

Incentive Aspects of Revenue Sharing:
Central and Regional Government in Russia

Alexander Plekhanov

July 2004

CWPE 0440

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Abstract

The paper provides an empirical analysis of fiscal incentives for Russian regional governments to foster economic growth and development. It points out several serious problems with previous empirical studies of fiscal incentives in Russian federalism, develops a new theoretical framework for the analysis of revenue-sharing policy between central and regional governments, paying particular attention to the case of non-benevolent authorities, and provides new estimates of incentive effects using an improved econometric methodology and a newly-collected dataset. Contrary to existing studies, incentives for regional governments are estimated to be present, but these incentive effects are considerably weaker in the short run than in the long run.

Key words: Fiscal federalism, incentives, Russia, regional government

JEL classification: H3, H7, O52, P35, R5

Incentive Aspects of Revenue Sharing: Central and Regional Government in Russia

*Alexander Plekhanov*¹

Faculty of Economics and Politics, University of Cambridge
8 Harvey Road, Cambridge, CB1 2ET, UK
E-mail: ap339@cam.ac.uk

15 July 2004

I. Introduction

In a federation as huge and heterogeneous as Russia the role of governance and economic policies at the regional level is of particular importance for economic development. But Russian regional authorities are deprived of traditional fiscal instruments: all taxes in Russia are collected by the federal Ministry of Tax Collection and are subsequently distributed among three levels of government (federal, regional, and local) according to certain rules. Regional authorities have almost no ability to set tax rates² and very limited freedom of expenditure due to significant share of spending being mandated by the federal centre. Furthermore the rules of revenue sharing between federal and regional budgets are set almost unilaterally by the central government. However regional authorities do possess a number of instruments and policies that can help to attract mobile labour and capital to the region and to foster economic growth. An important question is whether they have incentives to do so and how appropriate incentives can be created within the framework of Russian fiscal federalism.

The theoretical analysis of the paper shows that the elasticity of regional government revenue with respect to gross regional product (GRP) can serve a measure of fiscal incentives for regional governments in a federation where the power to levy and collect taxes rests almost entirely with the federal authorities.

¹ The author is grateful to Jeremy Edwards and Toke Aidt for valuable comments and to the Universities UK, Gates Cambridge Trust, and Gonville and Caius College, Cambridge, for financial support.

² The freedom of regional governments to choose tax rates or impose taxes was negligible, for instance they could collect either a parking duty or a 5% sale tax (the latter option was generally preferred, of course).

The paper focuses on the case of non-benevolent (rent-seeking) governments when fiscal incentives are particularly important for economic development.

Several studies have analysed the role of incentives in fiscal federalism using the framework of principal-agent models (Persson and Tabellini (1996), Bordignon et al. (2001), see also the survey in Lockwood, 1999). Bordignon et al. (2001) showed the importance of commitment of the central government to ex ante chosen revenue-sharing schemes. Weingast (1995) and Qian and Weingast (1997) emphasized the particular importance of fiscal incentives in economies in transition. Jin et al. (1999) and Blanchard and Shleifer (2000) argued that Chinese subnational governments have better incentives than their Russian counterparts. Litwack (2002) showed that strict federal control is unlikely to solve the incentive problem in economies with significant corruption. The measure of incentives proposed in this paper is consistent with this literature and captures the idea of commitment of the central government to certain revenue-sharing schemes.

However, little empirical work has been done in this area so far. In Russia the first attempt to measure incentive effects in Russia was made by Zhuravskaya (2000). By regressing the change in local governments' shared revenues on the change in their own revenues, Zhuravskaya found that an increase in own revenues was almost entirely offset by a decrease in shared revenues, suggesting that local governments had no incentives to increase their revenue-raising. Alexeev and Kurlyandskaya (2003) run a similar regression for municipalities of one Russian region. Their results show that changes in own revenues have a significant negative impact only on changes in planned transfers but not on actual transfers, suggesting that incentives were quite strong.

Despite the contradictory conclusions of these two empirical studies, the general consensus in the literature is that fiscal incentives in Russia have been very weak, particularly in comparison with those in China. The present paper questions this consensus. An alternative approach to measuring incentives is suggested and implemented on a newly collected data set that is more detailed and systematic than those used before. Contrary to the previous studies, the estimation reveals that fiscal incentives for regional governments in the Russian Federation do exist in both the long and the short run, however the short-run incentives, which are the most important, should be strengthened.

The rest of the paper is structured as follows. Section II discusses particularities of Russian fiscal federalism and the role of fiscal incentives for the

development of Russia. Section III presents and analyzes a simple model of revenue sharing and examines the role of elasticity of regional government revenue with respect to GRP. Section IV deals with problems of econometric estimation of incentive effects and section V presents the empirical results. Concluding remarks follow.

II. Why do incentives matter?

2.1. Moral hazard and adverse selection. How can Russian regional authorities contribute to faster economic growth? Firstly, though regional governments cannot vary taxes or officially grant tax abatements (as in Lithuania for instance) they can “protect” regional businesses from federal tax collectors and thus affect the actual tax burden in the area³. Secondly, they can (to a large extent) guarantee political stability in the region. Thirdly, they can improve the economic environment and investment climate in the region by adopting appropriate regional legislation, enforcing the rule of law, and reducing bureaucracy. In addition, regional expenditure is not entirely mandated so there is space for providing better public services, e.g. health care.

Benevolent regional governments will pursue such policies if they result in higher welfare for the inhabitants. However regional governments may be self-interested rather than benevolent. Self-interested governments may maximize the size of budget (the “leviathan” type of government depicted by Brennan and Buchanan, 1977) or they may maximize personal rents from managing budget resources rather than social welfare (i.e. be corrupt and rent-seeking)⁴. Self-interested governments will foster regional growth if they can extract benefits from accelerated development (higher budget revenue for the leviathan or extra personal rents for corrupt officials). The problem is that regional growth will not *necessarily* lead to higher budget revenue or personal benefits of local authorities. Since all revenues are subject to sharing with the centre according to the rules set by the central government, it is up to the federal policy-makers to decide what the revenue of successful regions will be.

The central government has several reasons to stimulate regions via revenue sharing schemes. Firstly, the vast territory of the Russian Federation and the geographical heterogeneity of the regions make it impossible to control efficiently

³ See for instance a case study in Cai and Treisman (2004).

⁴ Some forms of corruption at the regional level in Russia in the 1990s and their relation to federalism are discussed in Blanchard and Shleifer (2000) and Cai and Treisman (2004).

the economic and political situation in regional centres such as Vladivostok from Moscow, implying that subnational governments will inevitably have a large degree of economic and budget autonomy. They know the situation in the region better than the central authorities and it is regional economic policy rather than the federal government policy that will largely affect economic development of the territories and eventually of the federation as a whole.

Secondly, Bordignon et al. (2001) show the importance of incentive mechanisms due to asymmetric information and differences between revenue distributions *ex ante* and *ex post*. “*Ex ante*” here refers to the plans of revenue distribution before the fiscal year begins and “*ex post*” to the resulting distribution at the end of the fiscal year when the actual amounts of taxes collected become known to the governments of all levels. Regional authorities know the economic situation in the region in great detail whereas central authorities only observe the results of economic activity. A desire of a benevolent central government to equalize *ex post* regional budget expenditure regardless of the sources of inequality leads to moral hazard problems: undertaxation and overspending at the regional level and the lack of incentives to extend the regional tax base. Indeed, an overspending or undertaxing regional government will benefit from equalizing transfers at the expense of other regions; looking “poorer” allows a region to free-ride on the effort of its neighbours.

The revenue sharing game with a redistribution rule can be also modelled as an adverse selection problem. In the adverse selection framework the federal government acts as a principal and regions can be treated as agents of heterogeneous types, not directly observed by the principal. Each region can pretend to be richer or poorer. Depending on the type of the region the central government offers one revenue sharing scheme or another. Schemes must be incentive compatible, i.e. it must not be in the interest of regions with high economic potential to be classified as poor regions to get a better revenue sharing “contract”. It is well known that in the repeated setting the outcome with full commitment is more efficient than that with no commitment to a certain distribution rule (e.g. Townsend, 1982).

However the Russian federal government consistently lacked commitment in the 1990s. There was no stability in the revenue sharing schemes throughout the decade. The rules changed each year rather haphazardly, with the regional share in VAT, the most important and well-collected tax in Russia, changing not only over

time (from 0% to 50%) but also across regions. If a region achieved extra revenue in a particular year it was generally withdrawn in three ways: explicitly, by reducing the regional share in consolidated budget revenues or – more commonly – implicitly, either by cutting down federal grants and transfers or by assigning extra expenditure responsibilities (so called “mandates”) to the regions. This lack of commitment resulted in complete distortion of incentives.

The lack of commitment and renegotiation of the “contract” ex post (when the agent has already revealed its type to the principal) is known as the “ratchet effect” in adverse selection games. This concept can be also applied to revenue sharing in a federal economy. The simplest example of a ratchet effect is when the central government cuts down the ex ante planned federal transfers and grants to those regions which achieved higher own budget revenue than they were expected to. Empirical evidence on the ratchet effect in the context of revenue sharing will be discussed in section V.

The distortion of incentives had another very harmful consequence for the economy: in some regions up to 30% of regional budgets were implemented in the form of barter and money surrogates, which almost blocked the normal functioning of the economy (OECD, 2000). This undesirable phenomenon was due to two reasons. First, the monetization of the economy was very low – the ratio of M2 to GDP was 13% to 19% in the second half of the 1990s, compared to 92% in China (IMF IFS 2002). Secondly, when all revenues in the form of money are subject to unfair sharing with the centre and surrogates are certainly not, the latter form becomes particularly attractive for regional authorities.

2.2. Incentives for rent-seeking governments. Commitment is thus a necessary condition for any successful incentive scheme. What additional arrangements are required to maintain incentives for rent-seeking governments? The most obvious solution would appear to involve strict central control over regional expenditure. However the ability of the central government to control regional spending and economic policies is very limited in practice. A model by Litwack (2002) shows that such control, even if theoretically possible, will be extremely costly and may soon become useless due to corruption. Hence legal prosecution alone cannot solve the problem of incentives efficiently. The traditional literature on fiscal federalism assumes that regional decision makers are accountable to the voters who elect them. However casual examination does not show that Russian voters are able to “punish” governments and legislatures whose

policies contradict their interests, though this issue requires further empirical investigation.

If neither federal nor voter controls work, how can incentives for self-interested governments to foster economic growth be created? A very stylized model will help to answer this question and provide some insight into the nature of incentives for regional governments.

III. The model

3.1. The revenue sharing game. Consider the following simple model of revenue sharing between the central and the regional governments. The central government sets the overall tax rate $\tau \in [0; 1]$ on regional output y . As discussed above the tax system is designed by the central government, which is free to choose the overall tax rate at its own discretion and outside the revenue sharing game. Hence τ is assumed to be preset and exogenous in the revenue sharing model below. Output in the region is given by:

$$y = y_0 g^\gamma G^\delta, \gamma > 0, \delta > 0, \gamma + \delta < 1, y_0 > 0 \quad (1)$$

where g is the amount of regional public goods provided, G is the amount of national public goods provided, and y_0 is “basic potential output”. This latter term captures the potential of the regional economy and the distortionary effect of taxation (so that y_0 can be thought of as a decreasing function of τ), and it is also exogenous. Investments in national public goods (such as law and order) and local public goods (such as infrastructure or health care) are assumed to be complementary for production and the parameters γ and δ reflect their relative importance for the development of the economy. If γ is small compared to δ then centrally provided goods are of primary importance for economic development, while if γ is high compared to δ then regionally provided public goods play a dominant role. The condition $\gamma + \delta < 1$ reflects diminishing returns to general government spending.

The central government collects τy in taxes and unilaterally determines the revenue of the regional government $e(y)$ as a function of regional output. Hence the difference $\tau y - e(y)$ constitutes the federal government revenue. The representative consumer in the region has the following preferences over public goods and private consumption x :

$$U(g, G, x) = \lambda \ln g + \mu \ln G + (1 - \lambda - \mu) \ln x, \lambda > 0, \mu > 0, \lambda + \mu < 1. \quad (2)$$

Private consumption x is output net of taxes:

$$x = (1 - \tau)y \quad (3)$$

Regional authorities can to some extent be rent-seeking and they split the budget between expenditure on public goods g and private political rents c . Following Edwards and Keen (1996) politicians' preferences are assumed to be of the following form:

$$V_r(g, G, x, c) = \beta \ln c + (1 - \beta)U(g, G, x), 0 \leq \beta \leq 1 \quad (4)$$

Thus regional politicians differ in the weight they attach to their personal rents relative to their voters' welfare. A regional leader with $\beta = 0$ is benevolent, while one with $\beta = 1$ is a leviathan that spends the entire budget on private rents. Similarly the central government is allowed to be rent-seeking and have a different level of non-benevolence α :

$$V_c(g, G, x, C) = \alpha \ln C + (1 - \alpha)U(g, G, x), 0 \leq \alpha \leq 1 \quad (5)$$

where the amount of political rents extracted at the federal level is denoted by C .

The timing of the game is as follows. First, the central government chooses the revenue sharing rule $e(y)$ and announces it to the region. At the second stage the central and the regional government simultaneously choose their levels of public spending G and g (and their political rents C and c) as to maximize their respective welfare functions subject to the balanced budget and production constraints.

The problem of the central government is:

$$\max_{G, C} \alpha \ln C + (1 - \alpha) \lambda \ln g + (1 - \alpha) \mu \ln G + (1 - \alpha)(1 - \lambda - \mu) \ln x \quad (6)$$

$$\text{s.t. } x = (1 - \tau) y_0 g^\gamma G^\delta \quad (7)$$

$$C + G = \tau y_0 g^\gamma G^\delta - e(y_0 g^\gamma G^\delta) \quad (8)$$

The problem of the regional government is:

$$\max_{g, c} \beta \ln c + (1 - \beta) \lambda \ln g + (1 - \beta) \mu \ln G + (1 - \beta)(1 - \lambda - \mu) \ln x \quad (9)$$

$$\text{s.t. } x = (1 - \tau) y_0 g^\gamma G^\delta \quad (10)$$

$$c + g = e(y_0 g^\gamma G^\delta) \quad (11)$$

The equilibrium concept is subgame perfect equilibrium (implying Nash equilibrium at the second stage).

Though the model is very stylized and, for instance, abstracts from interregional redistribution issues by considering only one typical region in a federation, it has two features essential for the analysis of fiscal incentives. It allows the importance of central and regional expenditure for economic development to differ and it also allows for different levels of political rent-seeking on the part of both central and regional authorities.

3.2. Creating incentives for good quality governance at the regional level. The quality of governance can be measured in different ways, but in the above model it is natural to associate good governance with relatively low political rents and relatively high public good provision and to use the ratio of “productive” local public expenditure g to regional government revenue as a measure of quality of governance: $\rho = \frac{g}{e(y)}$. If $\rho = 0$ then local authorities only extract political rents and thus waste all budget resources. At the other extreme all budget revenues are used to finance productive public goods and $\rho = 1$. The higher is ρ , the better is the quality of governance in the region (although higher values of ρ may be associated with higher *absolute* values of waste).

Denote the elasticity of regional government revenue with respect to GRP by ε : $\varepsilon(y) = \frac{e'(y)}{e(y)} y$. Then the following proposition describes the quality of governance in the region⁵:

$$\text{Proposition 1. } \rho = \frac{\Gamma + \gamma\varepsilon}{\Gamma + 1}, \text{ where } \Gamma = \frac{1 - \beta}{\beta} [\lambda(1 - \gamma) + \gamma(1 - \mu)].$$

ρ is increasing in ε .

Hence the quality of governance in the region is an increasing function of the elasticity of regional government revenue with respect to GRP and the stimulating effect depends on the production parameter γ :

$$\text{Corollary 1.1. } \frac{\partial \rho}{\partial \varepsilon} = \frac{\gamma}{\Gamma + 1} \text{ is increasing in } \gamma.$$

If output is sufficiently sensitive to public spending (γ is high) and the revenue sharing rule is sufficiently sensitive to changes in output (ε is high), then by choosing efficient expenditure rather than personal rents regional authorities significantly increase the amount of budget funds available to them, including the funds available for corrupt use. Hence regional output will be higher and the proportion of diverted budget funds will be lower (even if the absolute value of political rents rises).

Corollary 1.2. If $\beta \rightarrow 0$ (implying $\Gamma \rightarrow +\infty$) then $\rho \rightarrow 1$ for any $e(y)$.

Corollary 1.3. If $\beta \rightarrow 1$ (implying $\Gamma \rightarrow 0$) then $\rho \rightarrow \gamma\varepsilon$.

Corollaries 1.2 and 1.3 illustrate the earlier point that fiscal incentives are crucial primarily in the case of highly rent-seeking and corrupt governments. With

⁵ For all proofs see appendix 2.

completely self-interested governments ($\beta = 1$) the quality of governance is directly proportional to the elasticity of regional government revenue with respect to GRP. With no incentives ($\varepsilon \approx 0$) almost the entire regional budget will be diverted for private use!

Corollary 1.4. If $\varepsilon \rightarrow 1/\gamma > 1$ then $\rho \rightarrow 1$.

Corollary 1.4 implies that when corruption in the regions is a very serious issue, the central government may wish to design revenue sharing schemes with higher than unit elasticity of regional government revenue with respect to GRP, since when the elasticity approaches $1/\gamma$ the proportion of wasteful regional expenditure goes to zero. An example of such an incentive scheme is the lump-sum redistribution that underlies the recent practice of revenue sharing between Chinese provinces and Beijing: a province has to collect a fixed amount of taxes for the federal government and is allowed to keep all revenues above this fixed duty. This approach is described and advocated by Jin et al. (1999), who find that under the existing Chinese redistribution scheme from every extra yuan of tax revenues collected in the region only 0.24 yuan goes to the centre whereas it used to be 0.55 yuan before the reform. This lump-sum based redistribution significantly improved the incentives for Chinese provinces and reduced the ratchet effect. With lump-sum revenue sharing the ratio of regional government expenditure to output (E / Y) is increasing in Y and the corresponding elasticity is expected to exceed unity.

Under another incentive-enhancing scheme if a region collects more taxes than it was expected to, it is awarded with a transfer from the centre and underperforming regions may be penalized symmetrically. Bordignon et al. (2001) show the optimality of this rule for achieving incentive compatibility in the principal-agent problem outlined in section II. With fiscal effort based revenue sharing an increase in GRP can lead to a more than proportional increase in regional government expenditure due to an additional “carrot” resulting in a higher than unit elasticity of regional government revenue with respect to GRP. Hence the elasticity measure of incentives correctly identifies major incentive promoting schemes.

If a 10% increase in GRP results in a 10% increase in regional government revenue the elasticity measure of incentives will be equal to unity, which will be indicative of strong incentives and the quality of governance will depend positively on the relative importance of local public goods for the development of the economy. Programmes of interregional equalization and stabilization will normally

shift the elasticity of regional expenditure with respect to GRP away from unity as some part of extra revenue collected in successful regions will be used to help out their less successful neighbours, but as proposition 1 shows, regional government revenue must remain elastic to preserve incentives for successful regions to invest in the economy and extend the tax base.

Since the balanced budget condition is assumed, regional revenue and regional expenditure do not differ and for the purposes of empirical analysis it is more convenient to work with the elasticity of regional expenditure since the data on revenue often excludes federal bail-outs and other “last minute” sources of revenue.

3.3. Importance of fiscal incentives. Having obtained some insights into how incentives for regional governments can be created and measured, the next logical step is to look at the importance of such incentives for the development of the economy in various cases. Treisman (2003) argues that decentralization-induced fiscal incentives for regional governments have no effect on the economy (or at least no predictable effect) since whenever incentives for regional governments are improved incentives for the central government are weakened so as to exactly offset the effect of improved incentives in the regions. However such arguments fail to take into account both the *degree* and the *design* of decentralization. The latter is captured by the proposed elasticity measure of incentives, while the degree of decentralization can be represented by the share of regional government revenue in the consolidated budget revenue (federal and regional): $\pi = \frac{e(y)}{\tau y}$. Proposition 2 demonstrates how the design and the degree of decentralization jointly affect the quality of governance at the central level ρ_c

(defined similarly to ρ , i.e. $\rho_c = \frac{G}{\tau y - e(y)}$).

$$\text{Proposition 2. } \rho_c = \frac{\Delta + \delta \frac{1 - \pi \varepsilon}{1 - \pi}}{\Delta + 1}, \text{ where } \Delta = \frac{1 - \alpha}{\alpha} [\delta(1 - \lambda) + (1 - \delta)\mu].$$

$$\left. \frac{\partial \rho_c}{\partial \varepsilon} \right|_{\pi = \text{const}} = - \frac{\pi}{1 - \pi} \frac{\delta}{\Delta + 1}.$$

Hence a higher elasticity of regional revenue with respect to GRP indeed weakens the incentives for the central government, but this negative effect can be softened by appropriate choice of the degree of decentralization π (and the degree of decentralization itself does not affect the quality of regional governance). Thus

an appropriate combination of the degree and the design of decentralization can create incentives for high quality governance at *both* the central and regional levels.

Although the equilibrium elasticity of regional government revenue and the equilibrium degree of decentralization will be partially interdependent under almost any revenue sharing scheme, general policy guidelines can be obtained from proposition 2.

Corollary 2.1. For a given $\varepsilon < 1$ ρ_c is increasing in π .

If incentives for good regional governance are not very strong, a higher decentralization of government will improve the quality of governance at the central level. The intuition here is as follows. Returns to investment in national public goods are initially high but diminishing so it is *initially* rational to devote a large proportion of the central government budget to economic growth while, as the revenue grows, central government officials switch to private rents extraction.

Corollary 2.2. For a given $\varepsilon > 1$ ρ_c is decreasing in π ; for all schemes such that $\varepsilon = 1$ ρ_c is independent of π .

However if strong regional incentive schemes are implemented it is necessary to leave a substantial part of government finance under federal control in order to preserve incentives for the central government. When the revenue sharing rule becomes very elastic, most benefits of economic expansion stay with the region and public good provision is no longer attractive for the central authorities, who therefore *initially* divert a large proportion of budget resources for their private use. But since the marginal utility of substitution of public and private goods for political rents is also diminishing, at some point (as the budget grows) central government authorities switch back to public good provision.

Corollary 2.3. If $\alpha \rightarrow 0$ (implying $\Delta \rightarrow +\infty$) then $\rho_c \rightarrow 1$ for any $e(y)$. If $\alpha \rightarrow 1$ (implying $\Delta \rightarrow 0$) then $\rho_c \rightarrow \delta \frac{1 - \pi\varepsilon}{1 - \pi}$.

The intuition regarding the importance of the quality of central governance is the same as in the case of regions: incentives for the central government are particularly important if officials are corrupt or centrally provided public goods are crucial for successful economic development (δ is high).

The basic ideas developed in this section will now be used in the empirical analysis of incentives for high quality governance in Russian regions in sections IV and V.

IV. Estimating incentives for good quality regional governance.

4.1. Basic approach. An extensive literature on the empirical estimation of regional expenditure equalization and local shock smoothing has emerged recently (see the survey in Mélitz and Zumer, 2002), but less empirical work has been done on incentive effects. Zhuravskaya (2000) made the first attempt to measure such effects in Russia by estimating the following regression by OLS and fixed effects:

$$\Delta T_{it} = \alpha_i + \beta_1 \Delta R_{it} + \beta_2 POP_{it} + \beta_3 Year_t + \varepsilon_{it}, \quad (12)$$

where ΔT_{it} is the change in shared revenues of local governments, ΔR_{it} is the change in own revenues, POP_{it} is population of municipality i at time t , α_i are regional fixed effects, and $Year_t$ are year dummies.

The null hypothesis of no incentives for high quality governance can be formalized as $\beta_1 = -1$: in this case an increase in region's own revenues is completely offset by a decrease in transfers from the centre. If $\beta_1 = 0$ shared revenues available to the municipalities are independent of their own revenues suggesting that incentives are strong. The point estimate of β_1 obtained by Zhuravskaya was as low as -0.9 and the null of $\beta_1 = -1$ was not rejected leading to the conclusion that fiscal incentives for Russian municipalities were non-existent.

Alexeev and Kurlyandskaya [AK] (2003) point out that the data set used by Zhuravskaya (two to seven years of data for 35 Russian cities within 29 regions) was limited and fragmentary. Their critique can be reinforced by noticing that local authorities submitted data voluntarily upon request. If the municipalities prepared to submit the data were those that had suffered from the centre's withdrawal of transfers in response to an increase in the municipality's own revenue, while those that had not suffered did not submit data, Zhuravskaya's results will be seriously affected by self-selection bias. AK also notice that the non-per-capita specification (12) puts greater weight on large municipalities (it should be further noticed that it almost surely leads to the heteroscedasticity of the error term, the variance of which is most likely to be proportional to population).

Amending specification (12) accordingly, AK ran a similar regression for all 55 municipalities of Rostovskaya oblast, one of the 89 Russian regions, in the years 1996-1998:

$$\Delta T_{it}^{pc} = \alpha_i + \beta_1 \Delta R_{it}^{pc} + \beta_2 POP_{it} + \beta_3 Year_t + \varepsilon_{it}, \quad (13)$$

where ΔT_{it}^{pc} is now a change in per capita transfers to municipality i and ΔR_{it}^{pc} is a change in per capita own revenue. The point estimate of β_1 becomes -0.21 , which

is significantly different from -1 and this rejects the null hypothesis of no municipal incentives.

However, some serious problems with the AK estimation procedure raise doubts about this conclusion. Firstly the standard errors of estimation are large enough that the hypothesis $\beta_1 = 0$ cannot be rejected (this was not tested explicitly by the authors). Can it then be concluded that fiscal incentives were strong? Secondly, though the data set is systematic, it remains unclear how representative the case of Rostovskaya oblast is and whether one can generalize the results for Russia as a whole. Thirdly, just converting variables into per capita form does not solve the problem of the disproportionate influence of large municipalities on the results. To get rid of it one should take logarithms to give equal significance to a one per cent change in the revenue of both small and municipalities. Besides, specification (13) mixes the first differences of some variables with the levels of others in a way not justified by the authors.

AK draw attention to two other drawbacks of Zhuravskaya's approach. Firstly, her estimation procedure can identify only the effect of a change in own revenues on transfers within the same year. Any delayed effects are not identified. If the regional (federal) government responds to an increase in local (regional) government own revenue by leaving current transfers unchanged but totally withdrawing the transfers planned for the next year, the estimation procedure reports strong incentive effects, whereas in reality they are quite weak. Secondly, Zhuravskaya's method is very sensitive to the definition of different categories of revenue. For example, if revenues that used to go to the regional budget and were then returned to municipalities in the form of intergovernmental transfers are assigned to local budgets on a regular basis, then the change is a pure accounting one which should have no incentive effects. However, the data will register an increase in own revenue and a decrease in transfers exactly offsetting this increase, resulting in a misleading conclusion that $\beta_1 = -1$ and incentives are absent. The seriousness of the latter problem should not be underestimated since changes of revenue definition happened very frequently in Russia throughout the 1990s.

4.2. An extension of the basic approach. To circumvent partly these two problems, AK disentangle the change in transfers following a change in local government own revenue into two components -- the deviation of the actual transfer from the plan and the change in the planned transfer from current year t to year $t + 1$ -- and regress them separately on the same set of explanatory variables as

in specification (13). The first component is meant to capture the issue of commitment whereas the second captures dynamics. AK estimate that planned transfers respond negatively to changes in own revenue, but do not fully offset them, thus undermining incentives, though to a lesser extent than if these were current year transfers that responded to the changes in own revenue collection.

Unfortunately planned values of transfers in Russia are not verifiable: they exist only on paper and have an economic meaning only under sufficient commitment of the upper tier government to revenue sharing rules (i.e. in the case of strong incentive effects). In claiming to test the null hypothesis of non-existent incentives AK face the problem that in this case the plans do not indicate the upper tier authorities' genuine intentions due to the absence of commitment, so that their test appears to be based on an inconsistency. Actually AK faced major difficulties using planned transfers together with actual ones and had to exclude nine richer municipalities out of 55 (since their inclusion totally altered the results). As the exclusion of municipalities from the sample was clearly non-random the results were affected by selection biases and the lack of robustness makes it very difficult to have any confidence in the findings. Both the use of subtle categories such as planned transfers or own and shared revenues and the non-logarithmic specification are likely to have contributed to the poor robustness of AK's results.

The ability of their approach to capture dynamics is also limited to one year lagged effects and depends crucially on the assumptions about commitment, so that the short- and the long run effects still cannot be distinguished. The problems of the sensitivity of the results to the rules of budget accounting have not been resolved either. Thus although it is possible to resolve some of the problems with Zhuravskaya's estimates while remaining within her basic framework (such as the non-logarithmic specification), the latter two problems require a fundamentally different method of estimating fiscal incentives.

4.3. An alternative approach. The theoretical analysis in section III identified the elasticity of regional government expenditure with respect to GRP as a suitable measure of fiscal incentives for good governance at regional level. The suggested elasticity measure of incentives also reflects adequately the issue of commitment. When the central government cannot commit to a revenue sharing scheme and withdraws all extra revenue collected in the regions instead, regional government revenue becomes completely inelastic and no longer depends on the economic performance of the region, so that the regional government is left with no

incentives to improve regional performance. High values of the elasticity of regional expenditure with respect to GRP indicate that the central government is committed to leaving a certain proportion of the benefits of accelerated regional development to regional governments.

Although there is no one-to-one mathematical correspondence between the proposed measure of incentives and that used in the previous studies, in fact they are closely related. Suppose GRP goes up and regional own revenue increases proportionally. If transfers to the region are reduced to offset completely the increase in own revenue Zhuravskaya's β_I is equal to -1 and the elasticity of regional revenue is zero leading to the common conclusion of absent incentives. If on the contrary transfers remain unaffected, $\beta_I = 0$ and the elasticity of regional expenditure is close to unity⁶. Once again the conclusions are expected to be identical, namely that incentives are strong.

4.4. The choice of specification. The basic specification to measure the elasticity of regional government expenditure with respect to GRP is:

$$e_{it} = \delta_i + \gamma y_{it} + \varepsilon_{it} \quad (14)$$

where e is the logarithm of real per capita regional expenditure, y is the logarithm of real per capita GRP, and γ is the elasticity to be estimated. The use of a panel data model allows all relevant time-invariant differences between regions (δ_i) to be controlled for, including the size of the region, its national composition, distance from Moscow and the structure of the regional economy by industries. Two serious problems to deal with are endogeneity and ambiguous causality. Current GRP is expected to depend on current and past values of regional expenditure, since the whole basis of fiscal incentives depends on the assumption that regional governments *invest* in regional economies. Thus the explanatory variable y in equation (14) is not exogenous so neither fixed effects nor pooled estimators are consistent.⁷

In the panel framework the Arellano-Bond (1991) generalized method of moments (GMM) approach can be used to deal with the endogeneity of explanatory variables. After taking first differences of (14) the fixed regional effects disappear:

$$\Delta e_{it} = \gamma \Delta y_{it} + \Delta \varepsilon_{it} \quad (15)$$

⁶ The lower the proportion of transfers in regional government revenue, the closer to unity the elasticity in question will be.

⁷ The consequences of the violation of strict exogeneity assumptions for the fixed effects estimator are discussed by Nickell (1981).

The regressor Δy_{it} is still correlated with the error term and so is the first lag Δy_{it-1} . But all lags of higher order $\Delta y_{it-2}, \Delta y_{it-3}, \dots$ are uncorrelated with the error term and can serve as instruments in the GMM framework⁸.

Another question is how the dependence between regional expenditure and GRP should be interpreted: does higher GRP result in higher regional expenditure or does government expenditure boost GRP? To distinguish between these two effects a bivariate autoregression of the following panel form could in principle be used⁹:

$$e_{it} = \alpha_{1i} + \gamma_{11}e_{it-1} + \gamma_{12}y_{it} + v_{1it} \quad (16)$$

$$y_{it} = \alpha_{2i} + \gamma_{21}y_{it-1} + \gamma_{22}e_{it} + v_{2it} \quad (17)$$

Unlike the basic model (13), the specification above permits short- and long-run incentives to be distinguished. The former are reflected by the coefficient γ_{12} and the ratio $\frac{\gamma_{12}}{1-\gamma_{11}}$ characterizes the long run relationship. This can be easily seen by rearranging equation (16) in the error correction form:

$$\Delta e_{it} = \alpha_{1i} + \gamma_{11}\Delta y_{it} - (1-\gamma_{11})(e_{it-1} - \frac{\gamma_{12}}{1-\gamma_{11}}y_{it-1}) \quad (18)$$

Of the two elasticity estimates the short run responses γ_{12} are likely to be more important since regional policymakers are likely to care more about the short run because of the possibility of losing power, and the issue of commitment to revenue sharing rules is essentially a short run issue.

Unfortunately the lack of degrees of freedom makes it impossible to estimate the bivariate vector autoregression for every region separately and to obtain region-specific incentive effects in this way. Therefore the Arellano-Bond GMM estimator is applied to equation (16) treating variable y_{it} as endogenous and using its lagged differences of order 2 and higher and lagged differences of expenditure as instruments.

Even if one is interested primarily in the short run effects, assumptions about the long run are important to choose the right specification. Unfortunately with only 7 annual observations it is impossible to test for co-integration of GRP and regional expenditure properly even in the panel framework. If in fact series e and y

⁸ GMM estimator was applied by Méritz and Zumer (2002) in their study of interregional stabilization and equalization in developed countries.

⁹ A similar technique was used by Obstfeld and Peri (1998) in their study of interregional stabilization in the USA.

are not co-integrated, the short run specification in first differences is¹⁰:

$$\Delta e_{it} = \alpha_{2i} + \gamma_2 \Delta y_{it} + Z'_{it} \lambda_2 + v_{it} \quad (19)$$

To account for possible structural changes facilitating or impeding tax collection, changes in the share of enterprises making losses in the region (variable “*losses*”); the proportion of population employed in small businesses (variable “*smallbusiness*”¹¹); and the full set of time dummies are included as control variables Z .

V. Results.

5.1. Basic (short-run only) approach. The approach described above is implemented on a data set which is far more complete and systematic than those used by Zhuravskaya and AK. The data are observations on 89 Russian regions for the years 1994-2000¹². Regional and local budgets were aggregated into “consolidated” regional budgets because of the general focus of the analysis on the relations between the federal government and the regions.

Table 1 summarizes the results obtained by estimating equation (19). This specification assumes no long-run relationship between regional expenditure and GRP and hence no long-run incentives, as well as exogeneity of GRP. In this sense it is close to Zhuravskaya’s method and can serve as a useful starting point of the analysis.

¹⁰ All variables in equation (19) are stationary if the GRP and expenditure series are integrated of order 1. Numerous macroeconomic studies show that output normally should be treated as I(1) series, though it has to be assumed rather than tested here.

¹¹ Available only for the subsample starting from 1996.

¹² See appendix 1 for a detailed description of data sources. Ten regions were excluded since GRP and some other indicators were not calculated for 9 autonomous districts before 2000 and for Chechnya. GRPs are converted to 2000 prices using national GDP deflators since regional deflators are not computed. However this fact will not alter the results significantly: the analysis of 1999 regional consumer price indices showed that the ratio of the standard deviation to the mean was only 0.054.

Table 1. Estimating incentive effects in the short-run. Dependent variable – Δ expenditure								
Model	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Method	OLS	FE	RE	FE	OLS	FE	OLS	FE
Number of observ.	470	470	470	314	470	470	437	437
R ²	0.49	0.52	0.52	0.58	0.50	0.53	0.53	0.53
Δ GRP (γ_2)	0.19 (0.045)**	0.17 (0.051)**	0.19 (0.045)**	0.18 (0.058)**				
Δ GRP ⁺					0.34 (0.097)**	0.33 (0.113)**		
Δ GRP ⁻					0.12 (0.058)**	0.11 (0.066)*		
Δ taxes collected							0.3 (0.033)**	0.25 (0.039)**
Δ losses	-0.17 (0.065)**	-0.19 (0.072)**	-0.17 (0.065)**	-0.26 (0.107)**	-0.15 (0.066)**	-0.18 (0.072)**	-0.05 (0.065)	-0.09 (0.071)
Δ smallbusiness				-0.01 (0.028)				
Constant	0.03 (0.017)*	0.03 (0.018)*	0.03 (0.017)*	0.03 (0.018)*	0.02 (0.019)	0.02 (0.02)	0.09 (0.028)**	-0.09 (0.024)**
Time effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Test of $\gamma_2 = 1$: t-st (p-value)	-18.04 (0.000)**	-16.23 (0.000)**	-18.04 (0.000)**	-14.14 (0.000)**	-10.31 (0.000)**	-8.85 (0.000)**	-21.37 (0.000)**	-19.23 (0.000)**

Notes:

1. For coefficients standard errors are in parentheses, for tests p-values are in parentheses. Significance at 5% level is marked with **, at 10% -- with *.

2. Comparison of models 1-3. Hausman test statistic is 1.33 ($p = 0.986$) so the null hypothesis that random effects assumptions are valid is not rejected. Lagrange multipliers Breusch and Pagan test statistic is 3.00 ($p = 0.083$) for the null that the variance of random effects is zero (and pooling is justified). The F-test does not reject the hypothesis that regional effects are homogeneous and pooled OLS can be implemented: $F(78, 229) = 0.76$ ($p = 0.957$).

3. For models 5 and 6. The test of the null hypothesis that the coefficients of Δ GRP⁺ and Δ GRP⁻ are equal: for OLS $F(1, 461) = 3.22$ ($p = 0.073$); for fixed effects $F(1, 383) = 2.33$ ($p = 0.128$).

The estimated short-run incentives are very low but significantly positive. The point estimate is almost independent of the estimation method (pooled OLS, fixed effects or random effects, see models 1-4 in the table 1) and stays within the range of 0.17 to 0.2. All the coefficients have the expected signs: the higher the share of loss making enterprises in the region the more difficult it is to collect taxes, so the corresponding coefficient is negative. The impact of an increase in the share of population employed in small businesses also affects expenditure negatively since the tax revenue from bigger enterprises is once again easier to collect, but the latter dependence proved to be insignificant.

5.2. Asymmetry of responses. The next question is whether regional expenditure responds symmetrically to favourable and unfavourable shocks in

output (models 5-6 in table 1). To test the hypothesis of symmetric responses ($\gamma_2^+ = \gamma_2^-$) variable Δy_{it} is replaced by two different regressors:

$$\Delta y_{it}^+ = I(\Delta y_{it} > 0) \Delta y_{it} \text{ and } \Delta y_{it}^- = I(\Delta y_{it} < 0) \Delta y_{it},$$

where $I(x)$ is an indicator function. With OLS, the p-value for this test is 0.073, so that the null hypothesis can be rejected at the 10% level but not at the 5% one. With fixed effects this hypothesis is not rejected at standard significance levels. However regional expenditure seems to be more responsive to upward changes in GRP than to downward changes, with the response to downward changes even becoming insignificant at the 5% level.

Higher responsiveness of expenditure to increases than to decreases in GRP is a desirable feature of revenue sharing schemes. It indicates that the federal system provides regions with some insurance in case of local (and even possibly global) economic shocks while allowing regional governments to benefit more from positive regional economic trends. This feature is found to be “weakly” pronounced in Russia of the 1990s.

5.3. Long-run incentive effects. As discussed in section IV the estimates in table 1 are only consistent in the absence of long-run effects and under exogeneity of GRP. The only indirect evidence that such assumptions may not be totally invalid for Russian regions comes from model D in table 2, where equation (17) is estimated by the Arellano-Bond method. It yields an estimate of γ_{22} that is very close to zero suggesting that effects of expenditure on GRP were non-existent in the 1990s and endogeneity problems may not have been too serious in practice.

Model A in table 2 shows how the results change when the long-run effects and endogeneity of explanatory variables are taken into account and the Arellano-Bond procedure is employed.

Table 2. Estimates of the incentive effects					
Model	A	B	C	D	E
Method	Arellano-Bond (16)	Between	Fixed Effects	Arellano-Bond (17)	Arellano-Bond
Dependent variable	Expenditure	Expenditure	Expenditure	GRP	Expenditure
Number of observations	474	562	562	474	527
R ²		0.55	0.55		
GRP (γ)	0.61 (0.104)**	0.92 (0.072)**	0.58 (0.059)**		
Taxes collected					0.48 (0.036)**
Expenditure(-1)	0.44 (0.044)**				0.19 (0.037)**
Constant		-1.27 (0.256)**	-0.18 (0.203)		
GRP(-1)				0.40 (0.081)**	
Expenditure				0.02 (0.043)	
Long-run elasticity	1.10 (0.164)**	0.92 (0.072)**	0.58 (0.059)**		0.59 (0.052)**
Short-run elasticity	0.61 (0.104)**				0.48 (0.036)**
Test of $\gamma = 1$	$z = 3.75$ ($p = 0.000$)**				$z = 14.4$ ($p = 0.000$)**

Notes: For coefficients standard errors are in parentheses. For tests p-values are in parentheses. Significance at 5% are marked with **, at 10% with *.

Hausman test favours fixed effects over random effects ($p = 0.0006$ for the null hypothesis of valid random effects).

The long run elasticity of regional expenditure with respect to output is estimated to be not significantly different from unity. For comparison the fixed effects and between estimates for the long run specification (14) are reported (models B and C). These estimators can be justifiably used only if it is reasonable to ignore the problems of endogeneity, causality and small sample biases due to non-stationarity, which, as has been argued above, is not the case. The estimates in models B and C turn out to be lower (as low as 0.58 for fixed effects), suggesting that incentives are understated if such estimators are used. Though the between estimator is more robust to possible dynamic misspecifications it still relies on the strict exogeneity of the regressors (see Pesaran and Smith, 1995), which cannot be justified in this case.

However the estimate of the short run elasticity that is of particular interest is much lower: only 0.61. But this finding, unlike the results of Zhuravskaya (2000), does not indicate total absence of incentives: the short run coefficient is

significantly different from zero at the 1% level and is closer to unity than to zero. The results also differ from the findings of Alexeev and Kurlyandskaya (2003) who cannot reject the null hypothesis of full incentives¹³. But this difference is not surprising. Though Alexeev and Kurlyandskaya use panel estimators, their analysis is essentially cross-sectional: they use data on 46 cross-sectional units and only 2 time-series observations for each unit. Model B in table 2, using the between estimator, which is known to exploit primarily the cross-sectional dimension in a panel, leads to a similar result: a point estimate of 0.92, not significantly different from 1, and thus no rejection of the null of strong incentives either. However this result seems to be misleading since it is the time dynamics of revenue, expenditure, transfers, and GRP in each region that matters most for incentives.

The estimation results imply that if GRP grows by 10%, the regional budget revenue will only increase by approximately 6% in the short run. What factors other than insufficient incentives may account for the result? Firstly, using expenditure rather than revenue can theoretically lead to underreporting incentives if regional governments smooth expenditure intertemporally. However there is no evidence of significant intertemporal smoothing of expenditure in Russia in the 1990s. On the other hand data on revenue often do not include ex post federal “bail-outs” and other “last minute” sources of funding, while data on expenditure reflect the actual amount of funds available to regional governments more accurately. Secondly, the data are likely to be estimated with significant errors leading to downward attenuation bias that is proportional to the ratio of the variance of noise to the sum of the variances of noise and the regressor. However the standard deviation of GRP across regions is about 0.7 times the mean and even within one region it usually exceeds 0.05 of the mean so attenuation biases are unlikely to be severe.

5.4. The ratchet effect. Depending on the assumptions and estimation methods the short run elasticity of regional expenditure with respect to GRP stays in the range of 0.17 to 0.61 (0.33 to 0.61 for upward changes in GRP). These results cannot be directly compared with the studies of the ratchet effect in Russia and China. But they can be interpreted as indirect evidence of a ratchet effect, in which the central government in some way withdraws extra regional revenue if it

¹³ As argued in footnote 9 an approximate analogue of the hypothesis $\beta = 0$ in specification (1) will be the null hypothesis of $\gamma = 1$ in specification (14). This approximation, although imperfect, is used for comparison.

exceeds the expected level: a 10% increase in GRP leads only to a 3.3% to 6.1% increase in regional expenditure.

To get a better insight into whether the ratchet effect accounts for low incentives the regressions are repeated with GRP being replaced with the total amount of federal, regional, and local taxes collected in the region¹⁴. As expected, the increase in own regional revenue seems to be partly offset by a decrease in shared revenue and transfers, since a 10% rise in total taxes collected in the region increases regional budget only by 2.5% to 4.8% (see model E in table 2 and models 7-8 in table 1) and the elasticity of expenditure with respect to the total amount of taxes collected is significantly below unity.

Instead of the ratchet effect, these findings could in principle be explained by the fact that federal taxes are more efficiently collected than the taxes going to regional budgets and the possibility that the federal share in the consolidated budget revenue of all three levels gradually increases over time. However the federal share remained broadly constant over the period (fluctuating within the range of 45% to 49%).

5.5. Structural stability. The robustness of all results to the inclusion or exclusion of fixed time effects and other control variables and to the inclusion of the second lag of expenditure into dynamic specification (16) has been checked.

Bearing in mind that one of the major shortcomings of the previous studies of incentive effects in Russia was excessive sensitivity of the findings to the inclusion or exclusion of certain cities or municipalities, it is important to check the structural stability of the results. Treisman (1996) and Freinkman and Yossifov (1999) find some profound differences in the mechanisms of revenue sharing applied to the national republics and other (administrative) regions. The findings of Alexeev and Kurlyandskaya (2003) are fundamentally different for poorer and richer municipalities. Hence the sample was split into subsamples of national and administrative regions¹⁵ and into subsamples of donors and recipients¹⁶. The main

¹⁴ Unfortunately the data on tax collection are available for slightly later period, namely 1994 data is missing and 2001 data is added, however these data cover all the regions, including the autonomous districts.

¹⁵ National subsample includes 21 national republics, 10 autonomous districts and Jews' autonomous oblast.

¹⁶ There is no conventional definition of recipient regions. Here this word is used not for regions receiving federal transfers and grants (only Moscow does not), but for those regions where all the collected tax revenues (going to the central, regional, and local budgets) do not suffice to cover

results were robust to exclusion of any of these groups. For specification (16) the Arellano-Bond estimate of the incentive coefficient remains significantly different from both unity and zero and does not vary much (ranging from 0.51 to 0.78 in different subsamples). The same is true for specification (19). The likelihood ratio tests show that incentives for donors are slightly higher than for recipients and other differences are statistically insignificant. Hence the main results prove to be structurally stable.

VI. Conclusion

This paper has provided an empirical analysis of fiscal incentives for high quality governance in Russian regions. In order to measure these incentive effects the paper developed a new theoretical framework for the analysis of the appropriate policy of revenue sharing between federal and regional governments in a federation where the central government monopolizes the right to levy and collect all taxes, determines the revenue sharing rules and restricts the fiscal freedom of regional governments in other ways. The theoretical analysis shows that the quality of governance in the regions (defined as the ratio of “productive” (as opposed to wasteful) public expenditure to regional budget revenue) is increasing in the elasticity of regional government revenue with respect to GRP and the importance of fiscal incentives is particularly high if the authorities are not benevolent. A popular argument states that this positive effect of decentralization will be necessarily offset by the negative effect of decentralization on the incentives for the central government. However it was shown that this argument fails to take into account both the design and the degree of decentralization. Combining appropriate design and degree of decentralization it turns out to be possible to create good incentives for regional governments while maintaining strong incentives for the federal authorities.

Using the elasticity of regional government expenditure with respect to GRP as an alternative measure of incentive effects allows major problems that previous empirical studies could not resolve to be circumvented: it distinguishes between the incentive effects in the short run and in the long run and it is not sensitive to the way in which different categories of budget revenue are defined. This approach, and an improved econometric methodology, were used to estimate the incentive effects of revenue-sharing between central and regional governments in Russia

regional expenditure. Thirty out of 89 regions were estimated to be net recipients in 2001 and as many as 50 in 1997. Twenty regions have been net recipients in all years.

employing a newly-collected dataset that is more detailed and systematic than those used in previous studies.

Contrary to previous studies, the results of the empirical analysis show that fiscal incentives for regional governments in the Russian Federation do exist in both the long and the short run, but the long run incentive effects are substantially stronger than in the short run (with elasticity measures being around unity and 0.6 respectively), and thus the short-run incentives, which are the most important, should be strengthened. It will be in the interests of both the federal and regional governments.

It should be noted that the model used to assess the importance of the elasticity of regional government revenue with respect to GRP did not allow for interregional transfers and the analysis will need to be extended in this direction. Certainly there exists a trade-off between stronger incentives and better equalization of public goods provision and economic conditions across regions. Equalization implies the transfer of funds from more successful regions to less successful ones, inevitably affecting incentives negatively. But this trade-off exists only in the short run. In the long run better incentives lead to faster economic growth and a rapid increase in the amount of taxes collected. As a result more funds become available for equalization and stabilization programmes.

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Appendix 1. Data sources.

The data was collected from numerous sources (mostly various official paper-based yearbooks published by the Russian state statistical agency Goskomstat in Russian) and united into the most complete and systematic data set among those used for a comparable purpose. It covers all the 89 regions of the Russian Federation and starts from 1994 since before 1994 many indicators of interest – first of all GRP – were not computed. Individual sources for each indicator are listed below.

GRP: Regiony Rossii (RR) 2002, pp. 297-298 (for year 2000), Rossiiskiy Statisticheskii Ezhegodnik (RSE) 2001, pp. 293-294 (for years 1994-1999).

GDP, GDP deflators: RSE 2001, pp. 289-292.

Tax collection by regions: Ministry of Tax Collection of the Russian Federation (available at www.nalog.ru for 2001), Finansy v Rossii (FvR) 2002, pp. 59-61 (for 2000), FvR 2000, pp. 60-63 (for years before 1999).

Data on regional and local budgets: Ministry of Finance of the Russian Federation (available at www.minfin.ru for years after 2000), FvR 2000, pp. 33-43 (for years before 1999).

Population: RSE 2000, pp. 54-55 (for years before 2000), RR 2002, pp. 30-31 (for years after 2001).

Employment, small businesses and financial results of economic activity: RR 2002, pp. 334-339, 776-780.

Consumer price indices by regions: RR 2002, pp. 827-830.

Appendix 2. Proofs of the propositions of section III.

Proposition 1. The problem (9)-(11) of the regional government can be reduced to:

$$\max_g \beta \ln(e(y_0 g^\gamma G^\delta) - g) + (1 - \beta)\lambda \ln g + (1 - \beta)\mu \ln G + (1 - \beta)(1 - \lambda - \mu) \ln(1 - \tau) + (1 - \beta)(1 - \lambda - \mu) \ln y_0 + \gamma(1 - \beta)(1 - \lambda - \mu) \ln g + \delta(1 - \beta)(1 - \lambda - \mu) \ln G \quad (\text{A1})$$

$$\frac{\partial V_r}{\partial g} = \beta \frac{\gamma e'(y) y g^{-1} - 1}{e(y) - g} + \frac{(1 - \beta)[\lambda(1 - \gamma) + \gamma(1 - \mu)]}{g} = 0 \quad (\text{A2})$$

Defining $\Gamma = \frac{1 - \beta}{\beta} [\lambda(1 - \gamma) + \gamma(1 - \mu)]$ and remembering $\varepsilon = \frac{e'(y)}{e(y)} y$ and $\rho = \frac{g}{e(y)}$

the first order condition (A2) becomes:

$$g - \gamma e'(y)y = \Gamma e(y) - \Gamma g \Leftrightarrow \rho - \gamma \varepsilon = \Gamma - \Gamma \rho \Leftrightarrow \rho = \frac{\Gamma + \gamma \varepsilon}{\Gamma + 1} \quad (\text{A3})$$

$e(y)$ is a non-decreasing function of y so $V_r(g)$ is concave and second order conditions for maximum are satisfied.

Corollary 1.1. $\frac{\partial^2 \rho}{\partial \varepsilon \partial \gamma} = \frac{\lambda \frac{1 - \beta}{\beta}}{(\Gamma + 1)^2} \geq 0$. Equality holds only for $\beta = 1$.

Other corollaries follow automatically from (A3).

Proposition 2. The problem (6)-(8) of the central government can be reduced to:

$$\max_g \alpha \ln[\tau y_0 g^\gamma G^\delta - e(y_0 g^\gamma G^\delta) - G] + (1 - \alpha)\lambda \ln g + (1 - \alpha)\mu \ln G + (1 - \alpha)(1 - \lambda - \mu) \ln(1 - \tau) + (1 - \alpha)(1 - \lambda - \mu) \ln y_0 + \gamma(1 - \alpha)(1 - \lambda - \mu) \ln g + \delta(1 - \alpha)(1 - \lambda - \mu) \ln G \quad (\text{A4})$$

$$\frac{\partial V_c}{\partial G} = \alpha \frac{\delta[\tau - e'(y)]yG^{-1} - 1}{\tau y - e(y) - G} + \frac{(1 - \alpha)[\delta(1 - \lambda) + (1 - \delta)\mu]}{G} = 0 \quad (\text{A5})$$

Defining $\Delta = \frac{1 - \alpha}{\alpha} [\delta(1 - \lambda) + (1 - \delta)\mu]$ and recalling $\rho_c = \frac{G}{\tau y - e(y)}$ and $\pi = \frac{e(y)}{\tau y}$,

the first order condition (A5) becomes:

$$G - \delta \tau y + \delta e'(y)y = \Delta \tau y - \Delta e(y) - \Delta G \Leftrightarrow \rho_c(1 + \Delta) = \Delta + \delta \frac{\tau y - e'(y)y}{\tau y - e(y)} \quad (\text{A6})$$

Dividing the numerator and the denominator of the last term in (A6) by $e(y)$ one obtains:

$$\rho_c(1 + \Delta) = \Delta + \delta \frac{1 - \pi \varepsilon}{1 - \pi} \Leftrightarrow \rho_c = \frac{\Delta + \delta \frac{1 - \pi \varepsilon}{1 - \pi}}{\Delta + 1} \quad (\text{A7})$$

The corollaries follow automatically from (A7).