Introduction[1]

The budgetary system in most contemporary countries is characterized by different degrees of decentralization of the power to provide public goods production and collect taxes. The decentralization of tax and budgetary authority not only causes an increase in the efficiency of public goods production, but also affects efficiency and equity. In these circumstances, the only instruments that enhance the benefit of decentralization and minimize its negative effects are interbudgetary transfers. It is typically the case that interbudgetary equalization transfers play a key role in the system of financial assistance to lower-level governments of the majority of the world.

In the study presented below, we consider several approaches to study the impact of financial aid on the policy of regional authorities with respect to the type of assistance, the given country's budgetary system, the allocation of tax collection authority among governing levels, and so on. It is emphasized in the literature that these factors determine different incentives for subnational governments to increase tax collections to regional budgets. These factors also affect the structure and efficiency of subnational spending on public goods.

In the same fashion, certain other hypotheses regarding subnational tax and budgetary policy formulation are considered. Partly, the analysis presented in the paper suggests that the subnational levels of taxation and public expenditure are based on a compromise between, on one hand, the goal of increasing budgetary revenue and consequently public goods production (which enhances the electorate's support of government), and on the other hand, an increase in the tax burden on the taxpayers in the region (which in turn decreases the political popularity of the administration as well as negatively affects long-term economic activity and budgetary revenue). The subnational decisions regarding spending and public goods production, on one hand, are based on the given territory's voter interests. On the other hand, they are based on the maximization of the given territory's budget, the establishment of non-conflict relations with higher levels of government, etc.

As mentioned earlier, besides their own budgetary revenues, subnational authorities finance their spending using federal budget funds allocated as finan-

cial assistance[2]. In the Russian Federation, mostly due to the fact that practically all regions in one form or another receive federal financial assistance, the size, principles behind, and forms of assistance significantly affect regional financial policy. The allocation of federal assistance to regions until recently constituted a complex and inconsistent scheme of agreements and calculations that was based to a large extent on the positioning and bargaining among different levels of legislative and executive authorities[3]. Other than regular financial assistance, which is established in annual federal budgetary acts, an immense amount of non-regulated financial resources (allocated via mutual settlements, budgetary loans, etc.) is distributed among the regions through federal administrative organs.

This paper argues that subnational decision-making in such conditions is determined not only by the type and condition of financial assistance, but also by the principles (mechanisms) of financial aid allocation used by the federal center. In the Russian Federation different allocation schemes are applied for different types of assistance. However, two criteria usually apply – the size of subnational spending and revenue (or estimates of potential revenue and expenditure needs under attainment of maximum fiscal effort), as well as the relationship between these factors. In relation to this, the main aim of this research is to develop, based on traditional subnational behavior models, theoretical models of the influence of central grants allocation mechanisms on subnational tax and budgetary policy. Another aim of this research is to conduct an empirical estimation of the scale of incentives that are observed in the regions in today's Russian budgetary system under the present allocation mechanism for federal assistance to the Russian regions.

The research is presented as follows:

The first part examines these issues from a contemporary fiscal federalism theory point of view. We consider options for modeling the effects of financial assistance on regional budgetary and tax policy, together with the effects on general federal assistance allocation to subnational authorities. On this basis, a subnational fiscal behavior model will be presented, whose central idea will be to model the choice regional authorities have between attaining a certain level of tax revenues and producing a certain level of public goods in the form of solving the utility maximization problem of private and public goods consump-

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[2] Problems of subnational borrowings constitute the topic of the separate research and are not considered in the present paper.

[3] See. I. Trunin "Record of interbudgetary relations in Russia, Moscow: IET, 2000.

tion in the region. The amount of regional spending, in such a scenario, is constrained by the amount of tax revenues as well as by amount of financial assistance received under certain formalized principles.

The theoretical analysis of this model gives several conclusions concerning the possible influence of different principles utilized by national authorities in setting assistance amounts on the choice of the size of regional public spending and tax collection. Among the parameters that can be used by the national authority for financial assistance allocation, we take a look at several, including: the degree of federal financing of the gap between certain estimates of regional tax capacity and public expenditure needs (the degree being equal for all the regions that receive aid), and the degree of matching actual regional revenue and expenditure by the federal center. Depending on the relationship among these parameters, the allocation of assistance to a given region brings about a change in financial policy according to an income effect (increase in spending and drop in tax burden) as well as a substitution effect. This substitution effect can bring about a change in the amount of regional public spending and tax collection equal to the exact opposite of what would be caused by the income effect.

The empirical part of this work, based on analysis of Russian regional budget reports, tests a series of hypotheses that stem from theoretical assumptions. First, we test to see if the statistical data coincide with federal-to-regional allocation models that are used when assuming formal budget constraint of regional governments. Beyond the analysis of all Russian regions, we divide the regions into specific groups — Northern Russian regions and regions receiving relatively large amounts of aid from the federal budget.

Further on, we estimate the impact of federal assistance to the regions on tax collection levels and the level of public goods production. Special attention is paid to the statistical significance of the negative influence of the size of assistance to the regions on tax collection in the given region, i.e. to testing the significance of the 'leakage' effect with respect to the flow of federal assistance to the private sector by using the transfer amount for an increase in the private goods consumption.

This works represents an extension of the research done under the joint Russian-Canadian Consortium CEPRA, through the project "Fiscal Federalism in the Russian Federation" (see *Kadotchnikov, Sinelnikov, Trounin, Shkrebela 2001*). This version incorporates new analyses of theoretical models, as well as

their estimation using an expanded dataset, which includes data for the year 2000 and new models of statistical estimation.

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1. The Economic Theory of Fiscal Federalism and the Impact of Interbudgetary Transfers on the Decision-Making of Subnational Authorities.

Traditional theoretical economic analysis of the public sector as a whole and the system of government finances in particular usually does not address the institutional aspects of the development of government finances. At the same time, the specific trait of contemporary government structures in most countries (regardless of the type of government) is a multilevel government structure: 1) a central government, responsible for the attainment of certain goals and for setting goals for the country as a whole, and 2) regional, state, provincial and local governments. The latter are entitled to revenue collection privileges that are delegated to it along with certain spending responsibilities. In this manner, the public sector, regardless of country, represents a set of institutions, whose responsibilities include the formulation of tax policy as well as an array of various programs.

The existence of such a system of government organs, which can broadly be termed federal, is reflected in a separate field in public economics that studies its vertical structure. The subject matter of this field involves the normative and positive analysis of the distribution of functions to different levels of government, as well as the interactions among them through, for example, interbudgetary transfers.[4]

The traditional theory of fiscal federalism is based on the allocation of responsibilities as well as the fiscal instruments between levels of government necessary for fulfilling these responsibilities, along with other responsibilities. Among the research done in the field of fiscal federalism, Musgrave, (1959) and Oates (1972), deserve special attention. The main conclusion from their analysis is that responsibility for macroeconomic regulation as well as for income redistribution to individuals falling in low socioeconomic groups should lie with the central government.[5] At the same time, there exist several types of local public

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[4] See Oates (1972), pp. 16-17

[5] Classical models that apply limits to subnational authorities' macroeconomic policy are addressed in Oates (1972), pp. 21-30. The ineffective utilization of instruments for allo-

goods and services that should be provided at the subnational level, since this level will be more efficient at providing the services according to the needs and preferences of their residents.[6] The socioeconomic growth caused by such decentralization is negatively dependent on the price elasticity of public goods. Econometric research of the demand for public goods, traditionally thought of as local, displayed low values for price elasticity of demand. This removes the higher growth of socioeconomic levels from the decentralization of the public goods in question.[7]

The analysis of an efficient system of distributing taxing powers between government levels shows that in allocating of powers it is absolutely necessary that subnational governments defer from taxing economic transactions or agents that are highly mobile (e.g. household goods, capital, other goods, services). Some researchers have argued that taxes that are targeted mostly at non-mobile economic units must be considered "benefit taxes"[8] (see *Oates and Schwab (1991))*. An analysis of non-benefit taxes on a subnational level (*Gordon (1983)*) leads to the following consequences: export of the tax burden, congestion effects, as well as an influence on tax revenue of other jurisdictions.

However, recent research works on the foundation of tax and spending authority allocation theory show that there is not a clearly defined benefit from the decentralization of public services. For example, *Boadway (2000)* asserts that in a contemporary federal government, the decentralization process is accompanied by both benefits, as well as costs, and the balance between the two in each particular case depends on a multitude of economic and political factors in the given country. Consequently, it is impossible to establish a universal optimal degree of decentralization that would fit all governments and all multi-level budgetary structures. The decentralization of tax and spending authority results in so-called fiscal externalities that take three main forms[9].

First, the decentralization of authority leads to an interregional differential in net fiscal benefits — the difference between the size of benefit received by

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cating revenue between individuals by subnational authorities is summarized by Brueckner (1998).

[6] See "Theorem of Decentralization," by Oates (1972).

[7] Research survey by Rubinfeld (1987).

[8] Benefit taxes mean a form of taxes that represent a close tie between the size of the tax level for a specific taxpayer and the benefit received from the taxes. Nonbenefit taxes do not portray this relationship.

[9] See. *Boadway (2000)*, стр. 44–45

citizens from the consumption of public goods and services and the size of their tax payments. Such a differential creates incentives for relocation of firms and individuals into other regions, and also violates the principle of horizontal equity. Second, a high degree of the decentralization is followed by horizontal fiscal externalities that are tied, mostly, to subnational authority attempts to achieve their goals at expense of other regions (an example of this type of externalities is represented by harmful tax competition, the export of tax burden to other regions, etc.). Third, a federal system is also characterized by vertical fiscal externalities —a consequence of subnational authority attempts to shift their tax and spending burden onto the federal authority.

The role of regulating the decentralization process is partly played by different levels of authority through constitutional and legal provisions regarding allocation of responsibilities and areas of competence among governments of different levels. Also, a key (almost the central) role in achieving effective functioning of public finances in a federal system is played by different fiscal arrangements. An element of these arrangements consists of intergovernmental grants, which entails a certain degree of vertical fiscal imbalances in the budgetary system. Regardless of the fact that the optimal level of such an imbalance depends on a multitude of factors and cannot be universally established, it can be shown that decentralization of spending authority is much more effective than the decentralization of tax authority.[10] Other arrangements include vertical and horizontal coordination and harmonization of tax and budgetary policy among various levels of government.

The literature of fiscal federalism specifies three fundamental goals for interbudgetary transfers: the compensation of benefit spillovers between regions/subnational authorities, the equalization of revenue among subnational budgets, and adjustment for inefficiencies in the taxing system.[11]

Interbudgetary transfers can take one of two forms: conditional grants — limited in the manner and form in which they can be used — and unconditional lump-sum grants with no limits set for their use. Conditional grants can be allocated as matching funds that are intended to co-finance in a given proportion the spending of subnational budgets (in accordance with theoretical recommendation, if consumption of public goods in one region creates positive externality for other territories).[12] In such a case, matching grants lead to a situation in

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[10] For more details see *Boadway and Keen (1996)*
[11] For fiscal federalism survey, see Oates (1999)
[12] See Oates 1972.

which governments take these externalities into account allocating the public goods.

On the other hand, unconditional grants represent an essential instrument for stabilizing interbudgetary relations with the aim of transferring funds from territories with high socioeconomic levels to poorer ones. It is important to note that equalizing transfers are a key element in government fiscal policy in a multilevel budget structure (see Usher 1996). Equalizing transfers aim to stimulate interregional competition through the development of equal opportunities to provide public goods for rich and poor regions.[13] They also aim to re-allocate resources between regions. The main aim of such transfers is the equalization of net fiscal benefits, differentials of which are characteristic of any decentralized system of government.

Another key role of general unconditional transfers involves an increase in the efficiency of the tax system. As mentioned above, it is more efficient for most taxes to be imposed on a national level (in contemporary tax systems, non-benefit taxes are levied on mobile factors and are also progressive taxes). Consequently, the national administration acts as an agent of subnational authorities, establishing and administering taxes. In the subnational budgets, general unconditional grants are transferred in the form of a share in the tax revenue that is collected either on the territory of the subnational territory in question or from the country as a whole.

Recent research has highlighted the fact that an additional goal of equalizing transfers is to reduce the risk of a sharp decline in budgetary revenue at the subnational level[14]. In the case of a sharp decline of budgetary revenue due to economic reasons, subnational authorities can count on federal assistance. In essence, subnational authorities can count on federal assistance to a certain degree through the use of equalizing transfers.

In this manner, in accordance with the theory of an effective system of interbudgetary transfers, a supporting system of grants must be established. This system must consist of matching and general grants. The system of matching

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[13]For example, in Boadway and Flatters (1992), equalizing transfers can be a must for compensating regions that have a low tax base but can therefore present economic units better taxing conditions. On the other hand, in several research projects (McKinnon (1997)) it is proven that government transfers to poorer regions doe nothing but halt the said regional economic growth. For example, government transfers limit the benefits of poorer regions for economic agents, specifically low wage and other rents.

[14] See for example, *Persson and Tabellini (1996), Alesina and Perotti (1998)*

grants should be established in order to compensate any spillover effects of subnational public goods (such as education).[15] The system of unconditional general grants (in the form of direct payments as well as a reduction in national taxes to make room for higher subnational taxes) must be aimed at interregional equalization of provisions for public services. Empirical research has illustrated that the structures of interbudgetary transfers in nations with multilevel budgetary systems do not coincide generally with theoretical prescriptions.[16]

In this context, as well as in light of this research, one can highlight two research problems associated with interbudgetary transfers. First, it is interesting to explore how national authorities decide how to efficiently provide subnational governments with financial resources necessary to meet requirements that follow from the functions assigned to them by the Constitution and other laws. That is, what understanding is given by national authorities to the term "interbudgetary equalization"? Second, there exist many models that are aimed at analyzing the impact of different mechanisms of interbudgetary grants allocation on the tax policy, as well as the provision of public goods at the subnational level. It is clear that these two paths are closely related to one another, especially with the possible reaction of those receiving financial assistance from the federal level.

The following two sections take a look at the influence of different types of federal-to-regions financial assistance on subnational government behavior. These sections also look at different models used by the federal center for allocating grants among regions taking account of the different aims and goals of such transfers. After this we move to the development of a simple theoretical model that utilizes a central grant allocation scheme among regions that is integrated in a classical model expressing regional authority choice between the size of tax burden and the amount of public goods production.

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[15] *Boadway (2000)* makes a remark that recently many governments have come to a conclusion that matching grants are not efficient as they distort choices of subnational governments and create incentives for possible inefficient resource use at subnational level. In this regard Boadway (2000) states that conditional targeted grants without matching requirements are more efficient.

[16] For example, Inman (1988) argues that the economic theory of interstate grants does not adequately explain the structure of interbudgetary transfers in the USA. A better explanation is provided by political models.

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1.1. Models explaining the effect of interbudgetary grants on the fiscal and spending behavior of subnational authorities.

The central economic theory behind fiscal federalism entails the impact of specific types of financial assistance on the fiscal decision-making of subnational authorities. The formulas presented earlier leave this issue for the most part untouched and do not analyze the possible impact of financial assistance on the full array of decision-making at the subnational level. This section considers the effect of interbudgetary transfers on the revenue-related decisions of subnational authorities. The models highlight the effects of such grants.

Traditional models describing the impact of interbudgetary grants on the fiscal and spending behavior of subnational authorities. One of the main assumptions of traditional models is that the principles on which subnational authorities base their decision-making are electoral in nature. In other words, it is argued that subnational administrations, just like an individual, maximize their utility through the allocation of public and private goods.[17] Furthermore, traditional models are based on the maximization of utility in regards to the median voter's utility as well as the welfare of the society in general.

Traditional analysis is based on the following assumptions:[18] convexity of indifference curves, absence of corner solutions, independence of public good consumption from aggregate private consumption, the absence of the ability to export tax burdens to other territories, the provision of public goods directly as products and services rather than in the form of subsidies, payments, and social transfers, the absence of one subnational authority influencing another's decision-making, the absence of the grant influencing the grantee from changing its spending into a different type of budgetary expenditure, and the absence of direct individual tax payments in order to finance interbudgetary transfers.

Bradford and Oates (1971) analyzed lump-sum grant allocations under a particular characterization of the political process. This characterization asserted that such grants to jurisdictions were equivalent to grants transferred to individual members of society (that is, their allocative and redistributional effects were similar). Consequently, assuming majority voting in public finance and the

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[17] It is necessary to discuss a whole group of models, for example, Niskanen (1971)'s classical work that analyzed subnational authorities as a collection of bureaucratic organs fighting for self interest maximization and not individual maximization.
[18] See King (1982), p. 90.

absence of a progressive tax system, one can argue that distributing the lump-sum grant to the budget of a jurisdiction is equivalent, from the point of view of determining the amounts of the private and public goods consumed, to the effect of lump-sum grants allocated to members (citizens) of this jurisdiction, if these grants were distributed in proportion to the tax payments of each member relative to the size of the total tax revenue paid to the budget of the jurisdiction.

Traditional models classify interbudgetary grants by their impact on decision-making of subnational authorities (this is in contrast to the above classification of grants in relation to their allocation mechanism). For example, *Gramlich (1977)* delineates allocated grants into three types.

First, given benefit spillovers with respect to the provided public good, it is necessary to subsidize the production (or consumption) of public goods in the territories where they are produced. Such subsidies can be established with a *Pigovian price reduction grant*, which is based on matching funds provided by the Center for all spending by subnational governments on public goods production.[19] *Gramlich (1977)* calls such a transfer (a non-limited grant aimed at reducing the production costs of government services for the grantee) a grant of the first type.

Second, the transfer's goal could be to redistribute income from wealthier regions to poorer ones through the transfer of funds or the sharing of tax payments that are more effectively levied on the national level to the subnational budgets. This type of transfer aims to alter the revenue pattern of poorer territories and not to change the relative price of public goods for these territories. These types of transfers can be categorized as a transfer of the second type.[20]

Third, another type of interbudgetary transfer entails grants that are used to satisfy political necessity. These grants provide a minimum or standard level of public goods provision regardless of the level of government from which they are allocated. In order to maintain this given level of public goods, the Center provides specific grants for the financing of specific public goods. This financ-

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[19] See Thurow (1966).

[20] *Netzer (1974)* showed that second type grants must be aimed at assisting poorer regions. In cases where centralized revenue distribution does not occur, it is better for individuals to live in wealthier territories with high revenue levels. This is mainly because the "tax cost" of public goods will be lower in wealthier territories than in poorer ones. If social equity becomes a prevailing point of view, public goods provision should be equal regardless of the region or even cheaper in poorer regions. If such a political reality exists, the central government must allocate resources accordingly.

ing method allows two things to the Center. First, it allows it to maintain control of subnational spending. And second, it spurs public goods production by subnational authorities. It remains clear that these types of grants do not allot subnational authorities freedom of spending decision-making. Furthermore, the Center sets firm standards for the allotment and consumption of the allocated resources, including matching conditions.[21] Such transfers influence not only other public goods prices, but also the income of grantees. These transfers are used by countries with multilevel structures more regularly than those of the first type. *Gramlich (1977)* terms these transfers of the third-type.

Classical analyses of the effect of grant allocation on the choice of consumption levels of public and private goods by grantees usually employ the standard theory of voter's utility maximization subject to budget constraints. Below we look at models addressing the effect of interbudgetary transfers, presented in *Scott (1952), Richard A. Musgrave, Peggy B. Musgrave (1989), Rosen (1998), King (1982) Wilde (1971)*.

One can see (see for example, *Gramlich (1977)*), that in case of an open-ended matching grant, it will only influence the price of public goods and not the income of the jurisdiction. The choice between an increase in consumption of public and private goods depends on the price elasticity of demand for public goods. Consequently, if this price elasticity is equal to unity, receiving the given grant generates no change in the consumption of private goods. This means that the whole sum of the grant received is utilized for additional consumption of public goods and no funds leak to the private sector. A high price elasticity of demand for public goods reduces private goods consumption, and the grantee's public expenditures rise by an amount greater than the value of the grant received.

Lump-sum grants that only change the income of subnational jurisdictions (known as second type grants) bring about an increase in the consumption of both private and public goods. Consequently, such grants alter only the receiving jurisdiction's income, but not the relative prices of public and private goods. If public and private goods are normal, the income elasticity of demand on public goods will always be positive. As long as this elasticity remains positive with respect to both private and public goods, the increase in the consumption of

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[21] Schultz (1974) illustrates that a more effective method for the utilization of this mechanism entails the development of specific relations between national and subnational authorities, particularly when the latter is equal to the national government in public goods production (actual control over administration, etc.)

public goods cannot equal or exceed the grant amount. This means that there are always some funds leaking to the private sector, so that an increase in the grant amount leads to a lesser increase in the consumption of public goods since some of the funds are diverted to private goods consumption.

The effect caused by conditional close-ended grants (third type grants) on subnational fiscal choices is a variant midway between the effects of the first and second type grants. These grants are close-ended in sum and have constraints set on the grantor's resources that do not allow the grantee to receive more than a certain amount. Let us say that the conditions of the grant allocation require that the grantor match the grantee's expenditures on the subsidized good with the grant in some proportion. It is clear that until, the grant amount exceeds the budget constraint of the grantor [federal center] the effect of the grant on the size of spending on public goods consumption will be analogous to the first-type grants we reviewed earlier. It is worth mentioning that in case where matching conditions are set in regards to government financing, an increase of the grantee's spending on public goods consumption equal to the size of the grant (as long as there is a uniform price elasticity of demand for public goods) means that the grantee decreased its own spending on public goods consumption in comparison to what occurred if the grant were not received. Once the sum stipulated in the matching grant attains the maximum size of the grant, further increases in the grantee's public goods production can be financed only by an increase in its own spending. The influence of the grant from this moment onward becomes analogous to that of a lump-sum grant that alters only the grantee's income.

In such a manner, the response of subnational authorities to receiving a grant, in the traditional analysis, depends on whether the transfer affects the relative prices of private and public goods or changes the subnational jurisdiction's income. The response in essence, depends on the following factors:
- the price and income elasticities of demand for subnational public goods,
- the extent of the drop in the relative price of public goods as the grant is received,
- the maximum size of the grant.

In any case it can be shown that the influence of the grant on the grantee's spending on public goods production will reach a maximum point if an open-ended matching grant is received. It will be less in the case when a conditional close-ended grant is received because both relative public goods prices and the

grantee are affected. The minimum point will be reached when receiving the grant influences the grantee's income but does not alter the relative prices of private and public goods for the grantee.

This only applies when the public goods consumed by the grantee are homogenous. If this assumption does not hold, the grantee may find it unrealistic to replace its own spending on public goods with the resources granted by the matching transfer. Further limits on allocation can also be dictated by the transfer. Consequently, if the limited grant's conditions are spread to the financing of new spending programs as well as under limitations on reducing the grantee's spending, they can sharply increase spending. This is in contrast to close-ended matching grants that do not incorporate any transfer limitations.

Behavior models of subnational authorities in relation to their own budgetary priorities. The theoretical foundations for the effect of interbudgetary grants on subnational decisions show that the viability of the above-mentioned models depends on the assumptions being met. Particularly important is the assumption that bureaucrats on the subnational level strive to maximize the utility of the median voter.

However, empirical research highlights the fact that the effects caused by an increase in society's income in the forms of the grant received and individual income growth (for example, through tax breaks) do not always match. This effect was first noted by Gramlich (1977) and was termed the "flypaper effect" or the flypaper theory of incidence.[22] This theory concludes that once receiving the grant politicians and bureaucrats do not cut their local taxes as would be dictated by models in which governments maximize the interest of the median voter. Below we consider several models that explain situations in which a lump-sum grant causes a greater change in the size of budgetary spending than does the population income.

Niskanen's model. The lack of correlation between a grant allocation and the voter's preferences is explained by Niskanen (1971) through a mismatch between objective functions maximized by the voting population and their representatives (both elected and appointed).[23] The representative's behavioral models posit that the representative's welfare is determined by the income benefit from their post, reputation, power, the productivity of the administrative organ, and the ability to control decision-making.

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[22] Gramlich (1977) notes that this term was first used by Okun (see p. 236)
[23] See Niskanen (1968), Niskanen (1971), Breton and Wintrobe (1975)

It seems that all these factors are dependent on the specific government entity's budget size during the given representative's time in office. Consequently, the representative maximizes the size of the given entity's budget.

In this model the authorities are associated with a monopoly structure that provides voters (or their political representatives) with their services. In these instances, the equilibrium level of services provided is at the point where the average benefit from the provided public goods (services) equals the voter's average costs on public goods production. In such a situation, the grant generates an increase in the subnational budgets equal to or greater than the grant size (the total benefit gained from the grant can prevent a tax cut or even bring about a tax increase). Receiving a lump-sum grant induces the given authorities to lower taxes and consequently, reduce their budgets, in comparison to a situation in which the grant was conditional. This spurs the subnational governments to act in such cases as if the grant received were conditional.

Romer-Rosenthal Model. Romer and Rosenthal's model (1980), in similar fashion to Niskanen's models, has the property that subnational authorities maximize their budgets, while involving voters in the process of determining the size of public and private goods production. Romer and Rosenthal designed the following mechanism for the specification of budgetary spending: the authorities annually set their budgetary spending independently at a certain level (equal, for example, to the one from the previous period) if voters did not vote for a different level through a referendum. . Consequently, through such a referendum the authorities establish a series of choices or options in setting the spending for the following year.

The authors' hypothesis in these models states that in order to maximize their own budget, the authorities will change their budgetary spending only if the actual spending level is lower than the optimal level determined by the utility curve and budget constraint. In essence, a referendum is taken only to receive voters' approval for greater spending. In such a situation authorities set a spending level higher than the optimal one. In situations where the actual budgetary spending level is lower than the optimal, voters approve greater spending even if the suggested level is higher than their optimal one I because it is the only option offered in the referendum.

The authors explain "the flypaper effect" by the fact that the increase in the voters' income leads to a reassignment in spending only if the optimal level for public goods consumption is higher than the actual level. At the same time, as Romer and Rosenthal suggest, a grant transfer provides a legitimate reason for

subnational authorities to increase public goods consumption by the amount equal to the size of the grant. If the optimal consumption level corresponding to the size and conditions of the grant is greater than actual spending, then the latter should increase by even greater amount.

Oates' Model. Several models have attempted to explain the "flypaper effect" using the concept of fiscal illusion, better known as asymmetric market information. For example, *Oates (1979)* posited that subnational authorities set the spending level in correspondence with the preferences of the median voter. At the same time, the authorities do not provide the full array of information regarding government finances to the voting public.

This model dictates that once the authorities receive the grant, they can misinform the voters about the form and amount of the allocated assistance. If one assumes that the population selects the level of public goods production based on a subjective assessment that can be termed "tax cost" (the relationship between the taxing level to the amount of public goods received in a given region), then if preferences of voters and authorities coincide, a lump-sum grant is viewed by the regional authorities as a general expansion of regional revenue. In such a case, public goods production increases by an amount depending on the income elasticity of demand for public goods due to the maintenance of the previous tax –cost level, while the overall taxes fall.

At the same time, another variant is possible under which the regional authorities publicly provide information regarding the production of public goods at a new subsidized tax price (for example, they can inform the voters that the price of a given public good falls relative to the prices of the other public goods). Once the voters receive such information they act (or approve of the government's actions) in regards to the expansion of public goods production based on price elasticity of demand for public goods

Break's Model. Break's (1980) thesis regarding the election of subnational powers argues that voters in the regions also vote in national elections, and consequently influence interbudgetary transfers. Even given the incentive to increase spending when their individual income goes up, subnational voters will be aware of the negative effects related to the rise of subnational tax revenues (a drop in financial assistance, for example). In this case the growth of individual voters' income does not lead to an equal rise in public spending, but a rise in the grant amount is totally transferred to the public sector.

King's Model. *King (1984)* notes that the authority's behavior explains the "flypaper effect" in one way or another that traditional models do not properly

address. But, none of the models address why, regardless of the "flypaper" effect, the impact of the lump-sum grant on subnational spending in the majority of cases is less than the impact of matching grants.[24]

The author presents his own subnational authority behavioral model. The key difference between King's model and the rest is as follows: the voters' aim is to maximize their utility through an optimal selection between public and private goods, subject to the condition that the tax level at the subnational level cannot allow the poorest social groups to fall under the level determined by a median voter. In this situation the budget constraint becomes a polygonal line. This does not allow for the expansion of subnational spending.[25] At the same time, the grant spurs the same effects postulated by traditional models.

There exist other works that address the aforementioned effects that inter-budgetary transfers have on subnational spending. Several of them reject the idea that a "flypaper effect" occurs from the subsidization of public goods as a separate phenomenon. This suggests that there may exist several inconsistencies in the analysis of the effects created by the budgetary mechanism. *Zampelli (1986)* looks at the special nature of conditional (earmarked) interbudgetary transfers. In part, it becomes clear that if spending increases on subsidized public goods above a certain level is not a priority, then the grantees of conditional grants lower their own spending on the given public goods and utilize the freed up funds for other types of public goods. Consequently, open-ended conditional grants of subsidized public goods entail a more complicated transfer than lump-sum grants that expand the grantee's revenues but do not alter the price structure on other private and public goods. A study of American cities illustrates that from 40-70 percent of the entire grants allocated for financing housing and public services were fungible resources that were also utilized for financing on other public goods.

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[24] For a survey of grants in the USA, see Gramlich (1977).

[25] King (1984) provides an example in which lower national individual taxes do not influence the revenue of the poor (progressive). Under such a situation, if the subnational level of taxation incorporates a property tax then the poor's income level will be worsened.

1.2. Models for the allocation of interbudgetary equalizing transfers

In the previous chapter, we looked at several approaches to the analysis of the influence of intergovernmental transfers on subnational governments' taxation and public expenditure policies. In this section we tackle the second issue relevant for the impact of interbudgetary grants on subnational fiscal behavior — possible equalization principles that direct national financial assistance allocation. While the models addressing subnational authorities' response to different types of interbudgetary grants pay particular attention to specific grantee behavior depending on the type of grant and method of its calculation, the models for national financial assistance allocation will be based primarily on the priorities of the national government (i.e. of the government-paying body). This ignores most aspects related to the grantee's decision-making.

The literature concerning national-to-regional (federal-to-subnational) financial assistance allocation models can be categorized in two classes. (Technical aspects of the distribution of equalization transfers can be seen in Appendix 1):

- Models without limits on the resources of the national budget that are allocated for interbudgetary equalization. These grants are specifically tied to the revenues (fiscal capacity) and expenditures (expenditure needs) of a given subnational territory requesting financial assistance.[26]

- Models that include limits on federal grants and assume that the financing sources for interbudgetary equalization are the actual budgets of the donor territories.[27]

Both of these model groups can be based on the principles of equalization of spending and revenue variables in the subnational budgets. They can also be based on the potential or normative spending and revenue variables. The latter entail one of the most important factors in the allocation of financial assistance as stimulators for greater tax collection and more effective spending in a given region.

Before analyzing models of equalizing transfers it is important to understand the concept of "interbudgetary equalization." The literature usually in-

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[26] See, for example, *Smart (1996)*, *Fisher and Papke (2000)*, and *Inman (1988)*.

[27] More on this see *Musgrave (1961)*. In modeling, built in functions allocate whole grants with limits on the assets of the grantor.

cludes the following assumption for interbudgetary equalization: in the circumstance in which the tax revenues of a subnational budget are equal to a certain fiscal capacity value, a grant is transferred in order to finance a public goods provision in the territory in question up to the standard level corresponding to the territory's spending needs[28]. The key question in regards to the development of an effective interbudgetary equalizing scheme is whether the scheme is flexible in dealing with situations in which tax revenue does not conform with potential levels as well as situations in which it becomes problematic to adequately assess the spending need, fiscal capacity, and standard spending of a region.

Models without limits on resources allocated for interbudgetary equalization. The first type of models deals with equalizing transfers which are not limited by central budget resources in the determination of the amount of financial assistance (for a more complete analysis see *Musgrave (1961)* and *King (1980)*). Based on this approach, one can specify the following principles for determining the volume of financial assistance to a given regional unit (calculated for a given value of public goods).

First, it is possible to allocate financial assistance with the goal of eliminating the difference between the amounts of regional budget spending and revenue. One of the simplest options for calculating the amounts of financial assistance to the regions is to cover the difference between regional spending and revenue, or between their average values, without incorporating additional coefficients in the allocation formula. This calculation method for transfers can take the following main forms for calculating the amount of financial assistance:

1. Allocation of the transfer according to the actual territorial revenue and expenditure (covering the difference between subnational revenue and spending).

This financial assistance allocation method is the simplest one, and is usually employed in governments where subnational authorities enjoy a low level of autonomy in exercising discretion over their spending and revenue decisions. In such cases, the spending level, the tax base, and tax revenues on the subnational level are controlled by higher authorities. Consequently, a transfer can completely cover the difference between subnational spending and revenue. For example, the assistance allocation system in the USSR was based on such a

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[28] See *King (1980)*, *Aronson (1977)*, *Musgrave (1961)*

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principle. The same scheme is used in Italy in allocating its equalization fund.[29]

2. The priorities of the national government can be include in the transfer allocation with the aim of providing assistance for subnational spending up to a standard level independent of a given territory's fiscal capacity. The size of this standard expenditure level can be set by national government based on the average expenditure level in the country as a whole or on some other level of subnational public expenditure.

In the case where the national priorities include a stimulation of regional fiscal effort (which means setting rates of subnational taxes at a maximum level attainable) then the assistance allocation formula can be calculated in accordance with subnational fiscal capacity value (which is usually defined as a product of the regional standard tax rate and the tax base).

The interbudgetary equalization scheme illustrated above aims to allocate equalizing transfers as well as to provide specific types of financial assistance. For example, additional assistance to West German lands (*Bundesergänzungszuweizungen)* is given to poorer western lands and is allocated to cover additional resource needs, calculated based on the difference between necessary expenditures and the land's revenue capacity.[30] In the same manner, an annual block grant is distributed in Great Britain based on the difference between some estimates of the necessary spending and a given territory's revenue capacity made by central authorities.[31]

The assistance allocation methodology between subnational budgets can intermix criteria of actual and normative indicators. It can, for example, utilize actual subnational tax revenue and normative expenditure data. National authorities can establish criteria for the use of their own resources for covering necessary spending needs. In this case, the national government could distribute financial assistance based not on absolute deficit indicators but on certain estimates of some deficit level in relation to, say, regional normative expenditures that can be subsidized with the help of a transfer. A similar process is employed in Great Britain, where tax transfers (i.e. rights given to local authorities to raise tax rates, revenue from which goes to local budgets) cover the differences

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[29] See *Emiliani, Lugaresi and Ruggiero (1997), p.267-268*

[30] See *Spahn and Fottinger (1997)*

[31] See *Potter (1997), p.347*

between revenue and necessary local expenditures only to a certain cap amount (the process is known as "capping").

The second class consists of models of assistance allocation for the purposes of bringing regional fiscal indicators in line with the average or normative indicators. In essence, national authorities try to bring a given territory's fiscal capacity in line with the average (or standard) fiscal capacity in the country as a whole.[32]

The use of such a system can stimulate regions to raise the assistance amount they receive by increasing their tax rates. This brings about an increase in budgetary expenditures in regions with high tax bases. In particular, *Oates (1977)* notes that the utilization of such a scheme suggests that without a grant regional authorities would reduce their own expenditures. *King (1973)* asserts that such an equalization system causes an increase in interregional differentials in public expenditures.

For this reason this scheme is not widely used. An example of this scheme, however, can be seen in the Canadian resource allocation system, specifically through the Equalization Payments program. This program distributes unconditional lump-sum financial assistance packages from the federal budget. This distribution occurs in accordance with a given province's fiscal capacity, which is calculated based on standard tax rates and the average fiscal capacity level (based on the average tax base and standard tax rates).[33]

It is also possible to allocate the transfer depending on the relationship between spending indicators. For example, the relation of normative subnational expenditure needs to the actual subnational expenditures can be used. In such a case the transfer constitutes an amount equal to additional spending that is necessary for a region in comparison to the national average for the production of the average public goods provision level. This transfer allocation system can be employed by governments with a low interregional tax base differential. This system can also be employed if the goal of the transfer is to finance specific types of expenditures without taking into account the size of resources available. The key weakness of this scheme is the lack of ability to incorporate the subnational authority's fiscal efforts into the grant allocation formula. Thus, for example, lump-sum grants to subnational jurisdictions for transportation devel-

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[32] This scheme is close to the one in *Musgrave (1961)*, p. 104

[33] See *Courchene, Martinez, McLure, Webb (2000)*, p.101-103, *Krelove, Stotsky and Vehorn (1997)*

opment in Italy are distributed based on the difference between actual production costs of certain public goods and the national average value.

Other than the interbudgetary equalization schemes mentioned earlier, there exist different combinations of these variants that limit the schemes' failures. We will now take a look at several schemes that have been presented in theoretical works as variants for more effective allocation results.

Cripps-Godley Scheme.[34] This model for allocating resources among subnational budgets bases the grant amount on the difference between necessary current spending and its actual revenue, with an adjustment for the fluctuation of actual regional tax rate from the standard value. The government distributing the transfer sets the extent to which the difference between actual and standard tax rate is taken into account when calculating the transfer amount.[35]

Therefore, the scheme in question ensures that territories with equal tax powers receive equal assistance for public goods production.

Mathews' Scheme. With the purpose of integrating fiscal power indicators in the assistance allocation model, *Mathews (1977)* introduced a transfer allocation model that suggests that a transfer should be aimed at, first, equalizing interregional tax base differentials, and second, equalizing tax collection differences. This entails a combination of the schemes discussed above. Other than calculating the differences in tax capacities, this scheme does not have any advantages in comparison to the aforementioned schemes. Consequently, territories with equal tax powers can establish equal expenditure levels only if they have equal tax bases, but this equalization scheme stimulates regional authorities to increase tax rates.

In reality, a combination of equalization schemes is widely used. In accordance with the Australian federal assistance system, each territory has a value that expresses its tax capacity (calculated without taking account of standard taxing conditions) in relation to the national average indicator, adjusted in accordance to the relationship between the territory's expenditure needs and the national average.[36] Transfers are allocated based on this indicator, which in essence displays the territory's budgetary health in relation to the national average,

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[34] See *Cripps and Godley (1976)*

[35] By setting the value of k in the formula above

[36] See *Craig (1997)*

A similar system accounting for expenditure needs and subnational tax capacities is used for the allocation of lump-sum assistance in Korea.[37]

Several different interbudgetary equalization schemes were analyzed above based on simple spending and revenue indicators on the regional level. However, other sources present more complicated equalization mechanisms. Thus, for example, an interbudgetary transfer system can be aimed at equalizing indicators such as the intensity of subnational spending changes (accounting for differences in regional spending needs) due to a change in subnational tax powers, as well as the elasticity of regional spending changes in relation to regional tax power levels. *King (1980)* presents several variants of such a formula. It is possible to develop interbudgetary equalization formulas aimed at attaining equal values for the intensity of spending changes in regions under conditions of changing regional tax powers. The goal of this allocation would be to establish a certain relationship between current and standard expenditures. Under such a system, the intensity of subnational regional spending changes due to an equalization of tax powers is constant for all regions and is determined by national authorities.

It is also possible to develop an interbudgetary equalization formula based on the attainment of a given level of dependence between production indicators that we have seen and other indicators, including the relationship between subnational tax effort and average tax effort, and the relationship between the territorial expenditures and the national average. King (1980) presents equalization schemes in which the allocation results in a change in the intensity of subnational spending under condition of an equalization of standard expenditures. This occurs if the given territory's tax base is equal to the average value established by the elasticity of subnational expenditure changes in relation to subnational tax powers on a uniform level with the given region's tax base equal to the average value, and so on.

Models with limits on resources available for interbudgetary equalization. The analysis of transfer allocation systems and their influence on grantee's decision-making becomes complicated with the addition of limits on national budgets.[38] Until now we have assumed that national budgets are sufficiently endowed with resource for financial assistance to comply with the demands of

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[37] See *Chu and Norregaard (1997)*

[38] See *Musgrave (1961)* for details. Model by *Chernick (1979)* also employs conditional grants allocation function with constraint on the total funds of the grantor.

the schemes considered. In reality, however, national budgets obtain revenue, including revenue that can be used for interbudgetary equalization, through taxes in the territories. In this case the assistance allocation process can be defined as an amount of subsidy to the regions, allocated according to certain equalization criteria.

A simple illustration for such modeling is the interbudgetary equalization process in Germany where interbudgetary transfers occur via revenue garnered from a national value-added tax. This consequently helps those territories that have below-average value-added tax income.[39] If the amount set aside for equalization is not enough for the poorer regions, their right to receive financial assistance undergoes a proportional decrease.

One can assume that in order to support the transfers, the national government procures additional resources from richer regions through greater tax rates. This allocation scheme results in a more complicated calculation for the transfer size needed. This calculation depends on the relationship between the region's tax base and the average national tax base, and not on the direct difference between these two variables, as was the case in models that did not have budget limits. One must note that as a principle, national taxes are collected without a direct link to possible future assistance allocation. Also, the amount of the resources allocated between regions is always set regardless of overall national resource availability. At the same time, additional requests for interbudgetary assistance can be adjusted for through a change in national tax rates.

Consequently, the analysis of different equalization schemes leads one to note that the acceptance of a certain scheme in a given country depends on, first, the intended transfer allocation results, and two, the particular conditions in the country as a whole.

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The group of models analyzed in this chapter does not adequately address the influence of different assistance allocation schemes on regional tax policy, which is further complicated by limits on national budget allocation to recipient regions (equality of subnational expenditures, tax revenue, and financial assistance). The models offered in the next chapter not only illustrate the influence of grant allocation on subnational decision-making, but also concentrate on specific aspects of voter and regional administrative organ activity. However, these

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[39] See R. Watts and P.Hobson "Intergovernmental relations in Germany" // *Fiscal federalism in Russia: Problems, Theory, Experience* , Moscow, CEPRA, 2001, p. 209-271

models do not address the priorities of the authorities allocating the grants, as well as the priorities of the allocation schemes. One can still stipulate that the effect caused by interbudgetary transfers on the decision-making of those who receive the grant is not only based on the type of transfer, but also on the assistance allocation scheme.

It seems to us that a key and central aspect of the functioning of the assistance allocation system is the influence different schemes have on subnational fiscal policy options. One can clearly hypothesize that these choices depend on the assistance allocation models (including the type of grant), as well as on the inclinations of subnational authorities, the characteristics of private and public goods in the given region, and so on. Taking into account this hypothesis, we analyze the particular nature of equalizing transfer allocation in the Russian Federation. We also integrate the allocation models described in Chapter 1.2 among the Russian regions using a classical model that highlights the effects of the grants on subnational decision-making with respect to the production of public and private goods (see Chapter 1.1).

2. Modeling regional fiscal behavior

2.1. The Allocation of Financial Assistance Among Russian Regions

In this chapter, we attempt to formulate an allocation process for assistance allocation from the federal center to the Russian regions. In order to do this, we first look at the key characteristics of the assistance allocation system to the Russian regions, and then present a model that will incorporate principles for allocation as a relationship between the size of the transfer and a set of parameters that express the needs of given regions for public goods and their own ability to finance these public goods.

Federal assistance to the Russian regions flows through many channels. The size and nature of these channels have undergone serious changes in the past years. The main allocation channels are transfers from the federal fund for regional support, subventions (specific conditional transfers) given for financing specific items, "grants-in-aid" (general grants that can be used for all purposes but that are not allocated with a formalized methodology and are uniform for all regions), and resources transferred through mutual settlements. Table 1 presents data regarding different types of federal financial assistance to the Russian regions from 1992 to 2002.

Table 1

**Federal financial assistance to the Russian Regions
from 1992-2002 (% GDP) Closed jurisdictions
(usually – military plants, nuclear research centers,
etc that do not belong to any of the Federation subjects
and subordinate directly to the federal center)**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*
Grants-in-aid and subventions	0,00%	0,02%	0,09%	0,06%	0,09%	0,13%	0,10%	0,06%	0,15%	0,54%	0,34%
Including:											
Grants-in-aid and subventions to the "closed jurisdictions"									0,11%	0,12%	0,13%

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*
Other grants-in-aid and subventions									0,04%	0,42%	0,21%
Subventions**	0,79%	0,69%	0,42%	0,12%	0,12%	0,09%	0,02%	0,20%			
Transfers from the Fund for the Financial Support to the Regions	0,00%	0,00%	0,36%	1,17%	1,04%	1,22%	1,12%	0,99%	0,96%	1,14%	1,62%
Including:	0,00%							0,00%			
Transfers	0,00%	0,00%	0,36%	0,86%	0,68%	0,86%	1,00%	0,99%	0,96%	1,14%	1,35%
Including government support for the "northern supply."									0,06%	0,08%	0,08%
Transfers at the account of the regional share of VAT	0,00%	0,00%	0,00%	0,31%	0,36%	0,36%	0,12%				
Subsidies and subvention from the Compensation Fund										0,37%	0,45%
Including:											
Subsidies to finance the federal mandate of social protection of the handicapped										0,13%	0,13%
Subsidies to finance the federal mandate of government support of citizens with children										0,24%	0,26%
Matching grants to finance regional social expenditures											
Subsidies for regional development									0,03%	0,05%	0,19%
Government support of road construction								0,18%	0,11%	0,27%	0,33%
Fund resources for the reform of regional finances										0,00%	0,01%
Resources transferred through mutual settlements	0,61%	1,95%	2,54%	0,42%	0,81%	0,43%	0,36%	0,14%	0,28%	0,05%	0,00%
Net loans from the federal budget	0,09%	0,03%	0,02%	0,04%	0,23%	0,64%	-0,03%	-0,10%	-0,08%	0,02%	0,00%
Other types of federal financial assistance									0,00%	0,13%	0,05%
Total: resources transferred to other levels	1,49%	2,70%	3,4%	1,8%	2,3%	2,5%	1,60%	1,36%	1,54%	2,56%	3,03%

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*
of budget											

*plan

** until 1999 the subvention was allocated separately from the completion of the federal budget

Source: Ministry of Finance of the Russian Federation, authors' calculations

In order to formulate the hypothesis regarding which principles of assistance allocation to the regions should be used, we will take a brief look at the official distribution mechanisms used for different types of assistance. The analysis of the transfer allocation from the Federal Fund and manner of distributing additional assistance from 1994 to 1998 show that transfers were aimed at compensating either estimated or reported differences between regional revenue and public spending.[40]

The introduction of a new transfer allocation system from the Fund for regional financial support in 1999 highlights that the lion's share of the transfers was geared toward a factor relating the per capita regional tax capacity and the national average. This national average was calculated taking into account the interregional size differential indicator and the cost of public goods production in the given Russian region, which became known as the budgetary spending index. This index expresses the interregional differences in the cost and size of budgetary spending, taking into account some indirect factors. It shows the capacity to produce one or another type of public goods in different regions. This is tied to interregional differences in age demographics, as well as climate, geography, and other such factors. Accordingly, the present allocation system for transfer distribution from the Federal Fund is directly proportional to the budgetary spending index and inversely proportional to the region's tax capacity value. Consequently, to a given extent one can see that the consequent transfer allocation (70% in 2000 and more than 40% of federal financial assistance in 2001) is targeted at covering the difference between tax capacities and spending tendencies, as expressed by the budgetary spending index.

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[40] See «Russian economy: trends and prospects», annual surveys of the IET in 1996-2000.

It is important to note that in reality, transfer allocation is performed taking into account the size of assistance from the previous year, not only the difference in the regional revenue and spending indicators.[41]

Grants-in-aid and resources transferred through mutual settlements represent informal, unregulated types of federal financial assistance. The size of these transfer types is currently very large (30% in 2000 and 20% in 2001). As a whole, the allocation of mutual settlement grants-in-aid and resources is aimed at covering current regional budget deficits.

The significant increase of regional subventions during 2001 is tied to the development of Fund compensation with which a series of federal mandates were financed (payments to families with children, support for the handicapped, certain social obligations, etc.). These resources are allocated in accordance to a series of social support obligations and are not tied to a given region's ability to finance such obligations. Our research focuses on 2001, and consequently the above-mentioned fact does not influence our results.

As mentioned in Chapter 1.2, financial assistance allocated in order to achieve interregional equalization in regards to public goods production can be (depending on the interpretation of the term "equalization") targeted at compensating regional revenue (revenue capacity) that is lower than the average, raising regional spending, or covering the difference between spending (which the region itself considers necessary) and several regional revenue estimates. In the case of the Russian Federation, our analysis shows that regardless of the declarations inherent in the Budget Code (see article 135 of the Budget Code) that federal assistance is aimed at establishing minimal regional budgetary levels (a minimum amount necessary for a given region to supply certain public goods), practically speaking—other goals are apparent in the assistance allocation system. Based on this fact a hypothesis can be put: federal assistance to the Russian regions is targeted at financing the difference between the establishment of legal expenditure obligations and potential (calculated by the federal center) revenue. In other words, the federal center finances the difference between regional revenue and expenditures.

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[41] The total amount of transfers for 2000 was calculated using a lot of various adjustments that smoothed sharp changes in comparison to the previous year transfers when old methodology was employed (i.e. at least partly financial assistance was oriented on the older principle of filling the gap between subnational public revenues and expenditures)

In reality, calculating the spending obligations and potential revenue varies over time, and is based on actual revenue and spending values as well as on the normative size of spending tendencies and tax capacities.[42]

In the group of similar models, it is convenient to use Rawls-type functions for the behavior of the federal center. In Rawlsian models, the criterion for choosing the fair size of financial assistance is to maximize the welfare of the poorest regions.[43] Consequently, this introduces a question of what elements determine whether a region is poor or not.

If the criteria for being poor involve the revenue per capita in a given region, then one can assume that an equalization model must focus on the fact that the central authority chooses the transfer size on the basis of the difference between the actual and the average per capita tax receipts in the country. If the Center aims to maximize the size of the grant to a region, based on the highest possible value in the case of a situation of budget constraint on the assistance amount, then the optimal decision would be to peg the transfer amount to each region up to the level of the difference between actual tax receipts and the normative equivalent.

If the need indicators can also be understood to include spending per capita from regional budgets, than under a spending equalization plan the optimal decision would be to peg the transfer level to the difference between actual spending and average regional spending. We must note that even with such equalization of subnational expenditures (when regional spending tendencies are significant) the national authorities can orient their allocation method on regional revenue indicators. The national authorities can suppose that under equal actual (potential) revenue conditions, the ability to produce public goods at the regional level also equalize.

A more difficult question addresses the choice between traditional indicators of need (such as the revenue amount or regional spending, GDP per capita, Gini coefficient, etc.) and indicators that describe not only revenue in different regions, but also the necessity of spending on public and private goods.

There exist two groups of factors that affect the regional budgetary spending. The first group includes indicators of price difference in different regions.

The second group includes indicators that are based on the differential public and private goods consumption that arises due to geographic, demographic,

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[42] In general the proportion of filling the gap as well as weight assigned to actual values in the transfer allocation formula could be different for different regions.
[43] See J. Rawls (1971).

and other differences among regions. From the point of view of interbudgetary equalization, one of the most important factors is the difference in the demand for public goods. If the Center assesses the value of a region's revenue and spending, then the region's overall need for financial assistance should be determined using the size of revenues adjusted to the spending tendencies. This value can be the difference between the potential regional revenue and the normative spending in the region.

In order to check to what extent the difference between the normative revenue and spending coincides with traditional needs indicators, one must analyze the interdependence between these variables (the dependence between the normative deficit and the gross regional product) taking into account interregional difference in the minimum living standard. The results of this analysis done for the panel data from 1994 to 2000 for 88 Russian regions demonstrate that there exist a negative correlation between the budget deficit and the gross regional product per capita.

Using this definition of financial need, the Center, in the simplest case, chooses an amount that covers the difference in the normative spending and the taxing capacity, subject to budget constraint on total transfer amount. In such a case, the optimization of financial assistance allocation can be expressed as follows

$$\min_i\left\{\frac{Tr_i}{\widehat{E}_i - \widehat{T}_i}\right\} \to \max_{Tr_i} \text{ under the constraint } \sum_{i=1}^{N} Tr_i = Tr \qquad (1)$$

where

Tr_i – size of assistance given to a region from the Center;

$\widehat{T}_i$ – a region's fiscal capacity;

$\widehat{E}_i$ – a region's normative spending (expenditure needs);

Tr – the sum of assistance allocated to the region.

In order to solve this problem the following function for allocating assistance is assumed to apply:

$$Tr_i = \gamma\left(\widehat{E}_i - \widehat{T}_i\right) \qquad (2)$$

where γ depends on the following:

$$\sum_{i=1}^{N}\left(\widehat{E}_i - \widehat{T}_i\right) = \frac{Tr}{\gamma} \qquad (3)$$

In such a way, the Center's optimal strategy is to provide each region with a transfer that is tied to an equal financing for all regions from a given regional differential between normative spending and fiscal capacity. Covering this difference in equal terms for all regions, and on an equal basis with respect to the normative tendencies and the financial deficit is how the Center is assumed to behave. A similar formula can be written for a policy oriented not on the normative spending revenue factors but on actual values or a combination of actual and normative values.

In such a manner, our analysis allows us to formulate a hypothesis that in Russia, federal financial assistance is aimed at covering the difference between regional revenue and spending indicators. This coincides with federal assistance allocation between regions that is based on a Rawlsian equalization criterion. The next chapter uses the hypothesis regarding the features of the financial assistance allocation process among Russian regions to establish a theoretical model that incorporates budgetary limits on regional authorities. In the empirical part of our analysis, we test how this model fits available statistical data. The related formal allocation model will be used in the next chapter to develop a model, which includes budgetary limits on regional authorities.

2.2. Models of regional fiscal behavior.

In order to analyze regional fiscal behavior we build a simple theoretical model. We assume that the federal center sets a single standard for revenue requirements for all regions (based on federal, local and regional taxes, etc.). Based on these principles, regional authorities make revenue collection and expenditure decisions to produce public goods and redistribute of income among different social groups of population. We also assume that these decisions are made with their electorate's support in mind,. For the electorate (regional) the most important factors that affect their utility are the size of and quality of public goods provided as well as the tax level (regional taxes versus tax benefits). These assumptions suppose a relationship between the authorities' preferences and those of the population, which is affected by the voting system. This phenomenon is apparent in pre-election politics and should remain so in post-election politics because it strengthens trust, which becomes political capital for the next elections.

Utility function of regional authorities. We assume that the utility function depends on two factors – the size of the consolidated budgetary spending in

the region (positively) and tax collections in the region (negatively). The latter are determined by the chosen level of regional and local tax rates, as well as by the normative level of federal taxes in regional and local budgets. Therefore the utility function has the following form:

$$U\left(E^{(+)}, T^{(-)}\right) \rightarrow \max_{E,T},$$ (4)

where

E – the region's consolidated budget expenditures (as an indicator of public goods production in a given region);

T – the region's consolidated tax collections[44].

In adopting this form of the utility function, we are assuming that regional spending does not include transfers to the public (in cash or other forms) but rather the revenues constitute tax payments that reduce consumption of private goods for households. These assumptions lead to a model that aims to address the classical household's trade-off between private and public goods consumption.

Equation (4) can be rewritten in the following form[45]:

$$U\left(E^{(+)}, (Y - T)^{(+)}\right) \rightarrow \max_{E,T},$$ (5)

where

Y – gross regional income;

This formula shows explicitly that increases in tax collections lead to a reduction in private goods consumption. In what follows, we consider only this type of utility function.

Regional budget constraint. Regional authorities maximize their utility function (4) or (5) under constraints that dictate that spending does not surpass the total of own revenue plus financial aid[46]:

$$E \leq T + Tr$$ (6)

where Tr – financial aid that a region receives from the Center

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[44] To simplify this analysis we can assume that a single tax on income is used. This allows us to not be bothered by the interdependence between tax and revenue of regional economic players.

[45] For example, Samuelson (1954) and Williams (1966) suggest that the local society is afforded a choice between private and public goods in accordance to individual tastes.

[46] In this section, if it does not say otherwise, "financial assistance from the Center" and "transfers to the regions" are the same.

We assume that the transfer formula is set by the federal center, and that the amount of the transfer is set proportionally to the estimated deficit of the regional budget with the coefficient γ. We also assume that the estimates of the budget expenditure are based on actual values of spending with the weight α and normative spending with the weight *(1-α)*. Similarly, the estimate of the regional budget revenue is based on an average weighted value of actual revenues collected in the region with the weight β and fiscal capacity with the weight *(1-β)*.

Coefficients α and β show how the valuation process adopted by the Center to allocating assets depends on actual and normative indicators of revenue and expenditure. This can be interpreted as co-financing the actual regional budget expenditure as well as the methods of generating regional revenue (co-financing private goods consumption or the reduction of private goods prices).[47] Coefficient γ measures the overall extent to which the Center finances differences between regional expenditures and revenues. It can also be interpreted as the share of federal financing of the estimated regional budget deficit.

Thus we assume the following model of the federal financial aid distribution:

$$Tr = \gamma \left\{ \left[\alpha E + (1-\alpha) \cdot \widehat{E} \right] - \left[\beta T + (1-\beta) \cdot \widehat{T} \right] \right\}, \text{[48]} \tag{7}$$

where

$\widehat{T}$ – regional fiscal capacity;

$\widehat{E}$ – expenditure needs.

This model of the distribution of aid includes parameter values such as fiscal capacity and expenditure needs. A theoretical analysis would consider these parameters to be exogenous. In order to obtain empirical estimates of the model (see below) we employ our own estimates of regional fiscal capacity and expenditure needs. Values for fiscal capacity represent the estimated values of tax liabilities in a regression of actual tax liabilities that include tax bases for differ-

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[47] Central co-financing (matching) can be understood in several ways. Co-financing spending means that partial spending rises per given transfer amount. At the same time, co-financing revenue means that a reduction in practical revenue per transfer amount raises it by a given alpha value. A rise in practical revenue leads to a reduction in federal assistance. The Center compensates fluctuations in regional revenue.

[48] We can look at a more general type of formula that depends on both practical revenue/spending and normative values. We will be using formula 32 to further incorporate these variables in financial allocation.

ent taxes.[49] The values of expenditure needs are the sum of the regional expenditure needs for all the main expenditure items. These expenditure needs are also taken as the estimated values from a regression of actual expenditures over the main factors that affect the actual expenditures. Some variables that should not affect the expenditure needs but do affect actual expenditures e.g. budget revenues are fixed at a constant level for all the regions when the expenditure needs are calculated.[50]

The model of the federal financial aid distribution (7) can be rewritten as follows:

$$Tr_i = \gamma\alpha(E_i - \hat{E}_i) - \gamma\beta(T_i - \hat{T}_i) + \gamma(\hat{E}_i - \hat{T}_i) \qquad (8)$$

This formula shows that transfers can be set as the sum of resources given by the Center for partial financing of actual expenditure deviations from the norms, partial financing to cover the deviation of actual tax revenue from estimated fiscal capacity and for the partial co-financing of the regional normative deficit.

Depending on the indicators and parameters used by equalization models, the transfer size to the regions, as expressed in equations (7) and (8), can be either positive or negative. A pertinent example of negative transfers is the system utilized until 1994 in which for different regions there were set different proportions of the VAT that went to the regional budget. In cases when this proportion was lower than the average, the transfer could be considered negative. Presently in Russia negative transfers are not employed explicitly. Consequently, we will not impose any further model constraints (e.g. if the transfer size expressed in the model is negative, then the transfer is equal to zero) in order to continue our analysis in a broad scope. However, we will pay special attention only to regions that receive a positive transfer.

Analysis of the model of regional fiscal behavior.

Earlier we introduced a simple model for the choice by the regional authorities between goods (spending on public goods) and anti-goods (taxes) with budget and financial aid distribution constraints. The first-order conditions for the model ((5) to (7)) after the elimination of the Lagrange multiplier allow the following optimality conditions for the marginal rate of substitution between increasing the expenditures on the public goods and reducing the tax burden:

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[49] For more detail see Lugovoi, Sinelnikov, and Trounin (2001).
[50] For more detail see Kadochnikov, Sinelnikov, and Trounin (2001).

$$\text{MRS}_{\text{ET}} = -\frac{U_E}{U_T} = \frac{1 - \alpha\gamma}{1 - \beta\gamma} \tag{9}$$

Therefore, the marginal rate of substitution between changing the expenditures and tax revenues in the region depends on the rules according to which the assistance is distributed, i.e. on the values of the parameters α, β and γ, assuming that they are smaller than one.

From equation (9) it is clear that $\alpha\gamma$ and $\beta\gamma$ express a value for the co-financing by the federal center of actual spending and revenue deviations from the norms. Consequently, the optimality condition (9) expresses the relationship between the shares of financing the difference between actual and normative expenditures and between actual revenues from the fiscal capacity using own financial resources But the relative amount of self-financing revenues and expenditures is more important than the absolute values of this self-financing (or co-financing by the federal center). In essence, it is very important whether the Center co-finances to the same extent the deviations of the actual revenues and expenditures from the norms.

In order to obtain more detailed results, we consider next a particular form of the utility function, a function with a constant elasticity. We assume that this form will allow us to analyze the model without very strict limitations.

2.2.1. The analysis of the optimal values of regional budget revenues and expenditure for the logarithmic utility function.

We suggest the following function, which is essentially a Cobb-Douglas utility function:

$$U(E, T) = \ln E + \omega \ln (Y-T), \,[51] \tag{10}$$

where ω is a parameter expressing the relative elasticity of the tax burden.

To simplify, we transform the model's budget constraint by the substitution of the expression of determining the amount of the financial aid (7) into the constraint (6), and group the parameters by E and T. We obtain the following relationship:

$$E (1-\gamma\alpha) - T (1-\gamma\beta) = \gamma A, \tag{11}$$

where

$$A = (1-\alpha)\, \widehat{E} - (1-\beta)\, \widehat{T}. \tag{12}$$

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[51] Under condition that a full function constitutes a function of type 35, a straightforward Y=T value expresses a asymptom. $0 < T < Y$ expresses the same.

Parameter A in equation (11) multiplied by γ expresses the portion of financial aid that is given to a region on the basis of the norms (fiscal capacity and expenditure needs): it does not depend on the actual revenues or expenditures. Consequently, $Tr - \gamma A = \gamma(\alpha E - \beta T)$ is the part of the financial aid that is allocated based on the actual revenue and expenditure in the given region, adjusted by α and β.

The optimality conditions for the maximization of the utility function (10) subject to the constraints (11) and (12) gives us the following optimal values of E^* и T^*, that depend on the original parameters:

$$E^* = \frac{1-\gamma\beta}{1-\gamma\alpha} \cdot \frac{Y}{\omega+1} + \frac{\gamma}{1-\gamma\alpha} \cdot \frac{A}{\omega+1} \tag{13}$$

$$T^* = \frac{Y}{\omega+1} - \frac{\gamma}{1-\gamma\beta} \cdot \frac{\omega A}{\omega+1} \tag{14}$$

Below, based on (13) and (14), we consider what type of influence changes in different parameters (included in the models for allocating assistance) have on the optimal choices of the regions. We also analyze the influence that inter-budgetary relations have on regional fiscal behavior as expressed by the choice of the tax rate or the spending level.

The dependence of the optimal regional choice (E^* and T^*) on the volume of the region's gross income. Equations (13) and (14) show that optimal regional spending and tax revenue depend positively on the volume of the region's gross income Y. Under such conditions, the effect of Y on T^* is determined only by the parameter size ω, and is independent of the model of financial aid distribution. In essence, with the increase of the weight of the private goods in the utility function, (ω) tax revenue grows less with the increase of the gross income.

At the same time, the effect on the E^* of Y is dependent on the relationship between α and β. This means that with changes in Y optimal spending will grow by an amount based on the level of co-financing of the divergence of spending and revenue from norms. Specifically, it depends on the marginal rate of substitution between the regional budget tax revenue and expenditure at an optimal point MRS_{ET}. The greater the MRS_{ET}, the greater the spending increase with regional gross income growth.

In order to determine how the model's parameters influence a region's optimal choice, we must look more closely at the dependence of optimal spending and revenue on parameters α, β and γ. There are four possible combinations of

the ratio of the parameter α and β and sign of A determined by expression (12). The relationship between these parameters and the slope of the budget constraint dictate the budgetary limitations and influence the optimal choice of the regions. Depending on where the optimal point is, a region can become a donor or a recipient of federal financial aid. If the relative point is located above the 45° line on the graph E-T then the optimal regional spending is greater than revenues at the optimal point. This means that the given region receives financial aid. If the optimal point lies below the region is a donor (T^{cr} expresses this on the graph).

Fig. 1 shows that when $A>0$, $\beta>\alpha$ and when $A<0$, $\alpha>\beta$, the region can be both a recipient (line 1-1) and a donor (line 2-2)[52]. In the other two cases (also shown on the picture) the region can be either a recipient ($A>0$, $\beta<\alpha$), or a donor ($A<0$, $\beta>\alpha$).

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[52] It is easy to see that $T_{\kappa p} = |A| / |\alpha\text{-}\beta|$, if of course, $\alpha \neq \beta$.
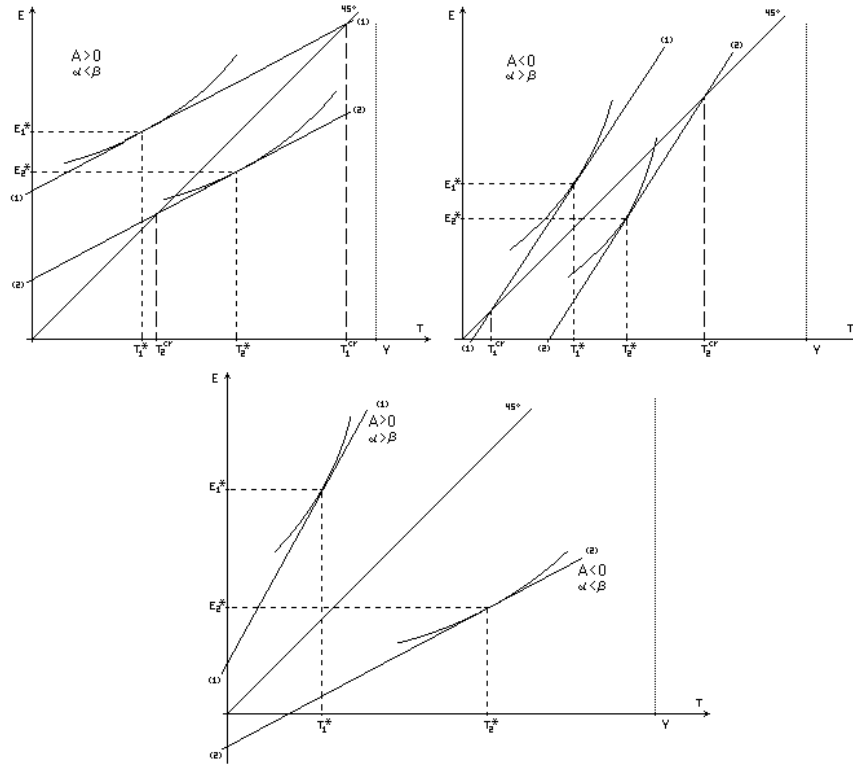
Figure 1.

The dependence of optimal regional choice on the size of the budget deficit (γ). Altering parameter γ causes a proportional change in the grant amount. The partial derivatives of the optimal values of regional budget tax revenue and expenditures per parameter γ are as follows:

$$T*_\gamma = \frac{\partial T^*}{\partial \gamma} = \frac{-\omega A}{(\omega + 1)(1 - \gamma\beta)^2} \tag{15}$$

$$E*_\gamma = \frac{\partial E^*}{\partial \gamma} = \frac{A + (\alpha - \beta)Y}{(\omega + 1)(1 - \gamma\alpha)^2} \tag{16}$$

The signs of these partial derivatives depend on the value of A and the relationship between A and $(\beta-\alpha)Y$. Below we consider only those regions that

receive a positive amount of the transfer. In addition, we assume that $\widehat{E} > \widehat{T}$. This inequality is satisfied for the regions for which data are used in the calculations below, so that we will not consider the regions that receive federal financial aid at the optimal point, but have a budget surplus in comparison to national norms.

1. $\alpha=\beta$ (including $\alpha=\beta=0$)[53], this allocation method is symmetric. In this case the sign of A is the same as the sign of the normative budget deficit $\left(\widehat{E} - \widehat{T}\right)$. If a region is a recipient ($A>0$), then $T^*_\gamma<0$ and $E^*_\gamma>0$. This means that if the transfer amount grows with increasing γ, then expenditure increases and revenue falls.[54] The budget constraint at the new optimal point must be satisfied, and thus the sum of the increase in expenditure and fall in revenue equals the increase in the amount of the financial aid. This means that even when regional choice of tax revenue and expenditure levels influence the amount of the financial aid (α and β are not equal to zero) and the model is symmetrical ($\alpha=\beta$), regional authorities reduce their revenues less than the increase of the financial aid.

In this case the model illustrates the famous fact that the allocation of a lump-sum (block) grant makes regional budget expenditure grow less than increase in the financial aid with the reduction of the tax burden at the same time.

2. $\alpha>\beta$. This relationship between α and β means that financial aid allocation model takes into account actual changes in expenditures to a higher degree than actual changes in revenue.

2a. $\alpha>\beta$, $A>0$. Given these parameters α and β, if $A>0$, the region will always receive a transfer (see the picture). Equations (15) and (16) assert that under such a parameter relationship $T^*_\gamma<0$, $E^*_\gamma>0$. In an asymmetrical situation ($\alpha\neq\beta$) with and increase in γ in addition to the income effect, the change in the slope of the budget constraint creates the substitution effect that results in the increase of budget expenditures and revenues. This results in a smaller decrease of revenues than in the symmetrical case ($\alpha=\beta$). Consequently, spending grows more. This means that under large expenditure co-financing from the federal

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[53] If coefficients α and β were both equal to zero, than the allocation system will be oriented on deciding allocation between revenue and spending and their normative indicators. In such cases the intermixing norm for tax spending MRS_{ET} is equal 1.

[54] Under a symmetric methodology the allocation of assistance does not depend on a specific full function.

center ($\alpha>\beta$), a revenue reduction occurs to a lesser extent in comparison to a symmetrical situation. From the point of view of the region's influence on the financial transfer size, if α and γ are large enough, then the region can raise its spending in order to get a larger transfer. This causes a rise in utility together with an increase in the tax burden (as γ is less than one and the model of financial aid allocation also is based on the expenditure needs and fiscal capacity) that decreases utility. At the same time, it is no longer required that the increase in the tax burden is equal to the rise in expenditure as the budget constraint becomes less strict due to the increase in the amount of the financial aid. As a result, choice of the regional authorities entails higher incentives to increase budget expenditure in the face of an increasing amount of the financial aid from the federal center.

2b. $\alpha>\beta$, $A<0$. Formula (15) shows that under such conditions $T^*_\gamma>0$, $E^*_\gamma>0$ [55]. This means that increase in γ results in the increase in both tax revenue and expenditure (equal to the amount of regional revenue plus the transfer). This can be explained by the impact of the substitution effect that is greater than the income effect. Such a situation is also based on the fact that federal co-financing of the actual regional expenditure is higher than the co-financing of the regional revenue deviations. This leads the region to increase spending even if the authorities need to raise taxes in order to balance the budget.

3. $\alpha<\beta$. This means that the transfer allocation formula to a large extent is based on actual tax collection in relation to actual spending. The relationship among parameters implies $A>0$, [56] which means that partial derivatives $T^*_\gamma<0$, and the sign of E^*_γ coincides with the sign of the expression $(A-Y(\beta-\alpha))$ and can be positive or negative. The income effect resulting from transfer growth (increasing γ) leads as before to a spending rise and a tax revenue fall. The asymmetry in the model of financial aid allocation ($\alpha<\beta$) leads to a rotation of the budget constraint line, and the substitution effect results in an expenditure and tax revenue drop. Consequently, revenue always falls and spending can fall or rise, but to a lesser degree in relation to a symmetrical situation ($\alpha=\beta$).

This means that if revenue co-financing from the federal center is larger ($\beta>\alpha$), then the growth in the transfer size with the increase in γ will induce the

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[55] The latter happens if $A+(\alpha-\beta)Y = (1-\alpha)\widehat{E} -(1-\beta)\widehat{T} +(\alpha-\beta)Y >$

$> (1-\alpha)\widehat{T} -(1-\beta)\widehat{T} +(\alpha-\beta)Y = (\alpha-\beta)(Y-\widehat{T})>0$, если $\alpha>\beta$, $\widehat{T} <$Y, $\widehat{E} > \widehat{T}$.

[56] This follows if $\alpha<\beta$ и $\widehat{E} > \widehat{T}$, then $(1-\alpha)\widehat{E} > (1-\beta)\widehat{T}$, and $A>0$.

region to reduce its revenue to a larger extent in comparison to a symmetrical situation, because it will be compensated for the revenue drop. In some cases, for example, if β is significantly less than α, this can even lead to a situation in which a transfer increase lowers spending in order to balance the region's revenue drop. In this situation, most unpleasant fiscal incentives take place that result in an excessive leakage of the transfer into increasing consumption of the private goods.

Accordingly, the transfer allocation through an asymmetric approach to accounting for normative and actual revenue and spending leads to an effect, equivalent to the change in the relative prices for consumption choices. At the same time, the transfer affects the relative prices for private and public goods due to the Center's co-financing of regional spending and revenue.

Table 2.

Signs of the partial derivatives of the optimal values of regional budget tax revenue and expenditure over γ (γ is supposed to increase, only situations in which a region is a recipient are used, $\widehat{E} > \widehat{T}$).

	Rise in γ	$\alpha=\beta$ $A>0$	$\alpha>\beta$ $A>0$	$\alpha>\beta$ $A<0$	$\alpha<\beta$ $A>0$
T^*	Income effect	–	–	–	–
	Substitution effect	No	+	+	–
	Total effect	–	–	+	–
E^*	Income effect	+	+	+	+
	Substitution effect	No	+	+	–
	Total effect	+	+	+	?[#]

[#] - coincides with the sign of *(A-Y(β-α))*

The effect of a change in parameter α on the financial behavior of regions. A change in α results in the change of the parameters of the grant allocation model. This also changes the actual expenditure co-financing level by the federal center and the regional authorities respectively. Consequently, partial derivatives of optimal expenditure and tax revenues with respect to α are as follows:

$$T^*_\alpha = \frac{\partial T^*}{\partial \alpha} = \frac{\omega\gamma\widehat{E}}{(\omega+1)(1-\gamma\beta)} > 0 \qquad (17)$$

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$$E^*{}_\alpha = \frac{\partial E^*}{\partial \alpha} = \frac{\gamma Y(1-\gamma\beta) - \gamma\widehat{E}(1-\gamma) - \gamma^2(1-\beta)\widehat{T}}{(\omega+1)(1-\gamma\alpha)^2} > 0 \quad [57] \tag{18}$$

Both $T^*{}_\alpha$ and $E^*{}_\alpha$ are positive (if α rises, then the optimal spending and tax revenue values also rise). An increase in α means that the Center co-finances more of the rise in actual expenditure so that regional authorities have incentives to increase their spending. Consequently, in such a situation the increase in regional budget expenditure results in an increase in federal financial aid. But the increase in financial aid is only partial so the regional authorities have to raise taxes in order to satisfy the budget constraint.

The influence of parameter β on the financial behavior of regional authorities. In order to examine how changes in the degree to which co-financing is based on the actual tax revenues influence on the optimal decision of regional authorities, we used partial derivatives of the expression for the optimal expenditures and revenues with respect to β:

$$T^*{}_\beta = \frac{\partial T^*}{\partial \beta} = \frac{-\omega\gamma[\gamma(1-\alpha)\widehat{E} + (1-\gamma)\widehat{T}]}{(\omega+1)(1-\gamma\beta)^2} < 0 \tag{19}$$

$$E^*{}_\beta = \frac{\partial E^*}{\partial \beta} = -\frac{\gamma(Y-\widehat{T})}{(\omega+1)(1-\gamma\alpha)} < 0 \tag{20}$$

Equation (19) illustrates that the partial derivative of optimal tax revenue with respect to the parameter β is always negative. Consequently, the more the federal center co-finances actual tax revenues, the more the regional authorities will lower taxes. In other words, the intensity of fiscal incentives to a large extent can be characterized by the value of β, which expresses the extent of the use of the fiscal capacity in the federal grant allocation formula. The reduction of β, (with the growth of the use of the fiscal capacity in the allocation process) will result in the increase of the optimal regional tax revenue.

The negative sign for the partial derivative of E^* with respect to β can be explained using the same arguments. If the allocation of the federal grants uses the actual tax collections to a greater extent, then regional authorities will reduce taxes in order to increase the transfer amount. This will occur regardless of

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[57] This follows from the fact that $\gamma(1-\gamma)\widehat{E} + \gamma^2(1-\beta)\widehat{T} < \gamma(1-\gamma+\gamma(1-\beta)) \cdot max\{\widehat{E}, \widehat{T}\} = \gamma(1-\gamma\beta) \cdot max\{\widehat{E}, \widehat{T}\} <$
$< \gamma(1-\gamma\beta) \cdot Y.$

the fact that under such behavior it is necessary to reduce expenditure in order to satisfy the budget constraint.

2.2.2. Conclusions from the theoretical analysis of the regional fiscal incentives model and economic policy proposals.

The results obtained from the analysis of the model are stated in the table 3.

Table 3.

Signs of the partial derivatives of the optimal values of the regional budget revenue and expenditure per parameters of the model (assuming that the region is a recipient of the federal financial aid)

	Y	$\widehat{E}$	$\widehat{T}$	α	β	γ
Partial derivative of E^*	+	+	−	+	−	?[#]
Partial derivative or T^*	+	−	+	+	−	?[##]

[#] -   "+", if $\alpha \geq \beta$; depends on the relation between $Y(\alpha-\beta)$ and A, if $\alpha < \beta$;
[##] -   "+", if $A < 0$; "−", if $A > 0$.

As shown above, a rise in the region's gross income due to either a rise in economic activity or a transfer of income to economic agents results in both a rise in tax revenue and expenditure of the regional budget. The degree of the tax revenue increase depends on the regional authorities' preferences concerning private and public goods consumption. It does not depend on the federal financial aid allocation formula. At the same time, when income increases, spending grows more with the higher marginal rate of substitution between the consumption of public and private goods. Thus the lower is the value of β, (i.e. the less is co-financing of the actual tax revenue deviation from the fiscal capacity by the federal center) and the higher is the value of α (i.e. the more is co-financing of the actual expenditure) the more is the increase of the public goods supply with the increase of the agents' gross income.

The consequence is that if the federal center wants to minimize the leakage of the transfers into the private sector during the periods of economic growth, the model of federal grant allocation should use fiscal capacity on the revenue side and actual budget expenditures on the spending side. During an economic recession, if the federal center wants to minimize the reduction of the public goods supply, then the center should use the actual values of the tax revenues

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and the normative expenditure needs (it is possible that expenditure needs should be reconsidered in order to be adequate for the new conditions).

A very important problem in formulating the methodology of the federal grants distribution is the calculation of the fiscal capacity and expenditure needs values. The table shows that the greater $\widehat{E}$, the greater the optimal budget expenditure and the lower the tax burden for the region. The influence of fiscal capacity is the opposite. The greater is $\widehat{T}$, the greater will be the tax revenue and the lower the regional spending. At the same time, we should take into account that fiscal capacity and expenditure needs cannot be used in order to manipulate the fiscal incentives. These parameters are calculated for each region individually and if they are used in the federal grants allocation formula the changes in these parameters can result in the changes of the amount of the financial aid (further understanding these effects is beyond the scope of this research).

In drawing conclusions about the influence of the proportion of the regional debt that is covered by the federal center on the fiscal behavior of the regional authorities, we should take into account ambiguous impact of the change in the parameter γ on the optimal choice of the regional authorities. The model developed above demonstrates that under different values of parameters used (proportion of co-financing revenue and expenditure, values of expenditure needs and fiscal capacity, etc.) the influence of the change in the amount of the federal financial aid on the optimal values of the regional budget revenue and expenditure can vary.

Under a symmetrical model, proportional increase in financial aid result in a rise in spending and a fall in tax revenues (increase in the consumption of both public and private goods). The same situation occurs in the case when the federal center does not consider the actual revenue and expenditures of the regional budgets but calculates the amount of the financial aid on the basis of fiscal capacity and expenditure needs. This allows one to conclude that if the federal center aims to minimize the negative fiscal incentives to change the regional policy towards influencing the size of the grant, then the center should accept the symmetric principle for looking at the revenue and expenditure size from the point of taking norms into account. In this case the increase in financial aid creates an income effect that leads to an increase in budget expenditures (consumption of public goods) and to a drop in taxes that allows greater private good consumption by agents. In cases where the allocation model is not symmetrical and uses not only norms but also actual values of expenditure and tax

revenue, a substitution effect also occurs. This effect is tied to a rotation of the budget constraint aimed at raising spending (lowering revenue). As a result a proportional increase in financial aid amount can result in either a rise or a fall in regional revenue and spending (Table 1).

When the grant allocation model co-finances an increasing proportion of actual budget expenditure (α) this stimulates the regional authorities to increase their budget expenditures. If the co-financing is not full, then regional authorities have to increase the tax revenue in order to satisfy the budget constraint. The opposite occurs if financial assistance is determined as a proportion of the deviation of tax revenue from fiscal capacity (β). In this case, the regions are driven to reduce their revenues. This reduction will be partially covered by the increasing amount of the federal financial aid. Thus, if the co-financing from the Center is not full, then the fall in regional spending will occur.

These results suggest that with the help of financial allocation model parameters the federal center can create different fiscal incentives. For example, if the goals are to minimize the transfer leakage to the private sector, then the Center must co-finance actual spending to a greater extent than actual tax revenue (α is greater than β). And the opposite applies if the goal is to reduce expenditure (provision of public goods): then the federal center must set β higher than α. Under the substitution effect the increase in the amount of the financial aid will result in a drop in tax revenue and (with certain values of parameters) a decrease regional budget expenditure. In this case, federal financial aid is fully used for an increase in the consumption of the private goods.

2.3 Estimation of the financial aid allocation models from the federal center to the Russian regions

In order to check how the grant allocation model used in the theoretical model described earlier fits the allocation principles actually used in the Russian Federation, as well as to estimate values of α, β and γ, we will estimate the allocation model econometrically. Stated in a more general way than above, the grant allocation formula can be written as follows:

$$Tr_{i,t} = f\left(T_{i,t-s}, \widehat{T}_{i,t-s}, E_{i,t-s}, \widehat{E}_{i,t-s}\right) + \varepsilon_{i,t-s}, \ s = 0,1,2 \qquad (21)$$

where $\varepsilon_{i,t-s}$ is the deviation of actual financial assistance to the ith region in year t, from the estimated value, which can be caused by some factors that the model does not account for. This can depend, for example on the influence of

the political authority on the grant distribution process as well as other disturbances.

This model incorporates revenue and spending values for a given region. If we assume that federal assistance is allocated in order to cover deficits, it logically follows that we could expect positive correlation between the transfer size and spending values, as well as a negative correlation between the size of the financial aid and regional budget revenue estimates.

It is also important to check which combinations of lags can be correctly used in the grant allocation equation (21). In our estimation we used the values of the revenue and spending with the lag from 0 to 2.[58] Below in the estimation of the fiscal incentives we will check the reverse — how the change in the transfer affects the revenue and expenditure of the regional budget. This means that the grant allocation formula in which estimates of the revenue and expenditure are taken without any lags should be estimated in a system of simultaneous equations in order to satisfy the condition of exogeneity of explanatory variables. If we use the values with the 1st and 2nd lags that completely uphold the budget development process, then we can estimate the grant allocation formula and the equation for the fiscal incentives separately. Estimating the grant allocation formula in order to avoid multicollinearity problem we do not include the same estimates of the revenue and expenditure taken with the same lags. The correlation between the variables taken with different lags is very high and averages about 0,85 to 0,95.

2.3.1. Estimation of the linear federal grant allocation model.

High correlation between actual and normative revenue and spending values makes it difficult to estimate equation (21) in linear form where the transfer amount depends on four factors — revenue, spending, and their two normative values. The grant allocation model, as shown earlier in (8), can be rewritten to include the co-financing of revenue and spending by the federal center as well as to include the partial covering of the normative regional budget deficit. The

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[58] In year t during the budgetary process the plans for transfers in year t + 1 are figured only from statistics from the year t – 1. After it is possible to allocate further assistance based on the size that can be realized after receiving information regarding year t. Factual spending and revenue data for the year t+1 becomes clear only the following year. One can assume that in an emergency situation (a large revenue slump or spending boom) will force financial allocation to be reconsidered.

appropriate linear regression equation (with a constant) can be written as follows:

$$Tr_{i,t} = a_0 + a_1(E - \widehat{E})_{i,t-s} + a_2(T - \widehat{T})_{i,t-s} +$$
$$a_3(\widehat{E} - \widehat{T})_{i,t-s} + \varepsilon_{i,t-s} \qquad , s = 0,1,2 \qquad (22)$$

In this form, estimation of the grant allocation model is possible because the correlation between the explanatory variables in this equation is not high.

Based on the theoretical analysis in the previous chapter, keeping in mind the relationship between the coefficients in equation (22) and the formula parameters ($a_3 = \gamma$, $a_1 = \alpha \cdot \gamma$, $a_2 = \beta \cdot \gamma$), we can formulate the following hypothesis about the coefficients:

$a_0 = 0$, i.e. the transfer size does not include any constant aid
(per capita) that is identical to all regions;

$0 \leq a_3 \leq 1$, this coincides with the assumption that $0 \leq \gamma \leq 1$;

$0 \leq a_1 \leq a_3$, with relationship $a_1 = \alpha \cdot \gamma$ this condition corre- (23)
sponds to $0 \leq \alpha \leq 1$;

$0 \leq -a_2 \leq a_3$, with relationship $a_2 = \beta \cdot \gamma$ this condition corresponds to $0 \leq \beta \leq 1$.

It is readily noted that in the case of equal parameter values, $\gamma = a_1 = -a_2 = a_3$, the financial grant simply covers the actual regional budget deficit and only the actual revenue and expenditure values are used in the grant allocation process ($\alpha = \beta = 1$).

The data we use include information for 86 regions (not including Chechnya, Hanty-Mansiyski, and Yamalo-Nenentski regions).[59] We will use data for the years of 1994 to 2000 for Russia[60], as well as values for fiscal capacity and expenditure needs values developed at IET.[61] All variables were taken per capi-

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[59] Data from autonomous regions are the only ones not utilized from all the available data. This can be explained by several reasons. First, these regions are located in the far north and arctic regions. This reality makes it difficult to gather data continuously. Second, the taxing potential of these areas is limited by the fact that they oftentimes depend on large industries in intensive resource production. Also, these areas are fairly self-sufficient and require minimal assistance, making their non-inclusion justified.

[60] Data regarding regional budgets from the Russian Ministry of Finance, can be found on their website: www.minfin.ru

[61] Methodology and results of regional potential assessments in Russia from Kabochnikov, Sinelnikov, and Trounin (2001)

ta deflated using the GDP deflator. In order to take into account cross-regional price differences, we also used relative minimum standard of living index at regional prices.

In the first stage, estimates of the equation (22) were done separately for all the lag combinations of the dependent and explanatory variables. Estimating the parameters for different periods, we can see that α and β (a_1/a_3, and $-a_2/a_3$, respectively) can change with the changes in the grant allocation mechanism and the proportion of the financial aid that is allocated through the Federal Fund for financial support of the regions. The parameter γ (a_3) could change with the change in the total amount of the financial aid that is distributed among the regions in relation to the sum of the regional deficits.

In order to understand how the allocation parameters changed with time, in addition to estimating the parameters using panel data (this helps to enlarge the data sample and increase the number of observations), we must test the hypothesis of whether the coefficients of the allocation model (22) are equal for different years. The analysis is undertaken using comparisons of pairs of years. Appropriate values of F-statistic are listed in table 4.

Table 4

Results of testing the hypothesis of the equality of allocation model parameters between years.

H_0:	$a_0^{(t)}=a_0^{(t-1)}$	$a_1^{(t)}=a_1^{(t-1)}$	$a_2^{(t)}=a_2^{(t-1)}$	$a_3^{(t)}=a_3^{(t-1)}$	$a_1^{(t)}=a_1^{(t-1)};$ $a_2^{(t)}=a_2^{(t-1)};$ $a_3^{(t)}=a_3^{(t-1)}$
year t (comparison with previous years)	*F*-criteria value (F>Fcr are listed in bold)				
1995 compared with 1994	**18,77**	**8,64**	0,00	**24,45**	**18,08**
1996 compared with 1995	2,27	6,67	0,67	2,51	**4,74**
1997 compared with 1996	0,01	0,03	2,82	3,78	2,50
1998 compared with 1997	0,61	6,69	**13,12**	1,64	**9,22**
1999 compared with 1998	1,58	5,45	0,11	0,17	2,33
2000 compared with 1999	0,59	**16,64**	2,68	0,82	**5,52**
1%-critical value for F-statisitic	6,83	6,83	6,83	6,83	3,94

The analysis[62] shows that based on the coefficients stability, we can divide 1994-2000 into three periods — 1994, 1995-1997, and 1998-2000 (taking into account that in 2001 there was a significant change in coefficient a_1). According to these results we estimated the model of financial aid allocation for these three periods – regression for the year of 1994, panel data estimates for 1995-1997 and panel data estimates for 1998-2000 with additional dummy variable for the coefficient a_1 in 2000.

It is essential to note that if we estimate the equation $Tr=E-T$, where Tr is the total financial assistance given to a region, than a spurious regression will be estimated as in this case we estimate not the model of the financial aid allocation but the budget constraint in which the sum of own revenue and financial aid is equal to the budget expenditure.[63] In our estimates we use not only actual values of regional revenue and expenditure but also their normative values – fiscal capacity and expenditure needs. As well, since regional revenue other than tax revenue is not used, we do not use other sources of budget deficit financing. The estimates of the aid allocation model (22) are done separately for the transfers from the FFSR and additional federal financial aid. All this leads to the fact that the financial aid in consideration only partially covers the difference between regional expenditure and tax revenue. That is why the estimates of the grant allocation model cannot be viewed as estimates of the budget constraint.

As mentioned above, the FFSR transfers are allocated on the basis of more formalized principles and these principles are equal for all the regions. The transfer amount is stated in the federal budget law for the appropriate year.[64] Also, the regions receive additional financial assistance that is the sum of different kinds of subsidies, subventions, resources received in mutual settlements etc. Total financial assistance is equal to the sum of the transfer and this additional financial aid. Analysis of the allocation principles of different kinds of

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[62] Concretely speaking, it is a must to test the different coefficients not only between neighboring years and for equal values but also for all years. The results of such tests show that the analysis is correct and can be applied to the data in the table.

[63] The idea behind the interdependence is not in the fact that the transfer size is based on a relationship with the revenue and spending size, but in the fact that the spending size is related to the size of revenue and financial assistance.

[64] Beginning in 2001, subsidies from the Compensation Fund can be added to the list of formalized financial assistance. This occurs in the form of federal mandates in regional budgets.

financial aid shows that the transfers from the FFSR, in comparison with the other forms of assistance, are based on objective parameters rather than regional current needs. In this chapter we test hypothesis (23) regarding the coefficients as well as their difference for various types of financial assistance and regions.

<u>Estimation of the allocation model for the transfers from the FFSR.</u> The results of the estimations for the three periods are shown in Table 5. The results for 1994 indicate that a model in which there is only one explanatory variable - the actual regional budget deficit- gives better estimates than model (22). The comparison was based on the values of the Schwarz criterion. This suggests that the key orientation for financial aid allocation in 1994 was based not on normative values of revenue and expenditure but on the actual state of the regional budget — the actual volume of revenue and spending. The estimations for the period of 1995-2000 showed that the model (22) is better than the equation with the actual budget deficit (estimates with the deficit are not listed in the table).

Table 5.

Results of the estimation of the equation (22) for the transfers from the Federal Fund of Support to the Regions.

Explanatory variable:	Transfers from the Federal Fund							
Period:	1994	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
Number of lags of the explanatory variables	0	0	0	1	2	0	1	2
Number of observations	86	86	258	258	172	258	258	258
Explanatory variables:	In parentheses under the coefficient is the t-statistic							
Constant	**-0,377**	**-0,330**	**-0,233**	**0,036**	**0,310**	**-0,645**	**-0,474**	**-0,404**
	(-4,849)	(-4,729)	(-2,941)	(0,445)	(2,725)	(-7,883)	(-4,323)	(-3,213)
Spending co-financing (a_1) $(E - \hat{E})$	**0,262** (13,299)		**0,324** (19,648)	**0,368** (17,977)	**0,324** (10,838)	**0,195** (9,397)	**0,218** (8,867)	**0,240** (5,525)
Same with dummy for 2000 $(E - \hat{E}) \cdot dummy$[20]						**0,072** (2,406)	**0,203** (4,651)	**0,327** (6,488)
Revenue co-financing (a_2) $T - \hat{T}$	**-0,355** (-5,134)		**-0,406** (-6,352)	**-0,385** (-5,269)	**-0,301** (-2,833)	**-0,347** (-10,967)	**-0,266** (-5,816)	**-0,332** (-5,707)

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Explanatory variable:	Transfers from the Federal Fund							
Period:	1994	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
Normative deficit equalization (a_3) $\widehat{E}-\widehat{T}$	**0,269** (15,257)		**0,455** (23,563)	**0,408** (20,141)	**0,343** (12,452)	**0,671** (26,462)	**0,537** (17,753)	**0,458** (13,992)
Actual deficit $E-T$		**0,262** (17,154)						
R^2 adjusted	*0,771*	*0,775*	*0,737*	*0,669*	*0,534*	*0,795*	*0,662*	*0,563*
Schwarz criterion	*1,476*	*1,378*						
$\square$	**0,974**	**1,000**	**0,712**	**0,902**	**0,945**	**0,291**	**0,406**	**0,524**
$\square$	**1,320**	**1,000**	**0,892**	**0,944**	**0,878**	**0,517**	**0,495**	**0,725**
$\square$	**0,269**	**0,262**	**0,455**	**0,408**	**0,343**	**0,671**	**0,537**	**0,458**
Difference between $\square^{2000}$ and $\square$ in 1998-99						0,107	0,378	0,714

On the whole, the results for the econometric estimations of the allocation models for 1995-2000 show that model (22) describes the actual financial aid allocated to the Russian regions quite satisfactorily. This illustrates that the Federal Center distributed financial aid on the basis of the factors like the ones in model (22), i.e. the center partially covered the gap between the estimates of the regional revenue and expenditure calculated using actual and normative values. These results show that explanatory variables explain up to 70 to 80 percent of the variance of the FFSR transfers. Coefficients a_1, a_2, and a_3 significantly differ from 0, and their standard errors are not large. That is why the values for α and β calculated as ratios of these parameters are fairly reliable.

The results of the estimations of model (22) help to formulate the following main conclusions from this empirical analysis:

1. The transfer from the federal center positively depends on the value of the difference between regional revenue and spending estimates. Also, there is a positive dependence of the amount of the transfer on the actual regional spending and expenditure needs. The transfer amount depends negatively on the actual tax revenue and fiscal capacity.

2. The results of the stability tests coincide with the changes in the federal financial aid allocation principles. In 1994 the main allocation factors were the actual regional deficits. From 1995-1997, the allocation became based more on actual values from the previous

years and normative revenue and spending values. In 1998, official allocation principles were legitimated. These principles use indexes of the fiscal capacity and expenditure needs as normative indicators for allocation policy. This explains the results for 1994 as well as the drop in the values of parameters α and β in 1998-2000 in comparison with 1995-1997. Lowering the value for α over time supports the idea that with time the allocation process was improved in a sense that the federal center gradually moved from using actual expenditures of the regional budget values to the use of expenditure needs. The lowering of β can be explained in an analogous way by the increasing weight of fiscal capacity in the transfer calculation formula.

3. As a whole the tables show that most of the estimated equations for the allocation model have a lower α value than β.[65] As the theoretical part of this work shows, this means that the federal center to a larger extent takes part in co-financing revenue than in co-financing expenditure. Such a situation can be explained by the fact that until 1999, the allocation scheme was based on actual tax revenue as the basis for transfer calculations. At the same time, as an estimate of expenditure needs we used the corrected expenditures in 1991. This value after many corrections and agreements was rather close to some average expenditure according to which the federal center was ready to allocate the financial aid (some estimate of the expenditure needs). Another part of the explanation of the fact that β is greater than α is that the regional revenue powers are less than the expenditure powers. In essence, decision-making at the regional level in regards to spending affects the budget deficit more thus increasing the amount of the transfer from the federal center. Consequently, the relatively lower tax revenue in the regions appears to be a more important signal to increase the amount of the financial aid in comparison to higher expenditures.

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[65] The significance of parameters α and β using Wald's test for comparing coefficients a_1 and a_2 with a_3, Also, it separates α and β as the relationship between a_1 and $-a_2$ to a_3. Consequently, a_3 also differs from zero to a large degree.

4. It is important to note that even in the past few years (which are characterized by increasing use of the normative values in the transfer allocation schemes) some portion of the federal financial aid remains unexplained by the factors used in the model. This can be partly explained by individualized approaches to each region and their problems in allocating additional financial aid. The governors' political power in some cases serves as pertinent examples as it can affect the amount of the federal financial aid allocated to particular regions.[66]

As was mentioned above the explanatory variables in equation (22) are not independent. Thus, we cannot split the variance of the transfer in equation (22) into three components based on the number of the variables included in the formula. This means that the statistical results do not allow us to conclude which part of the transfer is allocated to the co-financing of revenue and spending equalization and which for budget deficits. However, we can calculate the partial correlations of each explanatory variable. The respective values of the partial correlation coefficients between the transfer amount and the deviations of the expenditure and revenue from their normative values, and the normative deficit in the formula (22) are about 0.5~0.6, -0.5~-0.3, 0.8~0.9 respectively and do not change much over time.

<u>Estimation of the allocation model for financial aid distributed in addition to the transfer from the FFSR</u>. In addition to the above estimates for the transfer from the FFSR, a similar model for the additional financial aid was estimated. The hypothesis tested is that additional assistance to the regions is allocated by less formalized principles and by giving a higher weight to the actual values of regional budget revenue and spending in comparison to normative values.

The estimation results for additional financial assistance using equation (22) are presented in Table 6.

Table 6

Results of estimation of equation (22) for additional aid in 1994-2000.

Explanatory variable:	Additional financial aid							
Period:	1994	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
Lags of the explanatory variables	0	0	0	1	2	0	1	2

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[66] For more detail see, for example, Treisman (1996), Treisman (1999).

Explanatory variable:	Additional financial aid							
Period:	1994	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
Number of observations	86	86	258	258	172	258	258	258
Explanatory variable:	In parentheses is the t-statistic							
Constant	**0,214**	**0,276**	**-0,179**	**0,241**	**0,521**	**-0,504**	**-0,220**	**-0,356**
	(1,732)	(2,418)	(-2,496)	(2,800)	(5,053)	(-7,396)	(-2,360)	(-4,361)
Spending equalization (a_1) $E - \widehat{E}$	**0,671**		**0,243**	**0,247**	**0,237**	**0,276**	**0,236**	**0,295**
	(20,987)		(16,333)	(11,420)	(8,753)	(15,967)	(11,325)	(16,190)
with dummy for 2000 $\left(E - \widehat{E}\right) \cdot dummy^{2000}$						**-0,218**	**-0,136**	**-0,096**
						(-8,742)	(-3,650)	(-2,924)
Revenue equalization (a_2) $T - \widehat{T}$	**-0,691**		**-0,450**	**-0,372**	**-0,332**	**-0,243**	**-0,084**	**-0,217**
	(-6,184)		(-7,799)	(-4,825)	(-3,450)	(-9,248)	(-2,161)	(-5,753)
Deficit equalization (a_3) $\widehat{E} - \widehat{T}$	**0,720**		**0,329**	**0,223**	**0,168**	**0,349**	**0,211**	**0,236**
	(25,761)		(18,920)	(10,447)	(6,749)	(16,543)	(8,199)	(11,093)
Actual budget deficit $E - T$		**0,702**						
		(28,021)						
R² adjusted	*0,903*	*0,902*	*0,650*	*0,397*	*0,337*	*0,662*	*0,418*	*0,561*
Schwarz criterion	*2,439*	*2,363*						
α	**0,932**	**1,000**	**0,739**	**1,108**	**1,411**	**0,791**	**1,118**	**1,250**
β	**0,960**	**1,000**	**1,368**	**1,668**	**1,976**	**0,696**	**0,398**	**0,919**
γ	**0,720**	**0,702**	**0,329**	**0,223**	**0,168**	**0,349**	**0,211**	**0,236**
Deviation of α^{2000} from α in 1998-99						-0,625	-0,645	-0,407

Results for 1994 show that like the transfer from the FFSR the additional financial aid is better explained by using the actual regional budget deficit rather than equation (22). The coefficient γ for additional financial assistance (0.7) is higher than the appropriate value for the transfer from the FFSR (0.26). This shows that in 1994, additional financial assistance was the main source for covering the regional budget deficit, and the allocation principles were based on actual budget revenue and expenditure rather than expenditure needs and fiscal capacity. For 1995-2000 the estimates of model with the actual budget deficit as

the only explanatory variable are worse than the model (22) (the estimation results are not listed).

The estimation of the allocation model for the additional financial aid for 1995-1997 shows that the value of β (like the estimates for the transfer from the FFSR) is greater than α. This means that the federal center co-finances falls in the region revenue to a greater extent than spending growth. However, the fact that the estimated values of α and β are greater than 1 needs additional interpretation that cannot be given using the model (7) but can be provided in terms of the models (12) or (22). Additional assistance is allocated on the basis of less formal criteria than the transfer from the FFSR. The amount of this assistance often is a result of bargaining between the regional authorities and the federal center. The key arguments of the regional authorities in this bargaining are that their revenue is not enough or their expenditures need to be higher. The federal center allocates additional assistance on the basis of these arguments in order to cover the deficit and to compensate actual regional revenue and spending. Consequently, a financial assistance package can be even greater than what would have been allocated based on partial covering of the actual regional budget deficits.

The situation in 1998-2000 in comparison to previous periods is characterized by a drop in the value of β coefficient. This corresponds to increasing the weight of the fiscal capacity in the allocation formula. Value α remains nearly the same. The estimates of the coefficient of the dummy variable that is used to calculate the change in α in 2000 comparing to the previous years show that in 2000 there was a drop in α by about 0.4 to 0.6. This means that the federal center highly reduced the use of actual spending and increased the weight of the expenditure needs in calculations of financial aid amounts.

As a whole, it can be noted that the calculations of additional assistance were based more on actual revenue and spending than it was the case with transfers from the FFSR. Also, the estimation characteristics (significance of the coefficients and R^2) show that a significant part of the additional aid is allocated according to other factors that are not incorporated in the model, such as political influence of the regional authorities over the allocation process.

Estimation of the financial aid allocation model for different groups of regions. The special nature of Russian interbudgetary relations leads us to expect that the federal financial aid allocation principles can vary for different regions, or more correctly, for different regional groups. The FFSR allocation principles state that a part of the resources (20%) is allocated to the poorest regions in or-

der to increase their revenue to some minimal level. Also, the northern territories have a special status and get additional assistance for programs like food supply to remote areas due to limited transport accessibility during winter.

In order to test the differences in coefficients in the grant allocation model for different regional groups we select from all the regions a group of twenty-six regions that regularly receives significant per capita financial assistance.[67] . For testing this hypothesis, we used dummy variables equal to 1 for poor regions and 0 for the others. The significance of the difference in the coefficients was tested using the F-criterion (table 7). The null hypothesis is that the coefficients of the grant allocation model for poor regions are equal to those for the other regions.

Table 7.

Results of the tests for the differences in the coefficients of the grant allocation model for poor regions and other regions.

Period:	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
Number of lags of the explanatory variables	0	0	1	2	0	1	2
Number of observations	86	258	258	172	258	258	258
	Transfer from the FFSR						
F-statistic	2,343	1,476	3,856	3,392	3,694	6,964	9,948
P-value of F-statistic	0,102	0,210	0,005	0,011	0,003	0,000	0,000
	Additional financial assistance						
F-statistic	1,995	1,855	1,724	0,317	9,211	4,742	11,972
P-value of F-statistic	0,143	0,119	0,145	0,866	0,000	0,000	0,000

The results show that the coefficients for the poor regions in general differ only in the last years (1998-2000). This corresponds to the officially stated principles according to which part of the federal financial aid is allocated to the poorest regions in order to increase their revenue to some minimal level. The results of the estimation of the equation (22) for this group of regions are listed in Appendix 4.

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[67] "Strong recipients" were termed such for receiving financial assistance to an amount equal to at least twice the regional per capita minimum for at least three years form 1994-2000.

As a whole, it is important to note that the federal aid allocation model for the poor regions differs by somewhat higher α and β values. This means that there is greater co-financing of actual revenue and expenditure from the federal center. The value of γ for poor regions is also higher, which means that the federal center covers larger portion of the regional budget deficit. Consequently, the hypothesis regarding single grant allocation model for all regions is not supported by empirical data (at least in the past few years).

Let us perform the same analysis for the northern regions. The results of the appropriate F-test for the differences in the coefficients in the grant allocation model for the northern regions and the other regions are listed below.

Table 8.

Results of the tests for the differences in the coefficients of the grant allocation model for the northern regions and other regions.

Period:	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
Lags in the explana-tory variables	0	0	1	2	0	1	2
Number of observa-tions	86	258	258	172	258	258	258
Transfers from the FFSR							
F-statistic	9,011	26,786	23,734	14,887	19,025	17,270	24,371
P-value of F-statistic	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Additional financial assistance							
F-statistic	7,500	7,011	2,395	1,300	14,725	4,950	10,929
P-value of F-statistic	0,001	0,000	0,051	0,272	0,000	0,000	0,000

The results of the tests show that the parameters of the allocation model for the Northern territories in most cases differ significantly from the parameters for the rest of the regions. The results of econometric estimation of equation (22) (see Appendix 5) show that the model for the northern regions is characterized with the higher value of γ, which means that the federal center covers a larger portion of the northern regions' budget deficits compared to other regions.

2.3.2. Tests of hypotheses of regional fiscal behavior.

In the theoretical model formulated above, the regional authorities choose between tax burden and volume of public goods provision under a given federal financial aid allocation model. In terms of this model a change in the amount or principles of allocation of the federal financial aid fiscal incentives results in changes in optimal values of tax revenue and expenditure in order to maximize the regional utility function. In our investigations we do not address the problems of the utility function estimation, but will instead limit the definition of the fiscal incentives as was done by Jouravskaya[68] in her paper. We will suppose that fiscal incentives occur when the federal center defines the allocation princi-

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[68] See Jouravskaya (1998).

ples and creates conditions under which regional authorities change their optimal values of revenue and expenditure.

It is essential to note that there could be different points of view regarding which fiscal incentives are positive and which are negative. In general, if the goal is to maximize the regional welfare, then federal assistance could aim not only to increase public goods provision in the given region but also to increase private goods consumption (decrease the tax burden). If we introduce some limitations we can suggest that the aim for the federal grants is to increase public goods consumption in the region comparing to the situation without federal assistance. In this case the financial aid allocation principles need to support increasing regional budget expenditure without causing a drop in taxes. According to this formulation if the drop in tax revenue occurs then the situation can be considered to be creating negative fiscal incentives.

The theoretical analysis of the fiscal behavior of regional authorities suggests that the influence of the change in federal financial aid on the optimal values of regional budget revenue and expenditure can change depending on the relation between parameters α and β. An increase in the amount of financial aid under a symmetrical aid allocation model when the federal center equally co-finances the deviations of the actual revenue and expenditure results in a pure income effect. Thus, an increase in the transfer amount leads both to an increase in the regional budget expenditure and a reduction in tax collection. When the allocation model is asymmetrical with respect to the normative and actual values of revenues and expenditures, the signs of the changes in the optimal revenue and expenditure are not clear and depend on the parameters of the model as additional an substitution effect occurs.

Results of the empirical estimations of the federal financial aid allocation model that are listed above show that in 1994-2000 there was a situation in which the value of the parameter β was greater then α. The theoretical analysis showed that under this relation of the parameters, an increase in the amount of transfer (increase in γ) initiates both an income effect (decline in revenue and increase in expenditure) and a substitution effect under which both revenue and expenditure decrease. Consequently, under these conditions, a rise in the amount of federal financial assistance creates strong negative fiscal incentives and results in large drop in tax revenue, especially if β is much greater than α, and the sign of the change in expenditure can be positive or negative. At the same time, a drop in α and β also create two different effects (in sign) on the optimal values of revenue and expenditure. With a drop in α, spending and rev-

enue should fall. But with a drop in β they should increase. Therefore, the net effect in revenue and spending is ambiguous. However, we can expect that in Russia from 1994 to 2000 there could be negative fiscal incentives, i.e. a rise in the transfer amount resulting in a decline in regional tax revenues.

Estimation of the dependence between the change in regional budget tax revenue and expenditure and the change in the federal financial aid. In order to check the fiscal incentives of the regional authorities we first estimate the dependence of the change in budget tax revenue and expenditure on the change in the amount of the federal financial aid holding all other factors constant. As shown above, the amount of federal financial aid depends on actual regional revenue and expenditure in the given fiscal year. This refers mainly to the additional financial assistance that is allocated during the current fiscal year. This means that the dependence among revenue, spending and financial aid should be estimated as a system of simultaneous equations. Estimating the system we also suppose that changes in the regional tax revenue and spending depend not only on the change in the transfer but also on its values in the previous years, i.e. we suppose that revenue and expenditure have some inertia. The volume of the financial aid in the previous years is not included in the system because we suppose that new values of the transfers are calculated for each year using an allocation formula like (22). The system can be written in the following form, so that the coefficients are fully identifiable:

$$
\begin{cases}
\Delta_t T_i = a_0 + a_1 \cdot \Delta_{t-1} T_i + a_2 \cdot \Delta_t Tr_i + \varepsilon_i^T \\
\Delta_t E_i = b_0 + b_1 \cdot \Delta_{t-1} E_i + b_2 \cdot \Delta_t Tr_i + \varepsilon_i^E \\
\Delta_t Tr_i = c_0 + c_1 \cdot \Delta_t T_i + c_2 \cdot \Delta_t E_i + \varepsilon_i^{Tr}
\end{cases}
\tag{24}
$$

Estimating this system we suggest testing the following null hypothesis regarding the coefficients.

$b_2 > 0$ - rise in transfer size causes a rise in regional spending and consequently increases provision of public goods;

$a_2 < 0$ - rise in transfer size causes a decline in tax revenue (in the case when the coefficient does not statistically differ from zero the allocation does not create negative fiscal incentives)

$c_1 < 0$ - the amount of transfer decreases with a rise in regional tax revenue.

$c_2 > 0$ - rise in spending causes a rise in the transfer amount.

Using first differencing rather than levels in addition to keeping other factors constant, allows to get rid of the fixed effects specific for each region, However, it is not correct to estimate the system (24) with the ordinary least squares method as it gives inconsistent estimates due to the correlation between the error terms ε_i^T and ε_i^E and $\Delta_{t-1}T_i$ and $\Delta_{t-1}E_i$ respectively[69]. This problem can be solved using instrumental variables $\Delta_s T_i$ and $\Delta_s E_i$ for all $s<t-1$ using data available up to 1995.

In order to eliminate the effect of changes in federal financial aid in the previous years on regional revenues and spending in the current year, we also used instrumental variables $\Delta_s Tr_i$ for all $s \leq t-1$, for which data were available. In addition due to some other factors that we didn't take into account, it could be expected that the residuals for all the equations ε_i^T, ε_i^E and ε_i^{Tr} are correlated. Under all these conditions we used three-step least squares method for the system estimation using the data on regional budgets in Russia in 1994-2000. All nominal variables were taken per capita, also using the minimal standards index between regions and GDP index between years as the price deflator. Calculations were made for 85 Russian regions (all regions except Chechnya, Khanty-Mansiisky , Yamalo-Nenetsky and Taimyr autonomous regions). The estimation results of the system (24) are given in table 9.

Table 9

Results of the estimation of the system (24)

Period:	1996	1997	1998	1999	2000
Number of observations	255	255	255	255	255
	t-statistic in parentheses				
	Equation for the change in tax revenue				
a_0	0.001	**0.690**	**-0.396**	**-0.628**	0.348
Constant	(0.010)	(6.040)	(-2.830)	(-6.340)	(1.908)
a_1	0.031	0.641	**-0.675**	-0.024	0.404
Change in tax revenue with lag	(0.331)	(1.001)	(-2.968)	(-0.265)	(1.873)
a_2	-0.108	**-0.318**	**-0.110**	-0.076	-0.354
Change in financial aid	(-1.405)	(-3.016)	(-2.072)	(-1.188)	(-1.293)

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[69] This correlation appears in such a manner that it allows $T_{t,i}$ with mistake $u_{t,i}$, and thus $T_{t-1,i}$ с $u_{t-1,i}$. Once we incorporate the rise values we get: $\Delta_t T_i = T_{t,i} - T_{t-1,i}$, $\Delta_{t-1} T_i = T_{t-1,i} - T_{t-2,i}$, $\varepsilon_i^T = u_{t,i} - u_{t-1,i}$ and also $\Delta_{t-1} T_i$ which correlates with ε_i^T.

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Period:	1996	1997	1998	1999	2000
Number of observations	255	255	255	255	255
R^2 adjusted	-0.0003	0.0072	0.152	0.008	0.144
Equation for the change in expenditure					
b_0 Constant	0.305 (1.936)	6.942 (1.421)	**-0.814** (-3.694)	**-0.823** (-6.562)	0.226 (1.052)
b_1 change in expenditure with lag	-0.071 (-1.078)	-5.724 (-1.190)	**-0.442** (-2.332)	-0.003 (-0.114)	0.119 (1.349)
b_2 Change in financial aid	**0.585** (4.715)	-4.778 (-1.138)	**0.549** (3.065)	**0.785** (9.596)	**0.963** (2.992)
R^2 adjusted	0.197	0.144	0.564	0.570	0.104
Equation for the change in the financial aid					
C_0 Constant	-0.151 (-1.412)	**1.208** (2.297)	-0.510 (-1.885)	0.064 (0.605)	0.039 (0.787)
c_1 change in tax revenue	**-0.630** (-4.327)	**-2.803** (-3.876)	**-1.676** (-5.242)	**-1.384** (-10.926)	**-0.604** (10.685)
c_2 change in expenditure	**0.506** (6.465)	**0.572** (2.531)	**0.779** (9.595)	**1.124** (15.908)	$0.604^{\#)}$
R^2 adjusted	0.337	0.116	0.509	0.666	0.594

#) The results for 2000 differ from the previous years in a sense that the change in the increase in tax revenue and the change in spending display a strong correlation. The correlation coefficient is 0.86 while in other years it is not greater than 0.45. Thus estimations for the year 2000 were carried out with the additional limitation $c_1+c_2=0$.

These estimation results demonstrate significant negative coefficients for dependence of the change in the tax revenue on the change in the amount of the financial aid only for 1997 and 1998 where the coefficient equals –0.3 and 0.1, respectively. Results for 1998 can be possibly explained by low federal and regional revenues due to the financial crisis, which brought about a sharp drop in revenue. This phenomenon was not a result of the change in federal assistance. For 1999-2000 such dependence was not established. At the same time, almost for all years (except 1997) there was a significant positive dependence between the change in the regional spending and the change in financial assistance. The coefficient varies from 0.5 to almost 1 from year to year. This means that the increase of the federal financial aid was mostly spent on the increase of the public goods provision.

As a whole, no stable negative fiscal incentives were found in financial assistance allocation to the regions during 1994-2000. Partly, the dependence in the past years asserts that if this effect really had a place it was not overall.

Estimation of the model of tax revenue that includes tax base variables and federal financial aid In the previous subsection the estimation of the influence of the financial aid amount on tax revenue and spending was done using first differencing. This allowed us to obtain a well-specified model under the assumption that all other factors were held constant. Another way to check the transfer size impact on regional revenue and spending is to use more specific models of regional tax and spending. For this approach we must include into the model indicators for the tax base and characteristics of the budget institutions for regional expenditure. As was mentioned above, such models were developed in the IET in order to calculate fiscal capacity and expenditure needs.[70] In this research we included into these model the amount of the financial aid.

The estimation results of the regional tax revenue model that includes the financial aid amount as an explanatory variable show (see appendix 6) that in most cases the coefficient of this variable differs insignificantly from zero. These results are consistent with what we obtained in the empirical analysis presented above.

The taxing power of regional authorities is different for different taxes (e.g. granting privileged terms, payments delays, etc). If we assume that with an increase in the transfer size there occurs a decrease in some particular taxes (those in which regional authorities have maximum taxing power), then if this decrease is not significant, the appropriate coefficient will be insignificant.

Lugovoi, Sinelnikov, and Trounin (2001) developed regional revenue models for different taxes with respect to the subjects of federation. Using analogous models allows us to test the hypothesis regarding fiscal incentives for the revenue from different taxes on the federal and regional levels. In order to test how the transfer impacts on the collection of different taxes, we evaluated the models separately for profits tax, income tax, value added tax, property tax, alcohol excises, and resource taxes. We expect that regional authorities can apply different fiscal efforts for taxes that go to the federal and regional budgets. To check this effect we have made estimations separately for federal, regional and consolidated budget revenue. We also analyzed the tax liabilities (tax receipts

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[70] For more detail see Lugovoi, Sinelnikov, and Trounin (2001).

plus the change in tax arrears) in order to compare the influence on accrued and paid taxes.

The results (see appendix 7) show that a significant negative dependence on the federal financial aid occurs only for the part of the value added tax receipts that goes to the regional budget. Analogous estimates for the tax liabilities showed that the dependence was weaker – the appropriate coefficient was insignificant or significant at a lower level. This means that fiscal incentives in this case appear in a form that the tax efforts for the value added tax is lower in the regions that get more federal financial assistance. The absolute value of the appropriate coefficient is less than 0,03. This means that for each additional ruble in financial assistance the decline in tax collection is less than 0.03 rubles.

Interpreting these results, it should be mentioned that the presence of this interdependence could be explained by factors not tied to the taxing powers of regional authorities. For example, it can be explained by the fact that low taxable activity in poor regions (that get large amount of the federal financial aid) leads to lower tax revenues for the regional budget than can be expected on the basis of the regional indicators (GDP, agricultural production, etc.), which include shadow economic activity estimates such as barter, non-payments, own agricultural activities, etc. Taking these factors into account, it can be seen that large federal transfers and low VAT revenues appear in depressed regions and do not appear in developed ones.

It is also possible to explain the negative sign for the dependence of the VAT on the transfer amount taking into account that until 1998 additional (in comparison to set tax assignment) VAT revenues were assigned to the regional budget instead of the same portion of the transfer from the FFSR. Consequently, in regions that get large amount of the transfer these VAT revenues were accounted in the federal financial assistance item.

For the profit, income, and resource taxes as well as the excises, we did not find significant dependence between tax payments and the amount of the financial aid.

It should be mentioned that due to the specifics of the taxes assigned to the regional budget and spending liabilities of the regional authorities, the probability of negative fiscal incentives is rather low as the tax revenue of the regional budget is formed by the portion of the regulated federal taxes and can be treated as federal grants. That is why negative fiscal incentives can be expected to arise for taxes on which the regional authorities have some taxing power or ability to

provide payment delays or set some informal mechanisms of tax administrations.

Empirical estimation of the expenditure models including the volume of the federal financial aid and the factors that describe the volume and prices of public goods provision. In order to correctly specify the models of the dependence between the expenditure items and the amount of the federal financial aid, we use a set of factors that describe the differentiation of the expenditure volume for different regions. First, these include climate, demographic factors (age, urbanization), as well as price levels, etc. Second, the set of factors should include current state of the budget institutions (number of schools, hospitals per capita, etc.), as well as portion of the public services that is paid for by the households (this is important to a large extent for services like utilities). Another important factor is the ability to finance public goods, that is, the actual tax revenue of the regional budget. Kadotchnikov, Sinelnikov, and Trounin (2001) used the sum of regional revenue including own tax revenue and federal assistance received as an important factor in the models for different expenditure items.[71] For the purposes of this research, this variable was divided into two separate variables – regional tax revenue and the amount of the financial aid that is received from the federal center (the multicollinearity problem between these factors is smoothed by the fact that as it was shown above the financial aid have small effect on the regional budget tax revenue). The estimation results of the appropriate equations (see Appendix 8) showed that on average an increase in the financial aid by 1 ruble results in 1-1.5 rubles increase of the expenditure. These results are quite consistent with the conclusions stated above, i.e. the increase in the amount of the federal financial aid results in comparable increase in budget expenditure.

In order to evaluate how federal financial aid influences different spending items, we used models like those developed in Kadotchnikov, Sinelnikov, and Trounin (2001) with additional explanatory variable – federal financial aid. In similar fashion to the estimation the influence on the separate taxes, we will not concentrate on the underlying hypotheses, but rather will summarize the estimations results for 1999.[72]

The results (see Appendix 9) show that higher values of financial aid correspond to higher spending in all items (for spending on transport and adminis-

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[71] For more detail of the theoretical analysis see Lugovoi, Sinelnikov, and Trounin (2001).

[72] For more detail see Kabochnikov, Sinelnikov, and Trounin (2001).

trative needs the coefficient is insignificant). Greater elasticity values can be seen for expenditures on culture and arts, and social spending. This result supports the fact that financing of items such as utilities and maintenance of state housing, education, healthcare, law enforcement, is based on the regional revenue rather than on federal financial aid. This can be interpreted as an indicator of the importance of such spending items for the regional authorities. Resources received from the Center are used to finance less important items, which are not as vital for the population and financing of which can be delayed.

As a whole, results of the empirical analysis do not exactly coincide with the conclusions from the theoretical model. As shown above, theoretical considerations about the influence of the lump-sum grants on a grantee's choices between public and private goods show that the leakage effect pertains to the fact regions could allocate resources received to greater private goods (instead of public goods) consumption. In exactly the same way, our models highlight the fact that an increase in financial assistance from the center should cause a drop in tax payments. An empirical analysis to understand the effects that an inter-budgetary equalization scheme has on the size of regional tax collection in Russia shows in most cases that there is no statistical significance for the relationship. The increase in the transfer occurs either in accordance with or to a slightly lesser extent than the regional public spending increase.

In order to explain the lack of clear financial assistance "leakage" from the Center to the consumption of private goods, we can combine ideas from the literature covering financial and fiscal federalism with empirical analysis of the "flypaper effect". The expression "money sticks where it hits"[73] best describes this effect. In accordance with the flypaper effect, the reaction of the recipient of the lump-sum grant in choosing between private or public goods consumption differs from the reaction of the median voter, as in the case with falling federal taxes paid by particular region. For example, when federal taxes drop, a jurisdiction moves to increase public spending in its own territory. This occurs regardless of the fact that both situations (receiving the grant and an increase in the revenue of private agents as a consequence of drop in the federal taxes) are equal from a theoretical point of view.

An assessment of the effect of lump-sum grants on local spending in the USA (addressing block grants) shows that a grant of $100 increases public goods consumption by $40-50. At the same time, an increase in revenue of the

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[73] See Cullis and Jones (1998), pp. 321-326.

population in the given region due to a decline in federal taxes of the same amount increases public goods consumption by only $5-10.[74]

To explain this phenomenon in which a lump-sum grant brings about a larger than expected increase in spending from traditional theoretical assertions and the increase in voter's revenue leads to a lower increase in public goods spending than theoretical models suggest, one needs to introduce several hypotheses that were analyzed in detail in part 1.2 of this paper. These hypotheses deal with preferences of subnational decision-makers that do not coincide with those of a representative voter.

However, the reasons for the "flypaper effect" given in the section 1.2 are not sufficient to explain the significant spending rise in the Russian regions once the transfer is received. The average spending increase is close to 100% of the lump-sum transfer. This influence of the assistance on regional spending occurs for several other reasons. First, according to the law, regional authorities must provide the population with public goods, amounts of which sometimes exceeds regional revenues and provided financial assistance. Second, budgetary conditions in Russia are characterized by high levels of credit indebtedness of the regions to the suppliers of goods, services, and recipients of public transfers. Thus, the cost of public goods is greater than actual funding of their production. This is particularly the case for the regions that are very dependent on assistance. In such cases lump-sum grants act like conditional earmarked grants and force regional authorities to produce public goods to an extent that is significantly greater than the own regional revenues together with the financial assistance received.

It is important to note that current principles of aid allocation can differ from the those suggested by the theoretical model For example, in the process of financial aid calculation and transfer regions are required to set the maximum rates of regional taxes, make efforts to decrease tax arrears, make operations through the Treasury, etc. These requirements make the leakage of the grant into the private sector difficult.

We can also assume that regional spending on public goods is much more important for regional authorities than benefits gained from reducing the tax burden. This is particularly the case if we account for low taxing power of regional authorities and insignificant tax burden differences among regions.

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[74]See Gramlich (1977), pp. 282-290

Thus, empirical analysis does not support the idea that the system of inter-budgetary relations in Russia in 1994-2000 created negative fiscal incentives (in a quite narrow sense that there is negative dependence of the change in the tax revenue on the change in the amount of the federal financial aid). An increase (or decrease) in federal financial aid generated an increase (or decrease) in regional spending but did not generate a decline in regional tax collections.

It seems likely that the lack of fiscal incentives in this case was created not by the financial aid allocation system, but by other interbudgetary relations characteristics such as partly, a high level of federal mandates forced upon the regions, as well as low regional taxing powers.

2.3.3. Conclusions from the empirical analysis and economic policy proposals.

Our empirical estimates of the grant allocation formula and fiscal incentives for Russian regions in 1994-2000 highlights the following:

1. The results suggest that federal financial aid allocation was mostly based on covering estimated regional budget deficits. The results of the empirical tests coincide with the fact that the estimated regional budget deficit is calculated using actual budget revenue and expenditure, as well as their normative values (expenditure needs and fiscal capacity). During the considered period, federal financial aid allocation was oriented to a large extent towards normative fiscal capacity and expenditure needs in comparison to actual revenue and spending. This means that the federal center to a lesser and lesser extent co-financed actual spending and compensated regional tax revenue fluctuations from the normative values. These results are consistent with the formal official federal goals in the principles of the federal financial aid allocation. Empirical estimates support the hypothesis regarding the Rawlsian criterion about maximization of the welfare of the poorest regions. If this criterion is in fact the priority in the development of the federal financial aid allocation principles, then the federal center should continue to increase the portion of the financial aid distributed on the basis of formal allocation principles that address equalization as co-financing the gap between the revenue and expenditure of the regional budget.

It should be mentioned that the Compensation Fund established in 2001 to provide regional subsidies to partially finance the social obligations stated in the federal legislation, (e.g. subsidies to families with children, disabled and other social categories) is not consistent with the Rawlsian equalization criterion, as this type of financial aid is distributed according to the number of aid recipients

and does not depend on the regional budget revenue and expenditures on other items.

2. The estimations results show that federal aid allocation model is to a large extent oriented towards actual tax revenue rather than actual expenditure in comparison with the appropriate normative values. This means that more federal resource are needed to co-finance the revenue deviation from the fiscal capacity than expenditure deviation from expenditure needs. Explaining this result we should take into account that until 1999 the official distribution principles of the Fund for financial support of the regions had used actual tax revenue of the regional budget and corrected values of the regional budget expenditures in 1991. In addition to that, current distributional principles of financial aid other than transfer use rather the actual (low) tax revenue than (high) actual budget expenditure.

Theoretical analysis showed that the federal financial aid allocation system could create negative fiscal incentives, that is, when regional authorities reduce tax collections with increased financial aid from the federal center. However the empirical tests for these fiscal incentives did not show stable negative fiscal incentives; therefore the compensation of the regional budget revenue and expenditure fluctuations by the federal financial aid occurred particularly with relatively low regional taxing power in the current system (we do not take into account extreme regions-outliers such as the Altai Republic, Republics of Ingushetia and Kalmykia, etc.). This is quite reasonable and does not require immediate structural changes.

3. Empirical estimates of the allocation model for with respect to transfers other than those from the Fund for Financial Support of the Regions show that these resources are distributed on the basis of less objective criteria than the transfers from the FFSR. This requires a precise continuation of the policy aimed at reducing financial assistance allocated without formal rules of grant distribution. In particular, this type of financial aid must be reduced to the grants that are distributed to help the regions that suffer from the emergency situations or natural disasters.

4. Empirical tests of the grant allocation formula for different groups of regions show that different criteria are applied to different regions in the allocation process. Coefficients in the grant allocation model for poor and the northern regions significantly differ from the model for other regions. The differences for these regions are that the federal center covers a larger portion of the budget deficit and uses larger weights for the actual values of revenue and expenditure

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in the allocation model comparing to the weights for the fiscal capacity and expenditure needs (to a large extent co-finances actual revenue and spending deviations from the appropriate normative values comparing to allocating assistance to other regions).

Such a situation requires the formalization of the approaches to different groups of regions. Several approaches are possible. First, the allocation model can be enhanced by including factors that more clearly differentiate the expenditure needs of the Northern and poor territories from the other regions. Using this approach the federal center must abolish regional grants that are allocated on the basis of informal principles and not use the special treatment for these regions when allocating funds. Second, these regions can be picked out into separate groups for each of which there should be developed principles that take into account the special conditions in these regions. Third, the federal center can distribute grants using principles common for all the regions and in addition to that provide special financial aid to poor and/or northern regions accounting for their special circumstances.

5. The absence of negative fiscal incentives is in general confirmed by the empirical estimates of the dependence of tax revenue on federal aid; that is, almost all increase in the amount of federal financial aid goes to an increase in the regional budget expenditure (provision of public goods). This fact gives in a sense more freedom in the development of the federal aid allocation model. Particularly, the model of the grant allocation can be developed in a way to compensate for actual fluctuations of the regional tax revenue (stabilize the changes of the tax revenue over time) with small risk of creating the negative fiscal incentives, i.e. when regional authorities try to get more federal assistance in order to reduce the tax burden in the region.

Appendices

Appendix 1. Technical Aspects of Different Models for Interbudgetary Equalizing Transfers Allocation

Models without limits on resources available for interbudgetary equalization.

A. Allocation of financial assistance in order to cover the difference between estimated of subnational spending and revenue indicators.

1. Allocation of the transfer is dependent on the given territory's current revenue and expenditures.

The size of financial assistance is established by the following formula:

$$Tr_i = E_i - T_i \tag{P1-1}$$

Where Tr_i – the size of assistance to a given region.

E_i – the region's own expenditures.

T_i – the region's own revenues.

2. Allocation of transfers in order to set subnational spending on a certain level independent of the territory's fiscal capacity, as follows:

$$E_i = \overline{E}, \text{ or } E_i = \overline{E} \cdot N_i \tag{P1-2}$$

Where $\overline{E}_i$ – estimated expenditure needs in a given region (per capita). Expenditure needs are estimated by federal authorities based on the average national level or another level that federal authorities deem as a good basis for allocation.

N_i - expenditure needs index for a given region ($N_i=1$ for a region in which spending needs are equal to the average).

In this case the grant amount to a given territory is allocated based on the following formula:

$$Tr_i = \overline{E} \cdot N_i - T_i \tag{P1-3}$$

The formula for assistance allocation can also be built based on subnational fiscal capacity (if national authorities intend to stimulate regional fiscal efforts). In such a case the grant amount will be calculated in accordance to the following formula:

$$Tr_i = \overline{E} \cdot N_i - \overline{T}_i = \overline{E} \cdot N_i - \overline{t} \cdot B_i, \tag{P1-4}$$

Where $\bar{t}$ – standard (average or maximum) subnational tax rate from based on which national authorities allocate equalizing funds in accordance to the territory's fiscal capacity,.

$\hat{E}_i$ – estimated necessary expenditures in a given region.

$\bar{T}_i$ – estimated potential revenue in a given region given the standard tax rates .

B_i – actual tax base in a given region. .

Using the formula P1-4, it can be shown that federal authorities aim to establish spending at the following level:

$$E_i = \bar{E} \cdot N_i + B_i \cdot (t_i - \bar{t}), \tag{P1-5}$$

Where t_i – actual tax rate in a given region.

B. Allocation of financial assistance with the aim to bring regional fiscal indicators in line with average or normative indicators.

1. Allocation of transfers in dependence on the relationship between the recipient's fiscal capacity and the national (standard) average fiscal capacity:

$$Tr_i = t_i \cdot (\bar{B} - B_i), \tag{P1-6}$$

Where $\bar{B}$ -- standard tax base used for interbudgetary equalization purposes. –

In this case the assistance allocation results in the following level of regional spending (with account that $E_i = T_i + Tr_i = t_i \cdot B_i + Tr_i$:

$$E_i = t_i \cdot \bar{B} , \tag{P1-7}$$

2. The size of the transfer can also be calculated taking into account the standard tax rate level:

$$Tr_i = \bar{t}_i \cdot (\bar{B} - B_i), \tag{P1-8}$$

In this case subnational spending will be established by the following formula:

$$E_i = t_i \cdot B_i + \bar{t} \cdot \bar{B} - \bar{t} \cdot B_i = B_i \cdot (t_i - \bar{t}) + \bar{t} \cdot \bar{B} , \tag{P1-9}$$

According to the first scheme (P1-7) , subnational authorities with equal fiscal efforts (equal levels of tax rates) will have equal resources for financing expenditures. In the second instance (see formula P1-9) the regions should also possess equal tax bases. In both cases the allocation formula becomes more complicated once spending need differentials occur.

3. Transfer allocation is dependent on expenditure needs. In this case the size of the transfer is set as follows:

$$Tr_i = \overline{E} \cdot N_i - E_i, \qquad (P1\text{-}10)$$

This transfer allocation scheme suggests that national authorities aim to establish subnational spending on the following level:

$$E_i = \frac{t_i \cdot B_i + \overline{E} \cdot N_i}{2}, \qquad (P1\text{-}11)$$

It is clear that in this case there will be an incentive to raise regional tax rates in order to increase a given regional revenue. This formula has the same advantages, disadvantages, and inadequacies of the above formulas.

B. Combined equalization schemes.

1. Cripps-Godley Scheme[75]. Employing this scheme establishes resource allocation among subnational entities and determines grant size in accordance with the following formula[76]:

$$Tr_i = \overline{E} \cdot N_i + k \cdot (t_i - \overline{t}) - t_i \cdot B_i. \qquad (P1\text{-}12)$$

In this case subnational spending is set at the following level:

$$E_i = \overline{E} \cdot N_i + k \cdot (t_i - \overline{t}). \qquad (P1\text{-}13)$$

In other words, this scheme dictates that the grant amount to a given region is calculated as the difference between current necessary expenditures and their practical revenue values, with adjustments for the regional actual tax rates and the national average. The calculation of the difference between actual and standard tax rates is established by authorities using the parameter k.

2. Mathews' Scheme[77]. Using this scheme sets transfer allocation in accordance with the following formula:

$$Tr_i = \overline{t} \cdot (\overline{B} - B_i) + B_i \cdot (t_i - \overline{t}). \qquad (P1\text{-}14)$$

This brings about subnational spending on the following level:

$$E_i = \overline{t} \cdot \overline{B} + 2B_i \cdot (t_i - \overline{t}). \qquad (P1\text{-}15)$$

D. Assistance allocation schemes aimed at equalizing subnational spending and revenue indicators.

The consequent interbudgetary transfer systems can be aimed at equalizing the following indicators:

$$\varepsilon = \frac{\partial (E_i \cdot N_i)}{\partial (T_i / \overline{T_i})} = \overline{T_i} \cdot N_i \cdot \frac{\partial E_i}{\partial T_i},$$

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[75] See *Cripps and Godley (1976)*

[76] See *Cripps and Godley (1976)*

[77] See *Mathews (1977)*

where ε represents the intensity of subnational spending change (taking into account the differential in spending needs) under conditions of a change in subnational fiscal efforts;

$$\eta = \frac{\partial\left(E_i \cdot N_i\right)}{\partial\left(T_i / \overline{T_i}\right)} \frac{T_i / \overline{T}}{E_i \cdot N_i} = \frac{\partial E_i}{\partial T_i} \frac{\overline{T_i}}{E_i},$$

where η is the elasticity of subnational spending change in accordance to subnational fiscal efforts.

It is possible to develop equalization formulas aimed at attaining equal value ε, under which the aim of the transfer allocation is $\varepsilon = k\overline{E}$, where k—the parameter set by national authorities (without accounting for the spending need differences). Deciding the differential levels brings about the following formula for assistance allocation:

$$Tr_i = \overline{E} \cdot \left(\left(1 - k\right) + k \cdot \frac{T_i}{\overline{\overline{T}}} \right) - T_i. \tag{P1-16}$$

If a fixed elasticity of subnational spending changes is present in accordance with subnational tax powers (η) on several levels k, the allocation formula will look as follows:

$$Tr_i = \overline{E} \cdot \left(\frac{T_i}{\overline{\overline{T}}} \right)^k - T_i. \tag{P1-17}$$

Also, it is possible to build equalization models based on establishing a given dependence between ε and η from the relationship between subnational fiscal efforts and the average tax powers, the relationship between a given territory's spending and standard spending (King (1980), for example, uses equalization schemes that set ε on the level of $\overline{E}$, if $B_i = \overline{B}$, establishing $\eta = 1$, if $B_i = \overline{B}$ and so on).

Models with limits on the available resources for interbudgetary equalization.

Utilizing such schemes in the case when the amount needed for equalization is not enough for poorer regions, their right of financial assistance undergoes a proportional decrease. We can assume that in such an instance the national authorities will tax richer regions through an additional tax t_c. The equalization process will then take the following form:

$$\begin{cases} E_i = B_i t_i + Tr_i \\ Tr_i = \left(\overline{B} - B_i \right) \cdot \overline{t} - B_i t_c, \, где \ \overline{B} = \dfrac{\sum\limits_i B_i}{n}, \\ \sum\limits_i Tr_i = 0 \end{cases} \qquad \text{(P1-18)}$$

Where n is the amount of subnational administrative entities taking part in the equalization process.

Solving this system for t_c, allows us to establish a rate for a national tax needed for financing the assistance. In this case, regardless of the tax base, the size of the tax rate will equal:

$$t_c = \frac{\sum\limits_i \left(\overline{B} - B_i \right) \cdot \overline{t}}{n\overline{B}}, \qquad \text{(P1-19)}$$

It is necessary to set the additional tax (which rate is positive) under condition that $\sum\limits_i B_i t_i \le \overline{B} \sum\limits_i t_i$. From here we can establish the size of assistance to a given region:

$$Tr_i = t_i \cdot \left(\overline{B} - B_i \right) \cdot \left(1 - \frac{B_i}{n\overline{B}} \right) \qquad \text{(P1-20)}$$

This formula can be used to calculate the size of subnational financial assistance after equalization with the following level:

$$E_i = \frac{1}{n} \cdot t_i \cdot \left(\sum\limits_i B_i - B_i + n \cdot \frac{B_i^{\,2}}{\sum\limits_i B_i} \right) \qquad \text{(P1-21)}$$

This formula for the size of financial assistance and formula P1-21 for subnational spending after equalization allows us to see that the conditions under which financial assistance will be financed from the special tax revenue (and accordingly- the level of the spending per capita after equalization) depend on the relationship between the regional and the average tax base, but not on the difference between the two as was the case in previous models that did not account for resource limitations. Also, it is necessary to show this on more complicated formulas that establish the size of financial assistance.

Appendix 2. The interdependence between the regional deficit calculated using fiscal capacity and expenditure needs and the gross regional product

In order to test to what extent the size of the normative deficit $\left(\widehat{E} - \widehat{T}\right)$ coincides with traditional poverty criteria (per capita gross regional product) we estimated the following model (panel regression with fixed effects):

$$\left(\widehat{E} - \widehat{T}\right)_{ti} = \mu_i + \lambda \cdot GRP_{ti} + \varepsilon_{ti} \tag{P2-1}$$

where

$\widehat{E}$ – expenditure needs of the region;

$\widehat{T}$ – the region's fiscal capacity;

GRP_{ti} – gross regional product for year t

μ_i – a constant fixed effect, specific for each region,

λ – model coefficient.

Estimations were made on the data from 88 Russian regions (except Chechnya) from 1995-2000, Interregional price differentials (minimum living wage index) was used as a deflator. All the indicators were calculated on a per capita basis and a GDP deflator was used to adjust to prices between different years. The following results were attained (t-statistics are in parentheses):

	Pooled regression	Model with 'fixed effects'
Number of tests	528	528
λ	-0,091	-0,019
Coefficient for GDP	(-24,160)	(-1,754)
R^2 adjusted	0,525	0,697
$\mu_i = \mu$	5,935	
	(34,898)	
μ_i:		
Karel Republic		3,752
Komi Republic		1,599
Archangelsk Oblast		3,981
Nenetski Avt. Okrug		-3,785
Vologodskaya Oblast		0,643
Murmansk Oblast		0,896
Saint-Petersburg		4,120
Leningradskaya Oblast		2,868
Novgorodskaya Oblast		2,356
Pskovskaya Oblast		3,689
Brynskaya Oblast		5,669
Vladimirskaya Oblast		3,279
Ivanovskaya Oblast		4,281

	Pooled regression	Model with 'fixed effects'
Kaluzhskaya Oblast		3,763
Kostromskaya Oblast		3,176
Moscow City		0,815
Moscovskaya Oblast		1,555
Orlovskaya Oblast		3,338
Ryazanskaya Oblast		2,931
Smolenskaya Oblast		2,325
Tverskaya Oblast		2,947
Tulskaya Oblast		2,967
Yaroslavskaya Oblast		2,603
Republic Mari El		4,749
Republic Mordovia		5,695
Chuvaskaya Republic		4,160
Kirovskaya Oblast		3,359
Nizhigorodskaya Oblast		1,954
Belgogradskaya Oblast		1,945
Voronezhskaya Oblast		3,258
Kurskaya Oblast		3,392
Lipetzkaya Oblast		1,002
Tombovskaya Oblast		3,675
Republic Kalmiki		6,317
Republic Tatarstan		0,734
Astrachan Oblast		3,342
Volgogradskaya Oblast		3,047
Penzenskaya Oblast		4,300
Samarskaya Oblast		0,225
Saratovskaya Oblast		3,263
Ulyanovskaya Oblast		2,890
Republic Adigiya		4,198
Republic Dagestan		5,113
Republic Ingushetia		8,388
Kabardino-Balkarskaya Republic		4,843
Karachaevo-Kerchevskya Republic		2,164
Republic Severnaya Osetiya		9,146
Krasnodar krai		2,504
Stavropol krai		4,077
Rostovskaya Oblast		3,576
Republic Bashkirostan		2,485
Udmurtskaya Republic		2,603
Kurganskaya Oblast		3,346
Orenburgskaya Oblast		1,796
Permskaya Oblast		0,617
Komi-Permyatski okrug		5,265
Sverdlovskaya oblast		2,261
Chelyabinskaya oblast		0,829
Republic Altai		5,393
Altaiski Krai		4,021
Kemorovska oblast		2,450
Novosibirskaya Oblast		4,014
Omskaya Oblast		2,541
Tomskaya Oblast		2,270
Tiomenskaya oblast		5,413

	Pooled regression	Model with 'fixed effects'
Chanti-Mansinski Okrug		-4,406
Yamalo-Nenetski Avt. Okrug		-4,890
Republic Buryatia		3,402
Republic Tiva		6,063
Republic Chakasiya		2,645
Krasnoyarski Krai		-1,193
Taimirski Avt. Okrug		3,467
Yevenkiski Avt. Okrug		10,094
Irkustakya Oblast		1,683
Ust-Ordinski Buryatinski		6,210
Chitinski Okrug		3,988
Aginski Buryatiski Okrug		5,428
Republic Sacha (Yakutia)		3,379
Jewish Autonomous Okrug		4,876
Chukotski Okrug		7,255
Primorski Krai		3,550
Chabarovski Krai		2,497
Amurskaya Oblast		3,108
Kamchatskaya Oblast		4,482
Koryasksi Oblast		4,391
Magadanskaya Oblast		3,801
Sakhalinskaya Oblast		3,894
Kalingradskaya Oblast		3,948

Appendix 3. Lists of groups of poor and northern regions of the Russian Federation.

Regions that receive large transfers (the criterion—significant financial assistance received over a given time) number twenty-six:

Ninetski AO	Kamerovskaya oblast
Kostromskay oblast	Buryatya
Orlovskaya oblast	Tiva
Mordovia	Taymirksi AO
Kalmiki	Evenkinski AO
Adigia	Ust-Ordinski Burytski AO
Dagestan	Aginski Burytski AO
Ingushetia	Jewish AO
Kabardina Balkarskaya	Chukostki AO
Northern Osetia	Kamchatskaya oblast
Komi-Permytski AO	Korykski AO
Altai	Magadanskya oblast
Altaiski Krai	Sakhalinskaya oblast

Northern regions (29 in total):

Karil	Irkutskaya oblast
Komi	Ust-Ordinski Buryatski AO
Archangelsk Oblast	Chitinskaya oblast
Ninetski AO	Aginski Buryatski AO
Murmunskaya Oblast	Sacha (Yakutiya)
Altai	Jewish AO
Tomskaya Oblast	Chukotski AO
Tumenskaya Oblast	Primorski krai
Chanti-Mansinski AO	Chaborovski krai
Yamalo-Ninetski AO	Amurskaya oblast
Buryatiya	Kamchatskaya oblast
Tiva	Koryaksi AO
Krasnoyarski krai	Magadan oblast
Taymirski AO	Sakhalin oblast
Evenkiski AO	

Appendix 4. Estimation results of the financial aid allocation for the poor regions

In order to test the differentials in the model of financial aid allocation to poor regions in comparison to other regions the following equation was estimated:

$$Tr_i = a_0 \cdot D_i + a_1 \cdot (E - \widehat{E})_i \cdot D_i + a_2 \cdot (T - \widehat{T})_i \cdot D_i + a_3 \cdot (\widehat{E} - \widehat{T})_i \cdot D_i + b_0 \cdot (1 - D_i) +$$
$$+ b_1 \cdot (E - \widehat{E})_i \cdot (1 - D_i) + b_2 \cdot (T - \widehat{T})_i \cdot (1 - D_i) + b_3 \cdot (\widehat{E} - \widehat{T})_i \cdot (1 - D_i) + \varepsilon_i \qquad \text{(P4-1)}$$

where

Tr_i – financial aid to the given region;

E – actual regional spending;

$\widehat{E}$ – expenditure need;

T – actual regional tax revenue;

$\widehat{T}$ – fiscal capacity;

D_i – dummy variable equal to 1 for poor regions and 0 for others.

P4-1 allows us to test the significance of the differences in the financial aid allocation model between the two above-mentioned regional groups in Russia. Estimations were made using data from 1994 to 2000. As was with testing the parameter changes for prior models , three sub-periods can be seen. 1994 (as earlier, here it was better to use not the model (P4-1) but the one that used a dummy variable for the actual regional deficit for the poor regions in 1994), 1995-1997, and 1998-2000 (with an additional dummy for a_1 in 2000)

The following F-test checks whether the financial assistance parameters significantly differ from one regional group to another:

Period:	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
Lags (time)	0	0	1	2	0	1	2
Number of tests	86	258	258	172	258	258	258
Explanatory variable:	**Transfer from the Fund for the Financial Support of the Regions**						
F-statistic	9,011	26,786	23,734	14,887	19,025	17,270	24,371
P-value of F-statistic	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Explanatory variable:	**Additional financial assistance**						
F-statistic	7,500	7,011	2,395	1,300	14,725	4,950	10,929
P-value of F-statistic	0,001	0,000	0,051	0,272	0,000	0,000	0,000

Below are the results of the estimation of the equation P4-1 for the transfer from the Federal Fund for Financial Support of the Regions.

Explanatory variable:	Transfer from the Fund for the Financial Support of the Regions						
Period:	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
Lags in the explanatory variable	0	0	1	2	0	1	2
Number of tests	86	258	258	172	258	258	258
Explanatory variable:	t-statistic in parentheses						
Constant (a_0)	-0,461	0,068	0,176	0,303	0,040	0,067	0,078
For poor regions	(-3,112)	(0,617)	(1,429)	(1,714)	(0,298)	(0,425)	(0,443)
Constant (b_0) For the rest of the regions	0,085 (0,727)	0,696 (4,641)	1,107 (7,064)	1,609 (7,333)	-0,219 (-1,514)	0,351 (1,734)	0,636 (2,765)
Co-financing of spending (a_1)		0,069	0,087	0,081	0,050	0,012	0,033
For poor regions		(1,616)	(1,467)	(0,894)	(1,135)	(0,224)	(0,513)
Co-financing of spending (b_1) For the rest of the regions		0,325 (18,972)	0,353 (16,086)	0,298 (9,256)	0,145 (6,354)	0,190 (7,493)	0,191 (6,847)
With dummy for 2000 For poor regions					0,026 (0,533)	0,044 (0,634)	-0,048 (-0,612)
With dummy for 2000 For the rest of the regions					0,111 (3,660)	0,324 (6,825)	0,502 (9,668)
Co-financing of revenue (a_2)		-0,207	-0,192	-0,187	-0,068	-0,106	-0,151
For poor regions		(-2,729)	(-2,120)	(-1,358)	(-1,141)	(-1,238)	(-1,501)
Co-financing of revenue (b_2) For the rest of the regions		0,099 (0,739)	0,043 (0,263)	0,285 (1,233)	-0,368 (-11,829)	-0,253 (-5,431)	-0,340 (-5,591)
Deficit co-financing (a_3)		0,243	0,227	0,202	0,240	0,186	0,166
For poor regions		(5,710)	(4,064)	(2,357)	(3,657)	(2,926)	(2,462)
Deficit co-financing (b_3) For the rest of the regions		0,341 (13,781)	0,274 (10,897)	0,186 (5,511)	0,667 (20,955)	0,445 (11,239)	0,332 (8,077)
Actual budget	0,285						

Explanatory variable:	Transfer from the Fund for the Financial Support of the Regions						
Period:	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
deficit For poor regions	(14,803)						
Actual budget deficit For the rest of the regions	0,029 (0,512)						
R^2 adjusted	0,811	0,813	0,756	0,650	0,849	0,744	0,701
α for poor regions α for the rest of the regions	1,000 1,000	0,284 0,953	0,383 1,288	0,401 1,602	0,208 0,217	0,065 0,427	0,199 0,575
β for poor regions β for the rest of the regions	1,000 1,000	0,852 -0,290	0,846 -0,157	0,926 -1,532	0,283 0,552	0,570 0,569	0,910 1,024
γ for poor regions γ for the rest of the regions	0,285 0,029	0,243 0,341	0,227 0,274	0,202 0,186	0,240 0,667	0,186 0,445	0,166 0,332
Difference α^{2000} from $\alpha^{1998\text{-}99}$ for poor regions The rest of the regions					0,108 0,166	0,237 0,728	-0,289 1,512

Results of the estimation of the equation P4-1 for the additional financial aid:

Explanatory variable:	Additional financial aid						
Period:	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
Lags in the explanatory variable	0	0	1	2	0	1	2
Number of tests	86	258	258	172	258	258	258
Explanatory variable:	t-statistic in parentheses						
Constant (a_0) For poor regions	0,709 (2,866)	0,022 (0,193)	0,253 (1,688)	0,515 (2,796)	0,107 (0,942)	0,107 (0,715)	0,206 (1,631)
Constant (b_0) For the rest of the regions	0,680 (3,482)	-0,589 (-3,848)	0,577 (3,036)	0,917 (4,015)	-1,096 (-8,848)	-0,370 (-1,942)	-0,864 (-5,240)
Co-financing of spending (a_1) For poor regions		0,278 (6,424)	0,252 (3,532)	0,229 (2,416)	0,068 (1,813)	0,049 (0,971)	0,027 (0,586)
Co-financing of		0,225	0,202	0,198	0,321	0,278	0,361

Explanatory variable:	**Additional financial aid**						
Period:	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
spending (b_1)							
For the rest of the regions		(12,853)	(7,566)	(5,911)	(16,440)	(11,603)	(17,995)
With dummy for 2000					-0,032	-0,018	-0,010
For poor regions					(-0,754)	(-0,277)	(-0,176)
With dummy for 2000					-0,306	-0,192	-0,119
For the rest of the regions					(-11,710)	(-4,304)	(-3,190)
Co-financing of revenue (a_2)		-0,432	-0,344	-0,328	-0,057	-0,080	-0,038
For poor regions		(-5,575)	(-3,134)	(-2,282)	(-1,102)	(-0,993)	(-0,522)
Co-financing of revenue (b_2) For the rest of the regions		-0,743	-0,655	-0,397	-0,297	-0,053	-0,219
		(-5,456)	(-3,333)	(-1,653)	(-11,134)	(-1,211)	(-5,017)
Deficit co-financing (a_3)		0,259	0,190	0,133	0,064	0,049	0,007
For poor regions		(5,947)	(2,807)	(1,487)	(1,133)	(0,823)	(0,146)
Deficit co-financing (b_3) For the rest of the regions		0,408	0,196	0,132	0,460	0,238	0,310
		(16,135)	(6,411)	(3,750)	(16,848)	(6,388)	(10,511)
Actual budget deficit	0,673						
For poor regions	(20,918)						
Actual budget deficit For the rest of the regions	0,418						
	(4,375)						
R^2 adjusted	0,915	0,679	0,410	0,342	0,735	0,460	0,634
α for poor regions	1,000	1,073	1,326	1,722	1,063	1,000	3,857
α for the rest of the regions	1,000	0,551	1,031	1,500	0,698	1,168	1,165
β for poor regions	1,000	1,668	1,811	2,466	0,891	1,633	5,429
β for the rest of the regions	1,000	1,821	3,342	3,008	0,646	0,223	0,706
γ for poor regions	0,673	0,259	0,190	0,133	0,064	0,049	0,007
γ for the rest of the regions	0,418	0,408	0,196	0,132	0,460	0,238	0,310
Difference α^{2000} from					-0,500	-0,367	-1,429

Explanatory variable:	Additional financial aid						
Period:	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
$\alpha^{1998\text{-}99}$ for poor regions							
The rest of the re-gions					-0,665	-0,807	-0,384

Appendix 5. Estimation results of the financial aid allocation model for the northern regions

In order to test the statistical difference between the model of the financial aid allocation for the northern regions and that for the other regions, the following equation was estimated:

$$Tr_i = a_0 \cdot D_i + a_1 \cdot (E - \hat{E})_i \cdot D_i + a_2 \cdot (T - \hat{T})_i \cdot D_i + a_3 \cdot (\hat{E} - \hat{T})_i \cdot D_i + b_0 \cdot (1 - D_i) +$$
$$+ b_1 \cdot (E - \hat{E})_i \cdot (1 - D_i) + b_2 \cdot (T - \hat{T})_i \cdot (1 - D_i) + b_3 \cdot (\hat{E} - \hat{T})_i \cdot (1 - D_i) + \varepsilon_i \quad \text{(П5-1)}$$

where
Tr_i – federal financial aid to the given region;
E – actual regional spending;
$\hat{E}$ – expenditure needs;
T – actual regional tax revenue;
$\hat{T}$ – regional fiscal capacity;
D_i – dummy variable equal to 1 for northern regions and 0 for others.

P5-1 allows us to test the statistical significance of the difference in the model of the financial aid allocation for the northern regions compared to the other regions. Estimations were taken out using data from 1994 to 2000. As was with testing the parameter changes for the previous models, three sub-periods can be seen. 1994 (as earlier, here it would be better to use not the model P5-1 but the one that uses a dummy variable for the regional deficit in 1994), 1995-1997, and 1998-2000 (with additional dummy at a_1 for 2000)

The following F-test checks whether the model of the financial aid allocation parameters differ for the northern region compared to the others:

Period:	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
Lags (time)	0	0	1	2	0	1	2
Number of tests	86	258	258	172	258	258	258
Explanatory variable:	**Transfers from the Fund for the Financial Support**						
F-statistic	2,343	1,476	3,856	3,392	3,694	6,964	9,948
P-value F-statistic	0,102	0,210	0,005	0,011	0,003	0,000	0,000
Explanatory variable:	**Additional financial aid**						
F-statistic	1,995	1,855	1,724	0,317	9,211	4,742	11,972
P-value F-statistic	0,143	0,119	0,145	0,866	0,000	0,000	0,000

Below are the results from P5-1 applies to the transfers from the Fund for the financial support of the Russian regions:

Explanatory variable:	Transfers from the Fund for the Financial Support						
Period:	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
Lags in the explanatory variable	0	0	1	2	0	1	2
Number of tests	86	258	258	172	258	258	258
Explanatory variable:	t-statistic in parentheses						
Constant (a_0) For northern regions	-0,203 (-2,019)	-0,120 (-1,083)	-0,016 (-0,141)	0,234 (1,474)	-0,553 (-4,512)	-0,405 (-2,732)	-0,343 (-2,071)
Constant (b_0) For the rest of the regions	-0,566 (-4,333)	-0,084 (-0,458)	0,423 (2,411)	0,825 (3,387)	-0,560 (-4,211)	-0,404 (-2,229)	-0,269 (-1,219)
Co-financing of spending (a_1) For northern regions		0,218 (4,280)	0,305 (4,865)	0,222 (2,383)	0,233 (4,663)	0,190 (3,341)	0,219 (3,111)
Co-financing of spending (b_1) For the rest of the regions		0,346 (17,368)	0,400 (16,561)	0,366 (10,360)	0,147 (5,989)	0,195 (7,079)	0,218 (6,999)
With dummy for 2000 For northern regions					-0,073 (-1,045)	-0,123 (-1,329)	-0,105 (-1,146)
With dummy for 2000 For the rest of the regions					0,103 (3,175)	0,263 (5,609)	0,469 (8,090)
Co-financing of revenue (a_2) For northern regions		-0,261 (-2,361)	-0,333 (-2,674)	-0,189 (-1,029)	-0,415 (-4,782)	-0,410 (-3,437)	-0,417 (-2,961)
Co-financing of revenue (b_2) For the rest of the regions		-0,278 (-2,071)	-0,115 (-0,822)	0,035 (0,175)	-0,322 (-9,359)	-0,238 (-4,909)	-0,349 (-5,308)
Deficit equalization (a_3) For northern regions		0,400 (10,696)	0,414 (9,613)	0,345 (5,465)	0,598 (11,765)	0,441 (8,799)	0,392 (7,344)
Deficit equalization (b_3) For the rest of the regions		0,424 (11,762)	0,318 (9,701)	0,236 (5,562)	0,703 (21,423)	0,577 (13,643)	0,473 (9,423)
Actual budget deficit For northern regions	0,229 (6,401)						

Explanatory variable:	**Transfers from the Fund for the Financial Support**						
Period:	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
Actual budget deficit For the rest of the regions	0,286 (15,350)						
R^2 adjusted	0,783	0,739	0,683	0,559	0,805	0,697	0,628
α for northern regions	1,000	0,545	0,737	0,643	0,390	0,431	0,559
α for the rest of the regions	1,000	0,816	1,258	1,551	0,209	0,338	0,461
β for northern regions	1,000	0,653	0,804	0,548	0,694	0,930	1,064
β for the rest of the regions	1,000	0,656	0,362	-0,148	0,458	0,412	0,738
γ for northern regions	0,229	0,400	0,414	0,345	0,598	0,441	0,392
γ for the rest of the regions	0,286	0,424	0,318	0,236	0,703	0,577	0,473
Difference α^{2000} from $\alpha^{1998-99}$ for northern regions					-0,122	-0,279	-0,268
The rest of the regions					0,147	0,456	0,992

Below are results of the estimation of P5-1 for the additional financial aid:

Explanatory variable:	**Additional financial aid**						
Period:	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
Lags in the explanatory variable	0	0	1	2	0	1	2
Number of tests	86	258	258	172	258	258	258
Explanatory variable:	t-statistic in parentheses						
Constant (a_0) For northern regions	0,055 (0,332)	-0,280 (-2,809)	0,083 (0,682)	0,426 (2,869)	-0,068 (-0,701)	-0,033 (-0,255)	0,086 (0,815)
Constant (b_0) For the rest of the regions	0,385 (1,790)	-0,365 (-2,212)	0,505 (2,690)	0,666 (2,914)	-0,909 (-8,653)	-0,230 (-1,459)	-0,601 (-4,271)
Co-financing of spending (a_1) For northern regions		0,330 (7,191)	0,281 (4,205)	0,264 (3,021)	0,129 (3,267)	0,056 (1,139)	0,033 (0,727)
Co-financing of spending (b_1) For the rest of the regions		0,231 (12,876)	0,251 (9,722)	0,236 (7,138)	0,300 (15,463)	0,282 (11,816)	0,359 (18,103)
With dummy for 2000 For northern regions					-0,054 (-0,972)	-0,005 (-0,059)	0,008 (0,145)

Explanatory variable:	Additional financial aid						
Period:	1994	1995-97	1995-97	1996-97	1998-00	1998-00	1998-00
With dummy for 2000					-0,270	-0,185	-0,141
For the rest of the regions					(-10,529)	(-4,542)	(-3,808)
Co-financing of revenue (a_2)		-0,550	-0,379	-0,345	-0,148	-0,085	-0,056
For northern regions		(-5,529)	(-2,846)	(-1,999)	(-2,165)	(-0,823)	(-0,621)
Co-financing of revenue (b_2)		-0,623	-0,320	-0,306	-2,860	-0,066	-0,191
For the rest of the regions		(-5,168)	(-2,128)	(-1,628)	(-10,533)	(-1,557)	(-4,550)
Deficit equalization (a_3)		0,383	0,282	0,204	0,169	0,122	0,069
For northern regions		(11,410)	(6,123)	(3,450)	(4,218)	(2,817)	(2,035)
Deficit equalization (b_3)		0,382	0,158	0,138	0,441	0,211	0,280
For the rest of the regions		(10,840)	(4,506)	(3,473)	(16,998)	(5,762)	(8,739)
Actual budget deficit	0,803						
For northern regions	(13,637)						
Actual budget deficit	0,677						
For the rest of the regions	(22,000)						
R^2 *adjusted*	0,904	0,653	0,404	0,326	0,710	0,458	0,640
α for northern regions	1,000	0,862	0,996	1,294	0,763	0,459	0,478
α for the rest of the regions	1,000	0,605	1,589	1,710	0,680	1,336	1,282
β for northern regions	1,000	1,436	1,344	1,691	0,876	0,697	0,812
β for the rest of the regions	1,000	1,631	2,025	2,217	6,485	0,313	0,682
γ for northern regions	0,803	0,383	0,282	0,204	0,169	0,122	0,069
γ for the rest of the regions	0,677	0,382	0,158	0,138	0,441	0,211	0,280
Difference α^{2000} from $\alpha^{1998-99}$ for northern regions					-0,320	-0,041	0,116
The rest of the regions					-0,612	-0,877	-0,504

Appendix 6. Estimation results of the models of the tax revenues including the amount of the financial aid as an explanatory variable

The modeling of tax payments for calculating the fiscal capacity of the regions (see Lugovoi, Sinelnikov, and Trounin in 2001) allows us to specify a set of factors that should be used in tax revenue models for the regression to be correctly specified. These factors were used in order to estimate the influence of the financial aid on the tax revenues of the regional budget.

The corresponding equation is as follows:

$$T_i = a_0 + a_1 \cdot Y_i + a_2 \cdot N^F_i + a_3 \cdot Tr_i + \varepsilon_I \qquad (P6\text{-}1)$$

where

Tr_i – financial aid to the given region;

T – regional tax revenue;

Y_i – per capita gross product in a given region (we assume a positive relationship since it represents the regional tax base);

N^F_i – the proportion of the rural population– this variable is used to adjust the lower revenue from the agriculture (the greater the contributions, the lower the tax payments since payments from the agricultural sector are usually lower than other sectors).

Using this equation, P6-1, we suggest that tax revenue in each region depends on the tax base (gross regional product and proportion of the rural population) only in the current year. But their fiscal policy is based on the amount of the financial aid received not only this year but also in the previous three years. For example, the valuation of the tax revenue in 1997 in comparison to the aid received in 1995, shows that the former is the dependent variable, while the regional product per capita and the proportion of rural population in 1997 and financial aid amount per capita in 1995 are the explanatory variables. The results from estimation of the equation P5-1 are shown in the tables below (where symbols "*" express the coefficient significance for 10% (*), 5% (**) and 1% (***) levels of significance, the significance of the R^2 represents the significance of the appropriate F-statistic, the shaded areas represent lag combinations that were not estimated):

c_0

Налог. доходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	3,338***						
1995	2,830***	2,828***					
1996	1,557***	1,507***	1,460***				
1997	-2,842***	-3,009***	-3,337***	-3,330***			
1998		-0,172	-0,331	-0,283	-0,155		
1999			-1,177*	-1,074*	-0,986	-0,866	
2000				-2,659***	-2,553**	-2,357**	-2,406**

c_1

Налог. доходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	0,089***						
1995	0,083***	0,083***					
1996	0,106***	0,106***	0,106***				
1997	0,207***	0,209***	0,210***	0,211***			
1998		0,154***	0,153***	0,153***	0,152***		
1999			0,146***	0,145***	0,145***	0,145***	
2000				0,182***	0,182***	0,182***	0,181***

c_2

Налог. доходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	-4,688***						
1995	-4,447***	-3,976***					
1996	-3,336***	-3,164***	-2,643**				
1997	-0,862	-0,351	0,098	0,266			
1998		-3,445*	-3,041*	-2,909	-3,119		
1999			-0,443	-0,124	-0,310	-0,952	
2000				1,896	1,313	0,484	1,359

c_3

Налог. доходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	0,094						
1995	0,048	0,006					
1996	0,087	0,118	0,063				
1997	0,229**	0,309**	0,377*	0,246**			
1998		0,186	0,195	0,115	0,170		
1999			0,201	0,086	0,133	0,211***	
2000				0,108	0,230	0,320**	0,152

$adj.R^2$

Налог. доходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	0,656***						
1995	0,775***	0,773***					
1996	0,855***	0,855***	0,851***				
1997	0,766***	0,766***	0,763***	0,765***			
1998		0,656***	0,653***	0,653***	0,651***		
1999			0,806***	0,803***	0,802***	0,817***	
2000				0,716***	0,717***	0,734***	0,720***

Appendix 7. Estimation results for the models of tax revenues including the amount of financial aid as an explanatory variable per tax types

Lugovoi, Sinelnikov, and Trounin (2001) built tax revenue models for certain taxes. In this appendix we estimate these models including the variable of the financial aid given to region in order to check the magnitude of the fiscal incentives (negative relations between tax payments and the transfer size).

Below are the results of the estimation (in parentheses are the p-value for the t-statistic). The estimates were made for tax payments collected to the regional budget as well as the federal collections from the territory of the region in order to check for possible differentials in fiscal incentives for different parts of the taxes. There also were made estimates for tax liabilities (the sum of tax revenues and the changes in tax arrears).

	Profit tax revenues	Profit tax liabilities	Profit tax liabilities to the federal budget	Profits tax revenue to the regional budget	Profits tax liabilities to the regional budget
Constant	243.2*** (0.001)	71.1 (0.174)	-1.226 (0.257)	105.5*** (0.005)	63.4* (0.061)
Profits	0.148*** (0.000)	0.265*** (0.000)	0.099*** (0.000)	0.105*** (0.000)	0.163*** (0.000)
Financial aid	0.005 (0.816)	0.068* (0.058)	0.030* (0.052)	0.005 (0.709)	0.040* (0.082)
Adj R²	**0.489**	**0.873**	**0.835**	**0.569**	**0.865**

	VAT revenues	VAT liabilities	VAT revenues to the federal budget	VAT liabilities to the federal budget	VAT revenues to the regional budget	VAT liabilities to the regional budget
Constant	232.4 (0.265)	443.9* (0.052)	168.9 (0.331)	354.8* (0.068)	71.1 (0.149)	82.0* (0.083)
Gross regional product	0.034*** (0.000)	0.048*** (0.000)	0.020*** (0.000)	0.034*** (0.000)	0.010*** (0.000)	0.010*** (0.000)
Proportion f the rural population	-3.218 (0.365)	-9.322** (0.014)	-1.604 (0.605)	-5.806* (0.084)	-0.759 (0.331)	-1.455* (0.058)
Financial aid	-0.049** (0.023)	-0.009 (0.751)	-0.018 (0.340)	0.002 (0.920)	-0.027*** (0.000)	-0.010* (0.064)
Adj R²	**0.438**	**0.659**	**0.249**	**0.508**	**0.547**	**0.590**
	Personal	*Revenue of*	*Excises on*	*Resource*	*Resource*	*Resource*

	income tax revenue	the proper-ty tax on enterprises	alcohol	payments	payments to the fed-eral budget	payments to the re-gional budget
Constant	-213.12*** (0.000)	-61.97*** (0.003)	13.85** (0.039)	36.80*** (0.000)	3.42 (0.199)	31.14** (0.013)
Wages net the change in the wage arrears	0.111*** (0.000)	-	-	-	-	-
Total average personal income other than average wage	0.012*** (0.000)	-	-	-	-	-
Gross regional product	-	0.011*** (0.000)	-	-	-	-
Capital assets	-	0.001** (0.027)	-	-	-	-
Vodka and hard liquor production	-	-	0.169*** (0.000)	-	-	-
Wine production, including cham-pagne	-	-	0.141** (0.012)	-	-	-
Volume of fuel industry production	-	-	-	0.023*** (0.006)	0.012*** (0.000)	0.013** (0.017)
Volume of forestry industry production	-	-	-	0.019** (0.020)	0.007** (0.010)	0.011** (0.042)
Volume of non-ferrous industry production	-	-	-	0.025*** (0.000)	0.006*** (0.000)	0.019*** (0.000)
Volume of ferrous industry production	-	-	-	0.005* (0.063)	0.002** (0.033)	0.003* (0.091)
Volume of natural gas production	-	-	-	9.579* (0.065)	-2.327 (0.239)	8.795** (0.018)
Volume of natural condensed gas and oil production	-	-	-	0.042*** (0.006)	0.011** (0.049)	0.038*** (0.001)
Financial aid	0.006 (0.316)	-0.001 (0.776)	-0.000 (0.896)	0.003 (0.542)	0.000 (0.803)	0.002 (0.657)
Adj R^2	0.958	0.813	0.876	0.737	0.655	0.756

Appendix 8. Estimation results of the expenditure equation including the amount of financial aid as an explanatory variables

The calculation of expenditure needs as was done in Kadotchnikov, Sinelnikov, and Trounin (2001), is based on an econometric estimation of the equations for the different items of regional budget expenditures of. The results of the research stated above help to correctly specify the equation of the dependence of expenditures on the amount of the financial aid:

$$E_i = c_0 + c_1 T_i + c_2 N^C_i + c_3 R^H_i + c_4 R^M_i + c_5 R^S_i + c_6 I_i + c_7 Tr_i + \varepsilon_i \qquad (\text{П8-1})$$

where

N^C_i – proportion of the urban population in the ith region (as an indicator of the concentration and intensity of utility and housing maintenance services, education, healthcare, etc);

R^H_i – proportion of the housing services that is financed by the population in the ith region in 2000 (the greater this contribution, the less the regional authorities have to spend);

R^M_i –medical personnel availability in the ith region (as an indicator of the overall healthcare level);

R^S_i – number of schools per capita in the ith region (as an indicator of expenses on education);

I_i – the minimum living cost in the ith region (as an indicator of the interregional price differential);

The results from applying P8-1 are shown in the tables below, where symbols "*" express the coefficient significance for 10% (*), 5% (**) and 1% (***) levels of significance. Significance of R^2 represents the significance of the appropriate F-statistic, the shaded areas indicate the lag combinations that were not considered:

c_0

Расходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	-2,322***						
1995	-2,415	-4,820***					
1996	-0,460	-2,828**	-2,796**				
1997	-4,316	-7,339***	-6,724***	-3,141**			
1998		-0,653	-0,319	2,032*	-2,226*		
1999			-3,368	-0,738	-5,652***	-1,002	
2000				-3,031	-8,169***	-2,714**	-2,673***

c_1

Расходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	1,000***						
1995	0,881***	1,043***					
1996	0,965***	1,035***	1,053***				
1997	0,956***	1,022***	1,001***	1,039***			
1998		1,384***	1,370***	1,398***	1,386***		
1999			1,421***	1,486***	1,440***	1,376***	
2000				1,390***	1,346***	1,303***	1,342***

c_2

Расходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	-0,281						
1995	2,299	3,767***					
1996	-1,760	0,782	-0,672				
1997	1,631	5,091**	2,447	1,657			
1998		-1,477	-3,227**	-3,921***	0,110		
1999			-2,414	-2,182	1,633	-1,612	
2000				-1,108	3,019	0,065	-0,274

c_3

Расходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	3,468***						
1995	-1,751	3,869***					
1996	-2,973	1,985	0,476				
1997	-3,674	3,002	0,039	0,575			
1998		2,389	0,461	0,759	1,155		
1999			-1,540	0,254	-0,567	2,178*	
2000				-0,037	-1,602	2,750*	3,458***

c_4

Расходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	0,040						
1995	0,031	-0,051					
1996	0,231*	0,117	0,143*				
1997	0,332*	0,172	0,253**	0,025			
1998		0,041	0,094	-0,042	-0,006		
1999			0,169	-0,125	0,027	0,037	
2000				0,030	0,193	0,106	0,049

c_5

Расходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	0,409						
1995	2,468*	1,443**					
1996	1,883	1,221	1,282*				
1997	4,104**	3,226***	3,428***	1,904**			
1998		0,350	0,538	-0,493	0,632		
1999			1,605	0,209	1,841	-0,648	
2000				1,119	3,133*	0,029	-0,834

c_6

Расходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	0,010***						
1995	0,005**	0,002					
1996	0,004***	0,002**	0,003***				
1997	0,004**	0,001	0,003***	0,003***			
1998		-0,001*	0,000	0,000	0,000		
1999			0,001**	0,001***	0,002***	0,000	
2000				0,001	0,001*	0,000	0,000**

c_7

Расходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	0,934***						
1995	0,536***	1,386***					
1996	0,256**	0,972***	1,163***				
1997	0,390**	1,361***	1,375***	1,084***			
1998		0,904***	0,935***	0,712***	1,345***		
1999			1,065***	0,994***	1,531***	1,196***	
2000				1,149***	1,702***	1,498***	1,345***

$adj.R^2$

Расходы	Финансовая помощь						
	1994	1995	1996	1997	1998	1999	2000
1994	0,967***						
1995	0,701***	0,921***					
1996	0,827***	0,921***	0,927***				
1997	0,853***	0,926***	0,908***	0,951***			
1998		0,952***	0,943***	0,967***	0,967***		
1999			0,879***	0,942***	0,905***	0,971***	
2000				0,939***	0,908***	0,973***	0,986***

Appendix 9. Estimation of the dependence of expenditures on the amount of the financial aid for different expenditure items

Econometric models for spending on different items were developed and estimated in Kadotchnikov, Sinelnikov, and Trounin (2001). These models can be used to estimate the dependence of expenditures from the amount of the financial aid.

The estimation results are provided below. Each column represents a different expenditure item. The explanatory variables are in the left column.

Spending elasticity per explanatory variable	Spending on housing maintenance services	Healthcare	Education	Art and culture
Constant	0.201 (0.892)	0.376 (0.742)	1.044 (0.230)	-3.040* (0.058)
budgetary revenue per capita	0.419*** (0.000)	0.179** (0.051)	0.309*** (0.000)	0.393*** (0.000)
financial aid per capita	0.103** (0.046)	0.114*** (0.002)	0.075** (0.040)	0.121*** (0.009)
Minimum cost of living	0.482** (0.021)	0.622*** (0.000)	0.924*** (0.000)	0.752*** (0.000)
Proportion of the urban population	0.484*** (0.010)	-	-	-
Average wage	-	0.505** (0.024)	-	-
Proportion of the municipal housing	0.256** (0,014)	-	-	-
Number of enterprise per capita	0.465* (0.002)	-	-	-
Medical personnel availability	-	0,701*** (0.000)	-	-
Number of schools per capita	-	-	0.332*** (0.000)	-
Number of books and journals in public libraries	-	-	-	0.303*** (0.010)
Public buses	-	-	-	-
Population in the region	-	-	-	-
average city size in the region	-	-	-	-
Adjusted R^2	**0.777**	**0,771**	**0.832**	**0.773**

Spending elasticity per explanatory variable	Law-enforcement	transporta-tion	government administra-tion	Social policy
Constant	2.110* (0.064)	4.459*** (0.000)	1.889** (0.026)	5.862*** (0.001)
budgetary revenue per capita	0.279*** (0.000)	0.596*** (0.000)	0,334*** (0.000)	0.400*** (0.000)
financial aid per capita	0.105** (0.018)	0.031 (0.667)	0.138 (0.138)	0.127** (0.049)
Minimum cost of living	0,387** (0.039)	-	0.629*** (0.000)	-0.018 (0.946)
Proportion of the urban population	-	1.274*** (0.002)	-0.348*** (0.005)	-
Average wage	-	-	0.363** (0.022)	-
Proportion of the municipal housing	-	-	-	-
Number of enter-prise per capita	-	-	-	-
Medical personnel availability	-	-	-	-
Number of schools per capita	-	-	-	-
Number of books and journals in public libraries	-	-	-	-
Public buses	-	0.179* (0.086)	-	-
Population in the region	-	-	-0.131*** (0.001)	-
average city size in the region	-	-	-	-0.155 (0.147)
Adjusted R^2	0.545	0.610	0.917	0.375

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