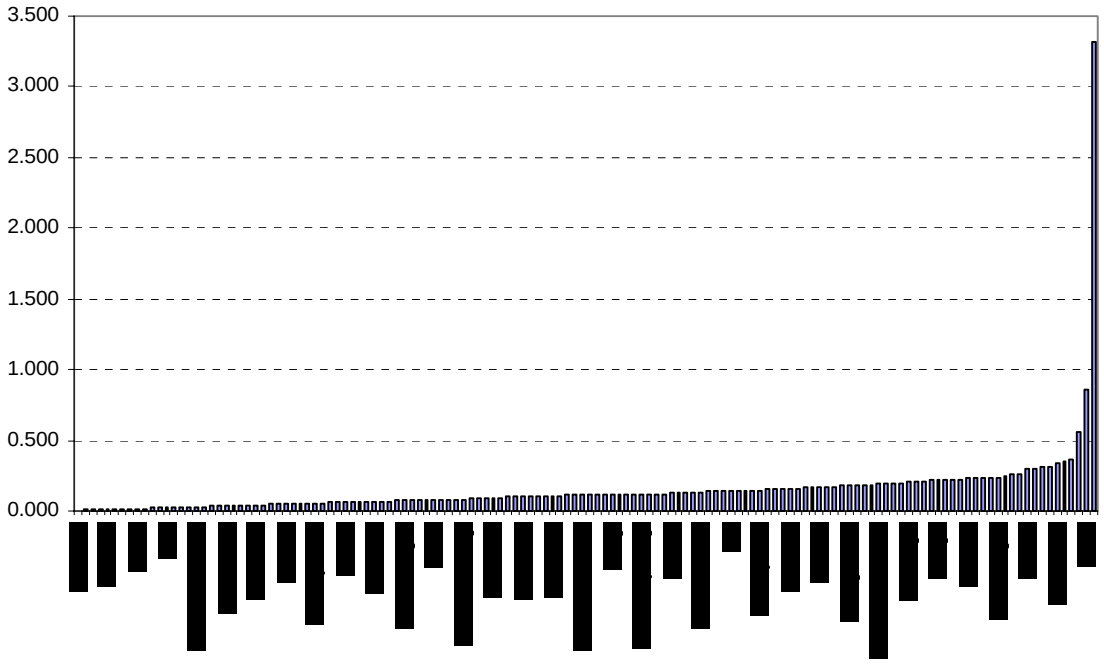


Table 4 shows the real property tax base disincentives are distributed among cities of Seven-County Twin Cities metropolitan area.

Table 4
Frequency and Cumulative Percentage of the Real Property Tax Base Disincentives for Cities in the Seven-County Twin Cites Metropolitan Area

Bin	Frequency	Cumulative %
0.1	58	42.03%
0.2	53	80.43%
0.3	18	93.48%
0.4	6	97.83%
0.5	0	97.83%
0.6	1	98.55%
0.7	0	98.55%
0.8	0	98.55%
0.9	1	99.28%
1	0	99.28%
More	1	100.00%

According to Table 3, 58 cities (42% of total number) were facing real property tax base disincentives that were smaller than 0.1. For 53 cities, the disincentive was in the range between 0.1 and 0.20, for 18 cities–between 0.2 and 0.3, for 6 cities–between 0.3 and 0.4, and for 3 cities the disincentives were larger than 0.5: 0.563 for New Trier, 0.856 for Hilltop, and 3.323 for Landfall. Thus, more than a half of the cities were facing real tax base disincentives larger than 0.1.

Figure 6: Fiscal Capacity and per capita Commercial and Industrial Shared Tax Bases, Simulation, Dollars

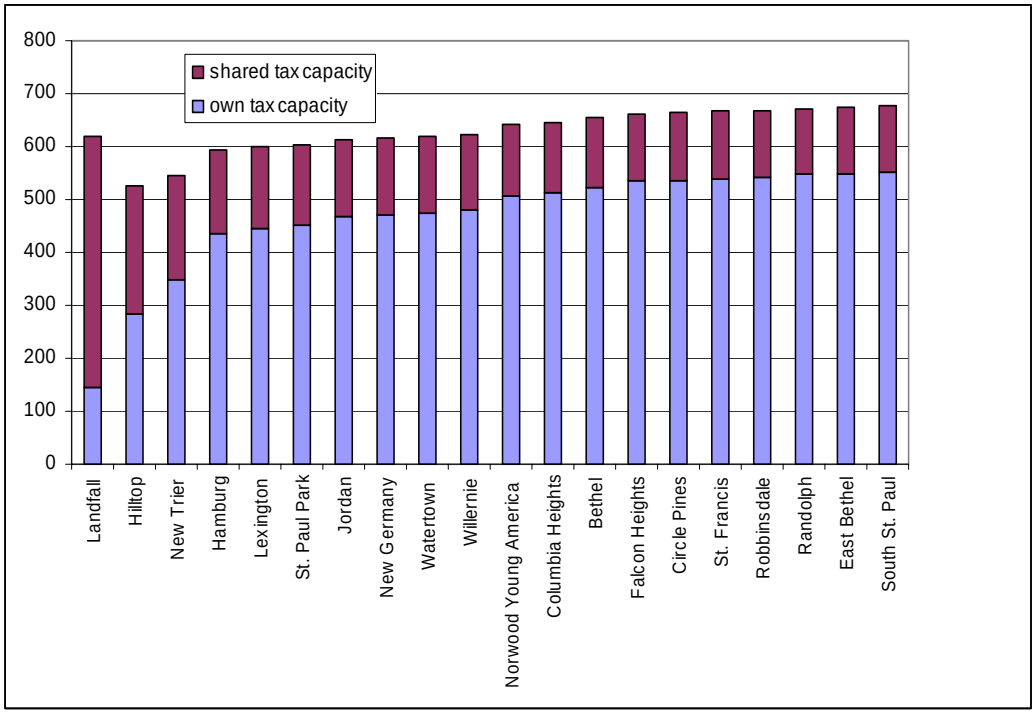


Figure 6 shows that one municipality, the one with the lowest per capita real property, Landfall, ends up getting a higher tax base size than ten other municipalities (which have with higher per capita real property) after the shared commercial and industrial tax bases are assigned to them.

Empirical Estimation

The presence of two disincentive effects described above allows us to put forward an empirical hypothesis that the program has negatively affected the size of commercial and industrial properties in the municipalities located in the seven-county metro area due to the effect of the areawide taxation resulting from the revenue side of the program and

due to the effect of clawback on real property resulting from the expenditure side of the program.[24]

The Sample

As explained above, the fiscal disparities program affects all taxing jurisdictions in the Seven-County Twin Cities Metropolitan Area: counties, school districts, special tax districts, cities and townships. We use a sample of cities as opposed to other types of taxing jurisdictions because cities constitute the largest group of taxing jurisdictions for which the necessary data are available.

The total number of cities included in the program varies according to different sources. For example, according to the website of the Twin Cities' Metropolitan Council there are 2 central and 143 other cities in the area, i.e., 145 cities total.[25] The data provided by the Center for Small Towns[26] include population for 138 cities, while a report[27] prepared by the House Research Department of the Minnesota House of Representatives refers to 139 cities included in the program as of 2004.

Our sample of 110 cities that are affected by the program (i.e., cities that are located inside the Seven-County Twin Cities Metropolitan Area) includes all cities inside the metropolitan area for which the necessary data are available. Accordingly, these cities are located in the seven counties that comprise the Seven-County Twin Cities Metropolitan area: Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington (see Figure 7).

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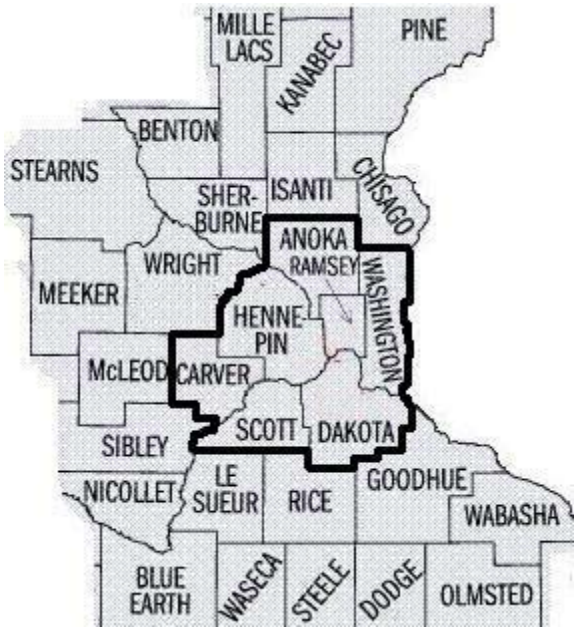
[24] The latter effect should take place because commercial and industrial properties are included in fiscal capacity as a part of real property.

[25] http://www.metrocouncil.org/metroarea/FiscalDisparities/index.htm

[26] http://www.morris.umn.edu/services/cst/index.htm

[27] Minnesota's Fiscal Disparities Programs, Twin Cities Metropolitan Area and Iron Range

Figure 7: Fiscal Disparities Program Geographic Area:
Seven-County Twin Cities Metropolitan Area and Surrounding Counties



The sample of the cities that are not affected by the program is based on geographical proximity of their location to the metropolitan area: to balance the sample of the cities located inside the metropolitan area I select a sample of 110 cities located outside its borders, but as close as possible to the metropolitan area (measured by driving time to Minneapolis).[28] These cities are located in 21 counties that surround the Seven-County Twin Cities Metropolitan area (see Figure 4.6). Finally, the total number of cities in our sample is 220 (i.e., 110 cities inside the metro area and 110 cities outside of the metro area).

[28] Out of three cities located in the longest driving time (93 minutes) I drop the one that is located in the longest driving distance, leaving the total number of cities located outside the metro area in my sample equal to 110.

Cities from Wisconsin are not included in our sample of cities located outside the metro area despite the fact that some of them are located closer to its borders than some of the cities from Minnesota in our sample. For example, Hudson, WI is located just on the border with Washington county that is included in the Twin Cities Metropolitan area, and is only in 34 minutes of driving time from Minneapolis. I exclude the cities from Wisconsin for two reasons: first, when we compare cities inside and outside the metropolitan area it is preferable for them to be in the same state to keep as many things equal as possible.

Empirical Model and Hypothesis

In our empirical model we use a dummy variable that shows whether a city is located inside the seven-county metro area (metro dummy is equal to 1) or outside of it (metro dummy is equal to 0). The estimation of the coefficient for the metro dummy is of key importance for our analysis as it tells us whether the size of per capita commercial and industrial property inside the metro area is lower than its size outside of the metro area. As explained above, we expect it to be the case because the fiscal disparities program implemented in the Twin Cities Metropolitan area creates two price effects that discourage jurisdictions from allowing businesses to located inside their borders: first, resulting from its revenue side (i.e., taxation of commercial and industrial property) and, second, resulting from its expenditure side (i.e., distribution of commercial and industrial property among municipalities in the inverse proportion to the size of their per capita real property).

Table 5 shows descriptive statistics for per capita commercial and industrial property in cities in our sample distinguishing between cities located inside the seven-county area and cities located outside of the area.

Table 5
Descriptive Statistics: per capita Commercial and Industrial Property in the Cities in Our Sample

	Outside Seven-County Area	Inside Seven-County Area	Total
Max	30,350	52,047	52,047
Min	173.1	1,092.4	173.1
Average (simple)	6,928.0	10,995.7	8,961.9
Average (weighted)	10,177.6	14,952.8	13,982.6
Standard Deviation	5,175.8	9,431.1	7,858.7
Coefficient of Variation	0.51	0.63	0.56

Besides the metropolitan area dummy we should include in the model other parameters that might affect the size of per capita commercial and industrial property. In our choice of explanatory variables we partly rely on the previous literature that analyzes the effect of local fiscal policies on business location using the data aggregated at the localities' level, Fox (1981), McHone (1986), McHone (1990), and we also add some other explanatory variables.

The resulting empirical model is given by equation (4.21):

$$\ln CI = \alpha + \beta_1 METRO + \beta_2 \ln CI_{1972} + \beta_3 TIME + \beta_4 \ln DEN + \beta_5 \ln TX + \beta_6 \ln Y + \beta_7 PAF + \beta_8 LAP + \beta_9 \ln RES + \beta_{10} \ln POP \quad (4.28)$$

where *CI*–market values of commercial and industrial property per capita in the city in 2003,

METRO–dummy variable, which is equal to 1 if the city is located inside the metro area, and zero otherwise.

TIME–driving time in minutes from the city to the center of the metropolitan area (i.e., Minneapolis),

CI_{1972}–assessed valuation of commercial and industrial property per capita in the city in 1972,

DEN–population density per square mile of land area in the city in 2000,

Y–median family income in the city in 2000 (in 1999 prices),

RES–residential property market values per capita in the city in 2003,

TX–the average tax rates for county, city, school and special districts within the city in 2003,

PAF–police and fire protection expenditures per capita in the city in 2005,

LAP–library and park expenditures per capita in the city in 2005,

POP–population of the city, 2003.

Market values of commercial and industrial properties for year 2003, CI, are expressed in per capita terms to take account of differences in city size. The population data by which the commercial and industrial property are divided are from population census 2000. We assume that the three year discrepancy should not create a problem in this case.

The metro dummy, METRO, is of major importance in our analysis as it shows whether the city is located inside of the metro area and, accordingly, is either affected by

the fiscal disparities program or not. As those cities that are located inside the metro area are facing price effects that discourage them from allowing businesses to locate inside their borders, we expect that the sign of the estimate for the coefficient for this parameter is negative.

Driving time from the city to the center of the metropolitan area,[29] TIME, reflects the attractiveness of the city for firms as a place of location. As the proximity of central business district is a major attraction for commercial and industrial firms, the expected effect of driving time to the center of the metropolitan area on commercial and industrial property is negative. We use driving time instead of driving distance as driving time better reflects location convenience.[30]

Including in our model per capita assessed valuation of commercial and industrial property in the city in 1972, CI_{1972}, allows us to control for the size of commercial and industrial property before the fiscal disparities program was introduced. The expected effect of this parameter on the size of per capita commercial and industrial property values in 2003 is positive as it is likely that those cities that were attractive for businesses in 1972 would keep their attractiveness in 2003 everything else being equal.

The population density of a city, DEN, is expected to be negatively related to its willingness to accept commercial and industrial development because higher population density means that there is less space for stores and factories in the city and that, assuming that they mostly produce negative externalities, these might affect residents more severely.

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[29] Accessed 1 June 2007, available from www.mapquest.com.

[30] For example, of two cities that are located in 50 miles from the central business district, the one accessible by a highway will be more attractive than the one, accessible by rural roads (assuming no traffic jams on the highway, of course).

Both median family income in the city, Y, and residential property per capita in the city, RES, should negatively affect the size of commercial and industrial property in the city because richer individuals who own more expensive houses are less willing to accept commercial and industrial development in their neighborhoods, assuming again that this development mostly produces negative externalities.

The tax price for commercial and industrial property development, TX, is represented by average tax rates for county, school and special districts within the city, and its effect on per capita commercial and industrial property is expected to be negative.

There are also two components of local budget expenditures that might affect attractiveness of the city for commercial and industrial development: police and fire protection expenditures and local expenditures for library and parks.

Police and fire protection expenditures per capita in the city, PAF, should positively affect the size of commercial and industrial property values in the city as these services benefit commercial and industrial firms located in its borders.

As suggested in the previous literature,[31] those local budget expenditures that benefit local residents as opposed to local firms should negatively affect commercial and industrial development in communities. Thus we would expect that per capita expenditures for library and parks, LAP, will negatively affect the size of commercial and industrial property values in the city.

Finally, the size of the city's population, POP, should positively affect per capita commercial and industrial development as a larger population might mean easier access to labor market.

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[31] See for example McHone (1986)

Results

The parameters of empirical model represented by (4.28) are estimated using OLS. The results of the estimation are presented by (4.29):

$$\ln CI = 13.7 - \underset{(2.28)*}{.38}\, METRO + \underset{(7.01)*}{.33}\ln CI_{1972} - \underset{(3.98)*}{.01}\, TIME - \underset{(2.55)*}{.15}\ln DEN$$
$$- \underset{(.79)}{.19}\ln TX - \underset{(2.81)*}{.94}\ln Y + \underset{(2.68)*}{.002}\, PAF + \underset{(.92)}{.001}\, LAP + \underset{(2.28)*}{.36}\ln RES + \underset{(4.10)*}{.16}\ln POP \qquad (4.29)$$

Adjusted R^2 = .46, number of observations = 220.

The *t*-statistic for each variable's coefficient is given in parentheses underneath it. The statistical significance of the individual coefficients is indicated by an asterisk for a 5% significance level.

For the most of the control variables in our model, the signs and statistical significance of the estimated coefficients match our expectations: the level of commercial and industrial development in a city in 1972, police and fire expenditures from its budget in 2005 as well as the population size positively affected the level of its commercial and industrial development, while longer driving time to the center of the metropolitan area, higher population density and higher median family income affected it negatively. All these variables have coefficients that are statistically significant at the 5% level.

The expected negative effect on commercial and industrial development in a city resulting from higher level of taxation and expenditures on libraries and parks is not confirmed by our empirical estimation: despite having the expected negative sign, the estimates of the appropriate coefficients for these variables in our model are not statistically significant at a 5% level.

For one control variable in our model, per capita size of residential property in a city, the estimated coefficient has an unexpected sign and is also statistically significant at the 5% level. According to this estimate, larger per capita residential property values in a city are associated with a larger level of commercial and industrial development in its borders.

The key result of our empirical analysis is that the coefficient for METRO is negative and is statistically different from zero at the 5% significance level. This result is consistent with our hypothesis that other things being equal in the cities located in the Twin Cities Metropolitan area the per capita level of commercial and industrial development is lower as the fiscal disparities program discourages municipalities from accepting businesses inside their borders. Because the dependent variable enters the equation (4.29) in the logarithm form, the coefficient at METRO variable measures the semi-elasticity of per capita commercial and industrial property values with respect to changes in metro dummy, i.e., when multiplied by 100 it tells us the number of percentage points by which the explained variable will change when the explanatory variable changes by one unit. Accordingly, the sign and the magnitude of the coefficient tells us that the level of commercial and industrial development in a city as measured by its per capita commercial and industrial property values is 38% lower inside the metropolitan area than outside of it, other things being equal, which indicates rather large economic significance of the variable. The estimate of the coefficient is quite robust as it consistently stays in the range of 30-40% as we varied the specifications of the model and changed the functional form of the control variables entering the equation.

It is important to note that this result does not mean that per capita commercial and industrial property values in the cities located inside of the seven-county area are lower than in the cities located outside of the area. On contrary, the descriptive statistics for our data in Table 4 shows that our sample of cities located in the seven-county Twin Cities metro area has larger per capita commercial and industrial property values. In terms of our model, on average for the cities located inside the tax base sharing area their proximity to the central cities (inversely related to the driving time to Minneapolis) outweighs the negative effect of the metro dummy. The fact that a city is affected by the fiscal disparities program negatively affects its per capita commercial and industrial property values, but it does not mean that this factor will always prevail.

When interpreting these findings we should take into account the possibility that some other factors might have contributed to the lower level of commercial and industrial development in the cities located in the seven-county Twin Cities area as compared with the cities located in the surrounding counties. In his evaluation of the Twin Cities metropolitan area tax base sharing, Reschovsky (1980) refers to Minnesota's land planning legislation and to a regional comprehensive plan instituted by Metropolitan Council as to instruments intended to control or at least influence the location of business activity in the area and argues that these changes in Minnesota development policies made statistical analysis of the tax base sharing program extremely difficult.

My review of the Minnesota Land Planning Act (MLPA) and a number of cities' comprehensive plans shows that there is no clear restriction on commercial and industrial development implemented in this law. Basically, it requires jurisdictions within the metropolitan area to develop comprehensive plans that show the planned pattern of

development in their borders and to make sure that these plans are in agreement with the current Regional Development Framework. This is a very general document, and it does not specify any particular restrictions on growth. Its summary is presented in Appendix IV.

Apparently, there is no reason for these policies to intervene with commercial and industrial development in the Twin Cities metropolitan area. On contrary, if the first set of the policies achieves its goals, the result should be an improvement in the area's economic (i.e., commercial and industrial) development in the metropolitan area.

Still, we should not disregard the possibility that some other region-specific factors that we are not aware of have contributed to the lower level of commercial and industrial property values in the seven-county area included in the fiscal disparities program.

CHAPTER 4

CONCLUSION

Given the importance of equalization programs, which comprise a significant part of subnational government revenues in many countries, the study of the unintended consequences of equalization programs is important both for academic research and for policy making. The major theme of this dissertation is to show that, even though equalization is achieved by means of unconditional grants that are not supposed to influence governments' policies and residents' behavior of the equalized jurisdictions, equalization programs might produce substitution effects that result in changes in the residents' consumption of those goods that are related to the factors that are used as measures of jurisdictions' fiscal capacity, followed by appropriate changes in local governments' policies. Depending on the choice of the factors that are used to measure jurisdictions' ability to raise budget revenues, equalization programs could suppress either revenue collections in the equalized jurisdictions or the size of their tax bases.

As a part of a general problem of disincentives created by equalization, we study the case of Russia where regions distribute equalization grants among their constituent municipalities based on their actual revenue collections. As different regions pursue different degrees of equalization, the disincentives produced by their equalization programs vary across regions, which allows us to test the hypothesis that a higher degree of equalization, which our model predicts produces a stronger substitution effect, should be associated with lower revenue collections in a region.

In this part of our work we develop a new approach that allows us to calculate fiscal incentives faced by municipalities when the sharing rates of shared taxes assigned

to them by regions vary from year to year. Using this approach we estimate fiscal incentives faced by municipalities in 47 regions of Russia in a four-year time period of 1998-2001 at the first stage, and at the second stage we use those estimates to measure the effect of fiscal incentives on the size of revenue collections in the regions.

The empirical evidence from the Russia's case is consistent with the hypothesis that equalization programs that are based on the actual revenue collections by equalized jurisdictions might discourage them from collecting their own revenues when the degree of equalization gets higher. The estimate of the coefficient that measures the effect of fiscal incentives on tax effort is different from zero at a 5% significance level and has a positive sign, which means that higher fiscal incentives (i.e., lower clawback or larger matching effect of changes in regional transfers in response to changes in municipalities' own revenues) result in a higher level of tax effort in the regions.

The magnitude of the effect that we can infer from the size of the coefficient is not large. As fiscal incentives change by one unit, fiscal effort in a region would change by 5.2%. The small effect of fiscal incentives faced by municipalities in Russia's regions is not surprising given that subnational governments in Russia lack any formal powers to affect budget revenue collections. What is remarkable in these results is that despite the lack of the formal powers, we still find a statistically significant effect of fiscal incentives on tax effort in Russia's regions, which implies that the fiscal incentives not only affect Russia's municipalities, but also induce them to change the economic environment inside their borders.

This dissertation continues the study of the effects of equalization on the size of tax bases in the equalized jurisdictions, which in the past have been only cursory

addressed by Fischel (1975, 1976) and studied more deeply by Smart (1998). Both Fischel (1975, 1976) and Smart (1998) argue that equalization should negatively affect the size of tax bases located in the equalizing area, but there was no empirical evidence provided to support this notion. This dissertation provides the first empirical evidence in the literature related to this subject as we look at the empirical evidence from the Twin Cities' tax base sharing program.

Our empirical results show that for a sample of cities located inside the seven-county Twin Cities metropolitan area and in the surrounding counties, when controlling for other factors the fact that a city is included in the fiscal disparities program reduces its size of per capita commercial and industrial properties by 38%. The magnitude of this estimate not only indicates rather large economic significance of our findings for evaluation of the effect of the Twin Cities metropolitan area fiscal disparities program on economic development inside the area included in the tax base sharing program, but also calls for further research related to equalization programs that are based on redistribution of resources among jurisdictions based on the size of their tax bases.

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APPENDIX I

Table A1
Estimates of the Fiscal Incentives Coefficients (Clawbacks)
for Municipalities in Russia's Regions

No	REGION	1998	1999	2000	2001
1	Bashkortostan republic	-	-	-0.14	-0.58
2	Buryatia republic	-0.47	-0.74	-0.63	-0.33
4	Kabardino-Balkaria	-0.69	-0.87	0.25	-1.24
6	Karelia republic	-1.17	0.39	-	-
7	Komi republic	-	-	-0.43	-0.17
8	Mari-El republic	-0.80	0.12	-	-
9	Mordovia republic	-	-	-	-
11	Tatarstan republic	-0.58	-0.60	-0.78	0.87
13	Udmurtia republic	-	-	-	-
15	Chuvashia republic	-	-	-	-
19	Krasnoyarskiy krai	-	-	0.11	0.78
20	Primorskiy krai	-0.17	-0.01	0.00	-0.24
23	Amurskaya oblast	-0.21	-0.96	-0.55	-1.26
24	Arkhangelskaya oblast	-	-0.31	-	-
27	Bryanskaya oblast	-	-	-0.15	0.31
28	Vladimirskaya oblast	-0.33	-0.89	0.34	1.13
29	Volgogradskaya oblast	-0.01	-0.58	-0.70	0.02
31	Voronezhskaya oblast	-	-	-	-
33	Ivanovskaya oblast	0.70	0.28	-	-
34	Irkutskaya oblast	-0.79	-0.45	-0.77	0.22
35	Kaliningradskaya oblast	-	-	-0.14	-0.11
36	Tverskaya oblast	-	-	-0.91	0.39
39	Kemerovskaya oblast	0.65	-0.12	-	-
40	Kirovskaya oblast	-	-0.25	0.16	-0.15
41	Kostromskaya oblast	-	-	0.41	-0.02
42	Samarskaya oblast	-	-	-0.24	-0.23
43	Kurganskaya oblast	-0.54	1.25	-	-
44	Kurskaya oblast	-0.58	-0.78	-1.06	-
45	Leningradskaya oblast	-	-0.93	-0.56	-0.31

No	REGION	1998	1999	2000	2001
46	Lipetskaya oblast	0.48	-1.01	-	-
47	Magadanskaya oblast	0.11	-0.76	0.11	-0.27
48	Moskovskaya oblast	-	-	-1.04	-0.46
49	Murmanskaya oblast	-0.22	-0.77	-	-
52	Omskaya oblast	-	0.42	-0.14	0.01
55	Penzenskaya oblast	-0.68	-0.32	-	-
56	Permskaya oblast	-0.39	-0.17	-	-
58	Rostovskaya oblast	-0.22	-0.50	-1.15	-0.82
59	Ryazanskaya oblast	-0.65	0.24	-	-
60	Saratovskaya oblast	-0.54	0.09	-0.03	-0.88
61	Sakhalinskaya oblast	-0.91	-0.14	-0.41	-1.26
62	Sverdlovskaya oblast	-	-0.18	-0.76	-0.04
63	Smolenskaya oblast	-	-	-0.47	0.01
64	Tambovskaya oblast	-	-	-0.36	-1.06
65	Tomskaya oblast	-	-	-0.10	-1.30
66	Tulskaya oblast	-1.20	-0.64	-	-
68	Ulyanovskaya oblast	-0.84	-0.95	-0.01	0.14
70	Chitinskaya oblast	-	-	-0.27	0.09
71	Yaroslavskaya oblast	-	-	-0.23	-
76	Adygeya republic	0.58	-1.02	-	-
78	Yevreyskaya AO	-	-	-	-
87	Khanty-Mansiyskiy AO	-0.12	-0.21	-	-
90	Yamalo-Nenetskiy AO	-	-	-0.27	-0.99
	Number of estimates for the year:	*27*	*32*	*33*	*31*

APPENDIX II

CALCULATING FISCAL CAPACITY OF RUSSIA'S REGIONS

In this dissertation when calculating tax effort of Russia's regions we normalize their revenues by fiscal capacity which is calculated by multiplying the regions' gross domestic product (i.e., gross regional product or GRP) by an adjustment coefficient that takes into account the structure of value added and industrial output in each region and the tax burden on different sectors of Russia' economy and different sectors and sub-sectors of its industry.

GRP and the adjustment coefficients are taken from the Methodology and distribution of federal transfers to the regions of Russian Federation as calculated by Russia's Ministry of finance for 2003 and 2004. The calculation of fiscal capacity of the regions for 2003 and 2004 are based on the GRP, value added and industrial output data for 1998-2000 and 1999-2001 accordingly. The regions' fiscal capacity for these years is calculated by averaging the data over a period of three years taken with a three-year lag. The idea is that this approach should delay the changes in the size of the equalization funds in response to changes in GRP of the regions and as a result reduce disincentives imposed on the regions resulting from equalization.

For the purpose of this dissertation, we are interested in estimating the ability of the regions to collect the tax revenues as precise as possible without any averaging or delaying. Thus, when calculating tax effort for the regions in a particular year we use the size of their revenues as well as GDP, value added and industrial output data for that year.

To calculate fiscal capacity for 1998 and 1999-2001 we use the data from the Ministry of finance calculations for 2003 and 2004 accordingly. For a particular region the fiscal capacity (i.e., adjusted GRP) for a particular year is calculated according to formula (1):

$$GRP' = GRP \cdot K \tag{1}$$

The adjustment coefficient *K* for each region takes into account 7 sectors of Russia's economy, 12 sectors of industry, and 17 sub-sectors of the industry's sectors:

$$K = T_1 D_1 K_1 + \sum_{i=2}^{7} T_i D_i \tag{2}$$

where T_i–the level of tax burden for sector *i* in Russia's economy:

$$T_i = \frac{R_i}{VA_i} \tag{3}$$

where R_i - tax revenues collected to consolidated regional budgets in Russia in sector *i*,

VA_i–value added in sector *i* of Russia's economy.

Di–share of value added in sector *i* in total value added in the economy of the region:

$$D_i = \frac{VA_i}{\sum VA_i} \tag{4}$$

VA_i –value added in sector *i* of the economy of the region.

$\sum VA_i$ - value added in all sectors of the economy of the region.

The first component of the equation, related to the tax payments levied on the industrial output, is adjusted in its turn according to formula (5):

$$K_1 = \sum_{k=1}^{5} T_k^{'} D_k^{'} K_k^{'} + \sum_{k=6}^{12} T_k^{'} D_k^{'} \quad (5)$$

where $T_k^{'}$ is the level of tax burden on sector *k* of industry in the economy of Russia:

$$T_k^{'} = \frac{R_k}{I_k} \quad (6)$$

where R_k–tax revenues collected in sector *k* of industry to consolidated regional budgets in Russia,

I_k–output in sector *k* of Russia's industry.

$D_k^{'}$–share of output in sector *k* of region's industry:

$$D_k^{'} = \frac{I_i}{\sum I_i} \quad (7)$$

where I_i–output in sector *k* of region's industry.

$\sum I_k$ – total industrial output in the region.

Five components of equation (5) are adjusted to take into account the differences in the structure of the output of the appropriate sectors of industry according to formula (8).

$$K_k^{'} = \sum_{m=1}^{N} T_m^{''} D_m^{''} \quad (8)$$

where $T_m^{''}$ and $D_m^{''}$ are calculated similarly to $T_k^{'}$ and $D_k^{'}$ above with the only difference that revenues and industrial output are related not to sectors of industry, but to sub-sectors of industry's sectors.

The following list shows how those sectors of the economy, sectors and sub-sectors of industry are related when coefficient *K* is calculated.

1. Industry
    1) Fuel industry
        i. Oil extracting industry
        ii. Oil refining industry
        iii. Gas extracting industry
        iv. Coal industry
    2) Food industry
        i. Liquor and spirit industry
        ii. Tobacco industry
        iii. Fish industry
        iv. Other sub-sectors of food industry
    3) Chemical and petrochemical industry
        i. Chemical industry
        ii. Petrochemical industry
    4) Logging, woodworking, pulp-and-paper industry
        i. Logging industry
        ii. Woodworking industry
        iii. Pulp-and-paper industry
        iv. Wood-chemical
    5) Light industry
        i. Textile industry
        ii. Sewing industry
        iii. Other sub-sectors of light industry

6) Electric power industry

7) Ferrous metallurgy

8) Machine-building and metal cutting industry

9) Building materials industry

10) Microbiology industry

11) Medical industry

12) Other sectors of industry

2. Construction
3. Transport
4. Communication
5. Trade and services rendered to households
6. Housing and utilities
7. All other sectors of the economy

APPENDIX III

Table B1
Growth of Metro Areawide Tax Base

Year	Total Tax Base in Areawide Pool (millions)	Total Metro C/I Tax Base (millions)	% of Total C/I Tax Base in Areawide Pool	Total Metro Tax Base	% of Total Tax Base in Pool
	(A)	(B)	(C)=(A)/(B)	(D)	(E)=(A)/(D)
1975	137	2044	6.7	6403	2.1
1980	328	2930	11.2	9363	3.5
1985	1264	5394	23.4	15710	8.0
1990	265	1019	26.0	2097	12.6
1991	`291	1052	27.7	2185	13.3
1992	293	1007	29.1	2103	13.9
1993	289	984	29.4	2039	14.2
1994	277	923	30.0	2004	13.8
1995	241	917	26.3	2065	11.7
1996	260	941	27.6	2184	11.9
1997	275	1015	27.1	2351	11.7
1998	264	941	28.1	2286	11.5
1999	253	917	27.6	2273	11.1
2000	278	980	28.4	2439	11.4
2001	314	1094	28.7	2745	11.4
2002	214	710	30.1	2130	10.0
2003	232	757	30.6	2337	9.9
2004	252	781	32.3	2569	9.8

Source: House Research Department

APPENDIX IV

THE SUMMARY OF MINNESOTA LAND PLANNING ACT (MLPA)

1. Accommodating growth in a flexible, connected and efficient manner.
    - Supporting land-use patterns that efficiently connect housing, jobs, retail centers and civic uses.
    - Encouraging growth and reinvestment in centers with convenient access to transportation corridors.
    - Ensuring an adequate supply of developable land for future growth.
2. Slowing the growth in traffic congestion and improving mobility.
    - Improving the highway system, removing bottlenecks and adding capacity.
    - Making more efficient use of the highway system by encouraging flexible work hours, telecommuting, ridesharing and other traffic management efforts.
    - Expanding the bus system and developing a network of new bus and/or rail transit ways, based on a thorough cost-benefit analysis.
3. Encouraging expanded choices in housing locations and types.
    - Allowing market forces to respond to changing market needs, including increased demand for town homes and condominiums as baby-boomers grow older.
    - Preserving the existing housing stock to help maintain a full range of housing choices.

- Supporting the production of lifecycle and affordable housing with better links to jobs, services and amenities.

4. Working to conserve, protect and enhance the region's vital natural resources.
    - Encouraging the integration of natural-resource conservation into all land-planning decisions.
    - Seeking to protect important natural resources and adding areas to the regional park system.
    - Working to protect the region’s water resources.

VITA

Dmitry Shishkin was born on April 9, 1970 in Leningrad, USSR. He graduated from St. Petersburg Marine Technique University in June 1995 and in September 1995 entered Boston University where he earned his Masters of Economics degree in September 1997.

In 1997-98 he worked in Russia as a researcher assisting St.-Petersburg city government in developing a forecasting model of social and economic indicators. In 1998-2001 he worked as a consultant advising various regional governments and the State Duma of Russian Federation on intergovernmental fiscal relations.

In 2001, Dmitry entered the doctoral program at Georgia State University. His area of concentration was Public Finance. In 2007, he graduated with a Doctor of Philosophy degree in Economics.