Are subnational government budget constraints soft? Evidence from Russia

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Abstract[2]

The paper suggests a new test to assess whether subnational governments face soft or hard budget constraints and applies the suggested procedure to the data on Russian regions in 1995-2001. The test is based on the idea of strategic interaction between regions competing for potential federal bailouts. The estimated spatial lag econometric models support the view that budget constraints of Russian regional governments were soft.

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I. Introduction

If a subnational (local or regional) government expects that in case of financial difficulties and fiscal distress it will be bailed out by the central government, and if the central government indeed provides bailouts to regional and local governments covering their deficits or debt repayment, the budget constraints of subnational governments become soft.[3] Soft budget constraints create moral hazard: subnational governments have incentives not to put due effort into revenue collection, to overspend and to borrow excessively since the population of the region will enjoy all the benefits of lower taxation and higher public spending while the cost of these policies will be spread across all regions who contribute to financing central government bailouts and thus will not be fully internalized by subnational governments. This may result in irresponsible and unsustainable fiscal policies at the subnational level undermining overall macroeconomic stability. And since in the course of widespread decentralization of government spending subnational governments play an ever increasing role in shaping overall macroeconomic policies, the problem of soft budget constraints is a growing concern.

The solution to the soft budget constraint problem is obviously to ensure that the central government never provides bailouts. Unfortunately such a no-bailout policy, while optimal in the long run, is difficult to commit to in the short run, particularly if it means a reduction in the local provision of basic public goods with pensions left unpaid and schools being closed. Persson and Tabellini (1996) and Bordignon et al. (2001) formally demonstrate that even a central government maximizing a nation's social welfare is likely to find it advantageous to bail out a financially distressed region. Moreover, as Ter-Minassian and

[3] The term "soft budget constraint" was first introduced by Kornai (1979) in connection with bailouts of enterprises in socialist economies.

Craig (1997) emphasize, a painful default by one region can increase the cost of borrowing for all other jurisdictions, so that all regions may be interested in bailing the defaulting region out. Therefore there exists no easy recipe for eliminating soft budget constraints.

Nevertheless recently economists have made significant progress in understanding the origins and nature of the soft budget constraint (see a survey by Kornai et al., 2003). Rodden et al. (2003) summarized a number of case studies looking at how different countries address the problem of soft budget constraints for subnational governments, sometimes successfully, sometimes less so.[4] However the experiences of different countries are hardly comparable without a clear quantitative basis. Moreover, since federal transfers form an integral part of *any* decentralization arrangements it is very hard to tell the difference between soft and hard budget constraints at a glance.

Therefore the softness of subnational government budget constraints has to be measured, which is by no means straightforward because it involves the identification of *both* components of softness: the presence of bailout expectations and the provision of bailouts (as opposed to ordinary transfers). Several methods of empirical analysis suggested in the literature (and reviewed in section II) have their own advantages and disadvantages.

This paper introduces a new method of measuring the softness of budget constraints for subnational governments. It is based on the idea that if budget constraints are soft regions interact strategically competing for potential federal bailouts whereas if budget constraints are hard each regional government makes fiscal decisions independently (the latter is, of course, a strong assumption that is discussed in greater detail in sections II and III). The new approach is then tested using data on Russian regions in the period 1995-1996. The empirical analysis suggests that the budget constraints of Russian regional governments were soft.

[4] Also see Vigneault (2005) for a brief overview of measures aimed at alleviating the problem of the soft budget constraints for subnational governments.

The paper is structured as follows. Section II reviews the existing approaches to testing for soft budget constraints for subnational governments and gives the intuition for the alternative approach. Section III presents a simple model of interregional competition for federal bailouts providing a theoretical justification for the new approach. Section IV discusses the empirical implementation of this approach and presents the empirical results. Section V discusses the applicability of alternative approaches surveyed in section II to the Russian data and compares the results obtained by applying different approaches. Section V concludes.

II. Approaches to measuring the softness of subnational government budget constraints

2.1. Responses to unexpected revenue shocks. All approaches to assessing empirically the softness of budget constraints can be classified into direct and indirect ones. Although in the context of enterprises several studies (for instance Anderson et al., 2000) have tried to estimate the softness of budget constraints using direct survey-based measures of bailout expectations, such measures are not available in the context of subnational governments and in any case the reliability of such surveys would have been more than questionable.[5] Hence bailout expectations have to be estimated indirectly from the observed data under some maintained assumptions.

The assumption made by Rodden (2000) is that a regional government facing a negative revenue shock will cut expenditure in the absence of bailout expectations and leave expenditure unchanged if it expects a federal bailout. The strategy of testing for soft budget constraints is then to estimate a vector autoregression model [VAR] for subnational government revenue, gross regional product [GRP], unemployment and a number of other variables and to separate expected changes in regional government revenue (the values

[5] See also Dominitz and Manski (1997) for a discussion of general problems arising from the use of surveys to measure expectations.

predicted by the VAR model) from the unexpected components (VAR residuals). At the second stage, subnational government expenditure is regressed on the expected and unexpected components of revenue controlling for the expected and unexpected components of GRP and unemployment. A zero (or negative) response of subnational government expenditure to a revenue shock is interpreted as evidence of the soft budget constraint. Analyzing the data on German Länder in the period 1974-1995 Rodden concludes that financially weaker regions faced soft budget constraints whereas those of their richer counterparts were hard.

This approach is problematic in many respects. Since German Länder have little discretion over their revenue there may be many reasons not to decrease expenditure following a shock in their *own* revenue.[6] Analyzing the unpredicted components of GRP and unemployment Rodden rules out a possibility of a countercyclical policy at the subnational level. But even then, if the transfer mechanism provides poorer regions with insurance against adverse income shocks and the mechanism of this insurance is well-defined and does not depend on the actual actions of the regional government, the shape of the budget constraint of the poorer regions will be somewhat more complicated but will still remain *hard*. As opposed to bailouts, such formula-based transfers enhancing regional revenue during the downturns can be immune to moral hazard, and the observed lack of fiscal adjustment can be explained by these transfers being incorporated in the regional government budget constraint rather than by bailout expectations. Moreover, even if the analysis provides evidence of possible bailout expectations on the part of Länder it is not coupled with econometric evidence that the Bund

[6] Buettner and Wildasin (2002) in their study of fiscal policies of local governments in the USA specifically draw attention to the fact that any results obtained by estimating non-structural time series VAR / VECM [Vector Error Correction] models for subnational government budget components cannot be interpreted as causal: a result that is consistent with the soft budget constraint may be also consistent with a number of other specific arrangements under the hard budget constraint.

did bail distressed regions out.[7]

Finally the econometric specifications used by Rodden raise concerns, both about the validity of the first stage equation (estimated in levels in non-error-correction form in spite of dealing with short non-stationary series)[8] and the correlation of the error term of the second stage regression with the explanatory variables that represent the residuals of the first stage regressions (see Bordignon (2005) on the latter).

2.2. Epidemic defaults. Lewis (2003) does not state his objective as testing for the soft budget constraint, but his study in fact offers an interesting way of approaching the problem. Lewis studies the on-lending by the Indonesian central government to local governments in the 1990s. Each local government had two decisions to make: whether to borrow money from the central government (and how much) and whether to repay the debt when it was due. The central government presumably made decisions on whether to approve the borrowing and on the extent to which to enforce the repayment. In this context soft budget constraints arise if the central government approves loans irrespective of the municipality's fiscal capacity to repay the debt (thus providing bailouts) and if the municipality's decision to repay the debt is not determined by its capacity to do so (hence indicating that municipalities expect the debt to be written off anyway). Lewis finds evidence of both provision and expectations of bailouts by estimating the following system of equations using the Heckman (1979) two-step procedure and its maximum likelihood based variations:

$$BORROW_i = \beta_1 X_i + \varepsilon_i \quad (1)$$

$$REPAY_i = \alpha BORROW_i + \beta_2 Z_i + u_i \quad (2)$$

where *BORROW* and *REPAY* are variables representing the decisions to borrow and to repay

[7] Although, of course, such evidence is well documented in the literature. See for instance Wurzel (1999) and von Hagen et al. (2000).

[8] See Buettner and Wildasin (2002) for a discussion of an appropriate VECM model to study the fiscal policies of local governments.

the debt respectively and X and Z are exogenous explanatory variables, possibly overlapping.

Unfortunately the applicability of this approach to testing for soft budget constraints is limited to otherwise self-evident cases. This strategy is suitable for Indonesia because the non-repayment (arrears) rate among Indonesian municipalities approached 53%, i.e. about half of the municipalities de facto defaulted on their debt. Given the fact that no sanctions from the central government followed it is obvious without any estimation that subnational government budget constraints were *very soft*. However if the non-repayment rate were within reasonable limits (for instance 3% as in the case of Indonesian provinces) and assessing the softness of budget constraints were a non-trivial task, the system (1)-(2) effectively could not be estimated due to insufficient variation in the binary dependent variable.

2.3. Learning dynamics in bailout expectations. Pettersson-Lidbom and Dahlberg (2003) put a more explicit structure on bailout expectations. Namely, they assume that bailout expectations are based on the past incidences of bailouts of the municipality itself and its neighbours. The system of equations to be estimated is:

$$S_{it} = \beta_0 + \alpha B_{it}^{e} + \beta X_{it} + u_{it}, \tag{3}$$

where S is a measure of the fiscal outcome (e.g. the amount borrowed), X are exogenous controls, B is a bailout dummy, the superscript e denotes expectations, the subscript i denotes region and the subscript t denotes time period. Assuming rational expectations, equation (3) can be estimated by replacing the expected bailouts (B_{it}^{e}) by their actual values and using past bailout episodes as instruments[9]. One can also estimate the determinants of bailout episodes from the reduced form equation:

$$B_{it} = \lambda_0 + \lambda_1 B_{i,t-1} + \lambda_2 B_{J,t-1} + \mu_1 X_{it} + \mu_2 X_{Jt} + \varepsilon_{it} \tag{4}$$

where $B_{J,t-1}$ is the average number of bailouts of neighbouring municipalities in the previous

[9] Pettersson-Lidbom and Dahlberg (2005) recommend using own past bailouts as part of control variables and past bailouts of neighbours as instruments.

year and X_J is a vector of the averaged exogenous covariates in the neighbouring municipalities. Consistent estimation of equation (4) is itself a very difficult task but its successful resolution is not necessary for consistent estimation of model (3).

Analysing the data on 290 Swedish municipalities in the period 1974-1992, Pettersson-Lidbom and Dahlberg conclude that past bailouts did channel into inferior fiscal outcomes through bailout expectations and that the central government relief grants were to a large extent not based on "objective" difficulties faced by municipalities but rather covered the consequences of fiscal indiscipline fuelled by bailout expectations.[10] Combined, these two findings provide evidence of soft budget constraints for Swedish municipalities.

This elegant approach has several disadvantages. As Bordignon (2005) points out, the assumption of "adaptive" rational expectations formed on the basis of the past experiences of bailouts may be justified in a stable environment, but this justification is less convincing in periods of major reforms. At the same time in many countries the decentralization arrangements have recently undergone considerable and fast changes. (Clearly Rodden's approach has the same drawback since it estimates "expected" subnational government revenue from long time series.) Secondly, this framework assumes away any strategic interaction between the governments, including between the central and local governments.

Most importantly, the procedure requires detailed records of bailout events. These are readily available in the case of the Swedish municipalities, where the central government ran a special financial relief grants programme outside normal revenue sharing, whereby municipal governments used to hand in separate applications for relief grants before a certain deadline each year. Hence the bailout precedents were well-defined, totalling exactly 1697 episodes of relief grants being provided. But, as already mentioned, usually it is very hard to

[10] Although the authors warn that the results concerning the determinants of actual bailouts should not be seen as necessarily causal and the corresponding equation (4) may have been estimated inconsistently.

tell the difference between bailouts and routine intergovernmental transfers and hence the Pettersson-Lidbom-Dahlberg procedure is not directly applicable outside Sweden.

2.4. Vertical strategic interaction. Bordignon and Turati (2003) relax the history dependence of expectations assumption and introduce the notion of strategic interaction between the central and local governments. Local governments now form ex ante expectations about the total amount of federal funding they can get (including potential subsequent bailouts) by taking into account all currently available information, including for instance the current financial situation of the central government and its political preferences:

$$F_{it} = \alpha_0 + \alpha_1 X_{it} + \alpha_2 Z_{it} + \varepsilon_{it} \quad (5)$$

where F is the total amount of federal funding made available to a subnational government, X are variables that reflect the expected toughness of the central government (its willingness to provide a bailout) and Z are control variables (such as the share of population over the age of 65 in the case of health expenditure). Then the predicted values of total federal funding available are plugged in to estimate the impact of expectations on the actual regional government health expenditure:

$$E_{it} = \beta_0 + \beta_1 Z_{it} + \beta_2 \hat{F}_{it} + u_{it} \quad (6)$$

Bordignon and Turati (2003) implement this approach using data on health care spending by Italian regions in the period 1990-1999 and find evidence of bailout expectations that channelled into higher ex post central government funding via higher spending by regional governments (in anticipation of bailouts). By 2002 about 50% of the regional health care deficit accumulated in 1995-1999 was covered by federal bailouts. Once again, these two observations together constitute evidence of soft budget constraints. However Bordignon and Turati also find that the threat to discontinue the provision of bailouts following the Maastricht Treaty in 1992 was regarded as credible by the regional governments until the last

stage of the preparations for the European Monetary Union was entered, so that regional government budget constraints were harder in 1992-1997 and softer outside this period.

A relative advantage of this approach is its wider applicability, since it is much less data demanding and does not rely on the particularities of the Italian revenue sharing arrangements for the purposes of identification. The main problem of this approach as well as that of Pettersson-Lidbom and Dahlberg (2003) is its strict reliance upon the *rationality of expectations* that rules out any systematically biased forecast of central government's actions by regional governments. Namely, the following condition is imposed:

$$B_{it}^{e} = E(B_{it} \mid I_{it-1}) = B_{it} + \nu_{it}, \tag{7}$$

where I_{it-1} is the information available to subnational governments in period t - 1. This is an undoubtedly strong assumption, the validity of which cannot be directly tested. Moreover, in contrast to the approach of Pettersson-Lidbom and Dahlberg, consistent estimation of the performance equation (6) does require the correct specification of the expectation equation (5), whereby the instruments X and Z employed to obtain the expected values of federal transfers should at least be uncorrelated with the error term u of the regional government expenditure equation and at the same time have high explanatory power to achieve efficiency.

Therefore it would be advantageous to complement these approaches by an alternative approach that allows for persistent errors of judgement on the part of subnational governments, i.e. one that works under violations of the rational expectations hypothesis, and at the same time does not rely on the availability of very specific data.

2.5. The alternative approach. A simple model used by Bordignon and Turati (2003) to provide a theoretical foundation for their empirical approach captures the idea of strategic interaction between a regional government and the central government. The type of the central government (tough or not tough) is not known to the regional government. Observing

the initial amount of allocated federal funding, the regional government forms a belief about the toughness of its national counterpart and either chooses the expenditure level according to the allocated funding or decides to exceed this threshold anticipating a bailout in the future.[11]

In practice strategic interaction due to the soft budget constraints is even more complex. Eventually, the central government decides not only on the provision of bailouts but most importantly on their allocation across regions. Therefore regions engage in competition for central government bailouts, conditioning their actions on the fiscal policies and fiscal positions of other regions and those of the central government. However, if the regional government budget constraint is hard, regional fiscal policy will depend only on economic conditions in the region and structural parameters of the economy: it will be independent of the actions of the central government and other regional governments. Thus in order to assess the softness of subnational government budget constraints one could look for evidence of strategic interaction between regions competing for central government bailouts. This idea will be illustrated more formally in section III and applied empirically in section IV.

One difficulty with this approach is the possible presence of strategic interaction between regional governments even under hard budget constraints. Apart from competition for central government transfers, regions could also engage in tax competition or expenditure competition. Tax competition can target mobile factors (capital and labour) or voters (who generally dislike taxes). Expenditure competition can be driven by spillovers in public good provision (often implying complementarity of regional government spending in the neighbouring regions as in the case of building a road linking two regional capitals) or by voters comparing the performance of their local authorities with that of the authorities of other regions. However in practice the extent of these two forms of interregional competition

[11] See also Garcia-Milà et al. (2002) and Rodden (2005) for similar models of interaction between a regional government and the central government under the soft budget constraint.

should not be overstated, especially in the case of Russia.

In many countries, including Russia, subnational governments have very little autonomy, if any, to vary either tax rates or tax bases. This does not entirely rule out tax competition since, as Cai and Treisman (2004) argue, tax competition can simply take more distortionary forms. For instance, Cai and Treisman present three case studies of regional governments that protected their local enterprises from the federal tax collectors thus reducing the actual tax burden in an attempt to attract mobile capital. However the scope for such tax competition is very limited.

Of more direct relevance is the expenditure competition between subnational governments first documented by Case et al. (1993). Case et al. argue that if provision of public goods in one state is characterized by positive or negative spillovers onto other states, the choices of the level of expenditure on public goods by the neighbouring states must be interrelated. And indeed a one dollar increase in government expenditure of the neighbours of a USA state is estimated to induce an up to 70 cents increase in its own government expenditure (neighbours being defined as states with the closest proportion of black population in this case). Hence in general the expenditure competition effects are by no means negligible.

However, notice that an increase in public spending that benefits the population of the region via spillover effects is assumed to be financed by an increase in tax revenue, which is both feasible and plausible in the case of US states enjoying a high degree of fiscal autonomy. In contrast, regions that have no discretion over taxation cannot match an increase in expenditure by an increase in tax revenue and will have to borrow. Under a hard budget constraint regional governments will have to borrow cautiously and only under the condition that the benefits of partly matching an increase in their neighbours' expenditure are

substantial and, most importantly, can be cashed into the regional budget in the short or medium run. In most cases (for instance with expenditure on education or health care) this will be a very optimistic assumption. Therefore, under a hard budget constraint and in the absence of fiscal autonomy of subnational governments, the scope for mutual influence of regional expenditure policies is also very limited. In contrast, the soft budget constraints will encourage matching one's neighbours' increased spending.

Finally and importantly, the empirical analysis reveals that the nature of strategic interaction in borrowing depends on the transfer allocation mechanism. The theoretical model confirms that this is consistent with the situation when regions use debt to compete for federal assistance (see section 4.6) and it is unclear how it could be consistent with pure expenditure competition or tax competition.

Hence the strategic interaction approach seems to reveal the presence of the soft budget constraints rather adequately, at least in the case of countries with relatively low fiscal (tax setting) autonomy of subnational governments.

III. The Model

2.1. Setup. Consider the following simple model of decision making under hard or soft budget constraints for regional governments. The federation consists of two not necessarily identical regions indexed by $i \in \{1; 2\}$ and inhabited by representative individuals. The (forecasted) income of the representative individual in region i in period t is denoted by $y_i^{(t)}$.[12] The income of each representative individual is taxed, with an exogenous share τ going to the federal budget and an exogenous share t going to the regional budget. Private consumption in region i is thus $(1 - \tau - t)y_i$. Regional governments use tax revenue to provide

[12] Assuming income to be stochastic (drawn from a distribution with mean $\overline{y_i}$) will complicate the analysis without altering the main insights.

a regional public good g_i. The federal government runs a balanced budget and provides a federal public good G. Preferences of the representative individual in region i over private consumption and national and regional public goods are Cobb-Douglas, given by:

$$U_i = \lambda_i \ln G + \mu_i \ln g_i + (1 - \lambda_i - \mu_i)\ln[(1 - t - \tau)y_i],\ \lambda_i > 0,\ \mu_i > 0,\ \lambda_i + \mu_i < 1 \quad (8)$$

For simplicity spillovers in regional public goods are ruled out.

All governments are assumed to be partly self-interested, i.e. they care about social welfare to some extent but also about extracting personal political rent (denoted C at the federal level and c_i at the regional level respectively). Following Edwards and Keen (1996), the objective function ("utility") of a self-interested government is modelled as a weighted average of the welfare of the representative individual and the logarithm of political rents where the weight β reflects the degree of non-benevolence of government officials. The (one-period) objective function of the central government is thus:

$$V = \beta \ln C + (1 - \beta)[\tfrac{1}{2}U_1 + \tfrac{1}{2}U_2],\ \beta \in [0;\ 1] \quad (9)$$

If $\beta = 0$ the government is totally benevolent whereas if $\beta = 1$ the government is a leviathan[13] maximizing the budget revenue and diverting it all to private rents. Similarly the preferences of regional governments are given by:

$$V_i = \beta_i \ln c_i + (1 - \beta_i)U_i,\ \beta_i \in [0;\ 1] \quad (10)$$

The main difference is that regional governments take into account only the welfare of the population of their region while the federal government cares equally about the population of both regions.

The timing of the game is as follows. At the first stage regional governments observe the realization of income and decide on regional expenditure and political rents in period 1. They can borrow any amount D_i to cover the fiscal deficit. At the second stage all

[13] The term "leviathan" is borrowed from "Leviathan" by Thomas Hobbes (1651) and was used by Brennan and Buchanan (1977) to describe governments maximizing the size of the public sector (government revenue).

governments observe the new realization of incomes and the central government provides regions with transfers T_1 and T_2 respectively, simultaneously choosing its private rents and the quantity of the national public good provided. The regional government expenditure in period 2 (to be allocated between public goods and political rents) is its revenue inclusive of transfers and net of debt repayment:

$$g_i^{(2)} + c_i^{(2)} = ty_i^{(2)} + T_i - D_i(1 + r) \tag{11}$$

where r is the rate of interest.[14] Superscript $^{(.)}$ denotes the time period and is omitted wherever such omission does not cause ambiguity. The balanced budget constraint of the central government in the second period is:

$$G^{(2)} + C^{(2)} + T_1 + T_2 = \tau y_1^{(2)} + \tau y_2^{(2)} \tag{12}$$

In the first period the central government does not provide transfers, allocating its revenue exclusively to national public good provision and political rent extraction. Both governments maximize the discounted sum of their expected utilities defined by expressions (9) or (10) using the discount factor ρ. Although the central government weighs the benefits of providing the regions with transfers against the foregone national public good provision, it is assumed that the regional authorities fail to take into account the indirect effect of their policies on the amounts of national public goods provided. Such assumption seems to approximate better the actual decision making process at the subnational level. This is for several reasons: partly because when a region is small compared to the federation the regional authorities may indeed fail to notice the adverse effect of their policies on the national public good provision or may neglect this effect due to its relatively small magnitude; and partly because the quantity and the quality of the national public good provided is unlikely to affect their re-election chances. Finally, if due to the particularities of the budgeting process the central government is not in a

[14] For simplicity the interest rate r and the regional tax rate t are assumed to be the same across regions. Relaxing this assumption does not alter the analysis in any significant way.

position to change the overall amount of funds allocated to intergovernmental transfers but can reallocate funds across regions relatively flexibly, the assumption of partial foresight will also approximate the actual game better than that of the perfect foresight.

Goodspeed (2002) also develops a model of strategic interaction between the central and several regional governments under hard and soft budget constraints. The crucial distinction of the above setup from that in Goodspeed (2002) is the explicit incorporation of the balanced budget constraint for the central government that links central government policies with respect to different regions and enriches the field for strategic interaction between the regional governments. These policies could be independent and even mutually exclusive in Goodspeed (2002), in which case they were financed by arbitrarily changing taxes collected by the central government.

3.2. Decision making. Suppose the central government can choose an ex ante optimal rule[15] of transfer allocation and strictly commit itself to the announced rule. Since the rule is chosen ex ante, the transfers (T_1 and T_2) do not depend on the actions of the regional governments in period 1 and hence are perceived by the regional governments as given. At the start of the game each regional government solves:

$$\max_{c_i^{(1)}, c_i^{(2)}, D_i} [\beta_i \ln c_i^{(1)} + (1-\beta_i)\lambda_i \ln(\tau y_i^{(1)} + \tau y_{-i}^{(1)} - C^{(1)}) + (1-\beta_i)\mu_i \ln(t y_i^{(1)} + D_i - c_i^{(1)}) +$$

$$(1-\beta_i)(1-\lambda_i-\mu_i) \ln[(1-t-\tau) y_i^{(1)}] + \rho V_i(c_i^{(2)}, T_i, D_i) \qquad (13)$$

At the second stage, knowing the realization of income, each regional government will allocate the revenue between political rents and public spending by solving:

$$\max_{c_i^{(2)}} \beta_i \ln c_i^{(2)} + (1-\beta_i)\lambda_i \ln(\tau y_i^{(2)} + \tau y_{-i}^{(2)} - T_i - T_{-i} - C^{(2)}) +$$

$$(1-\beta_i)\mu_i \ln(t y_i^{(2)} + T_i - D_i(1+r) - c_i^{(2)}) + (1-\beta_i)(1-\lambda_i-\mu_i)\ln[(1-t-\tau) y_i^{(2)}] \qquad (14)$$

[15] *Ex ante* here refers to the time period before the regional governments borrow; *ex post* refers to the period after the actual amounts borrowed become known.

Solving problem (14), plugging the solution into expression (13) and omitting constant terms the maximization problem at stage 1 can be reduced to:[16]

$$\max_{c_i^{(1)},\, D_i} \beta_i \ln c_i^{(1)} + (1-\beta_i)\mu_i \ln(t y_i^{(1)} + D_i - c_i^{(1)}) + \rho(\beta_i + (1-\beta_i)\mu_i)\ln[t\, y_i^{(2)} + T_i - (1+r)D_i] \quad (15)$$

At the second stage of the game the central government solves (omitting constant terms and taking into account the rent-seeking behaviour of the regional authorities, i.e. the optimal $c_i^{(2)}$):

$$\max_{C^{(2)},T_1,T_2} \beta \ln C^{(2)} + \tfrac{1}{2}(1-\beta)(\lambda_1+\lambda_2)\ln[\tau(y_1^{(2)} + y_2^{(2)}) - T_1 - T_2 - C^{(2)}] + \quad (16)$$

$$\tfrac{1}{2}(1-\beta)\mu_1 \ln[t y_1^{(2)} + T_1 - D_1(1+r) - c_1^{(2)}] + \tfrac{1}{2}(1-\beta)\mu_2 \ln[t y_2^{(2)} + T_2 - D_2(1+r) - c_2^{(2)}]$$

The equilibrium concept is that of subgame perfect equilibrium implying Nash equilibrium at each stage of the game.

It is useful to start the analysis by looking at the optimal transfer policy of the central government. Denote $\gamma = 2\dfrac{\beta}{1-\beta}$ and $\eta_i = \dfrac{\mu_i}{\lambda_i + \lambda_{-i} + \mu_i + \mu_{-i} + \gamma}$, then:[17]

Proposition 1. The optimal transfer policy under the full commitment to no bailout policy is:

$$T_i^{HBC} = \eta_{-i} t(y_{-i}^{(2)} - y_i^{(2)}) + (\eta_i - \eta_{-i}) t y_2^{(2)} + \quad (17)$$

$$\eta_i \tau(y_i^{(2)} + y_{-i}^{(2)}) - \frac{\lambda_i + \lambda_{-i}}{\lambda_i + \lambda_{-i} + \mu_i + \mu_{-i} + \gamma} t y_i^{(2)} - \frac{\gamma}{\lambda_i + \lambda_{-i} + \mu_i + \mu_{-i} + \gamma} t y_i^{(2)}$$

The optimal (dynamically consistent) transfer policy is

$$T_i^{SBC} = T_i^{HBC} + (1 - \eta_i)(1+r)D_i - \eta_i(1+r)D_{-i}, \quad (18)$$

3.3. Debt-independent transfers. Expressions (17) and (18) indicate that the optimal transfers consist of 5 distinct components: equalization (encompassing pure equalization and

[16] For all derivations and proofs see Appendix 1.

[17] γ is not defined if $\beta = 1$. However a completely rent-seeking federal government in this model has no incentive to ever provide transfers to the regions. This rules out strategic competition for federal transfers making the case of $\beta = 1$ uninteresting.

insurance), preference matching, decentralization of spending, political rent extraction, and response to regional government indebtedness.

The equalization component for region 1 is equal to $\eta_2 t(y_2^{(2)} - y_1^{(2)})$. If the income of region 2 is higher than that of region 1, region 1 receives a positive extra transfer from the federal government. If region 1 is the richer of the two, the federal transfer is reduced by an appropriate amount.[18]

The preference matching component for region 1 is equal to $(\eta_1 - \eta_2) t y_2^{(2)}$. If preferences for local public goods are relatively higher in region 1 ($\mu_1 > \mu_2$ implying $\eta_1 > \eta_2$) then some proportion of the income of region 2 should be transferred to finance public good provision in region 1.

The decentralization component for region 1 is equal to $\eta_1 \tau(y_1^{(2)} + y_2^{(2)}) - \frac{\lambda_1 + \lambda_2}{\lambda_1 + \lambda_2 + \mu_1 + \mu_2 + \gamma} t y_1^{(2)}$ and depends on relative preferences for local and national public goods and on tax revenue sharing proportions. For instance in a plausible situation when the representative individuals have relatively higher preferences for the local public good ($\lambda_1 + \lambda_2 \approx \mu_1$) but most taxes are collected by the central government ($t << \tau$) the decentralization component of the transfer will be positive, i.e. the general government revenue will be decentralized to match the preferences of the population and to close the vertical fiscal imbalance.

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[18] If future income were assumed to be stochastic, this component could be further disentangled into the pure equalization component $\mu_2 t(\overline{y_2^{(2)}} - \overline{y_1^{(2)}})$ and the insurance component $\mu_2 t[(y_2^{(2)} - \overline{y_2^{(2)}}) - (y_1^{(2)} - \overline{y_1^{(2)}})]$. The former equalizes average regional government revenues while the latter provides additional assistance at the times when the regional output is affected by an adverse region-specific random shock. However such distinction is not central to the analysis and y_i are assumed to be deterministic.

The political rent extraction component for region 1 is equal to the negative of $\frac{\gamma}{\lambda_1 + \lambda_2 + \mu_1 + \mu_2 + \gamma} ty_1^{(2)}$. This component is set to zero if the central government is completely benevolent ($\beta = 0$ implying $\gamma = 0$). Note that γ is just a positive monotonic transformation of β and thus is increasing in the degree of central government rent seeking. Therefore the more rent-seeking is the central government, the higher is the deduction from the basic transfer that would have been allocated to the region by a benevolent central government.

If regions are not allowed to borrow, or the central government completely ignores their borrowing and allocates transfers regardless of the outstanding debts of the regional governments, these four components (denoted T_i^{HBC} in proposition 1) completely determine the optimal transfers, so that the federal transfers are independent of regional policy choices (the amount of rents extracted and borrowing activities) and are completely determined by the exogenous income distribution across regions, preferences of local populations, tax revenue assignment, and central government's propensity to extract political rents. In these circumstances regional governments will treat period 2 federal transfers as predetermined when making fiscal decisions at stage 1 so that the amounts of public goods provided, political rents extracted, and debt accumulated will be independent of the decisions of the other regional government and the central government. *The hard budget constraint* thus corresponds to the subgame perfect solution of the game when the optimal transfer policy is decided outside the game and is strictly adhered to.

3.4. Debt-dependent transfers. However, in general the optimal transfer for region 1 has a fifth component that depends on the outstanding debts of all regional governments. This component is equal to $(1 - \eta_1)(1 + r)D_1 - \eta_1(1 + r)D_2$ and represents an additional entitlement

that the regional government receives due to the fact that its disposable income is no longer $ty_1^{(2)}$ but $ty_1^{(2)} - (1 + r)D_1$. In other words, the regional government is now poorer than it otherwise would have been and as a result regional public goods will be underprovided reducing the welfare of the citizens. This motivates the central government to compensate partly for the lack of regional public goods via federal transfers, increasing social welfare in the poorer (indebted) regions.[19] Of course, this situation of relative poverty arose in the first place because regional public goods were oversupplied in the same region in the previous period (financed by means of borrowing). If the central government were taking into account past, present and future welfare of the population it could deny the indebted regional government additional assistance. However dynamically consistent (subgame perfect) policy requires that the central government maximizes the current and future welfare regardless of how the current financial situation arose. *The soft budget constraint* thus corresponds to the subgame perfect solution of the game where the optimal transfer policy is revised within the game.

The extra entitlement of a region under soft budget constraints can be decomposed into the four components corresponding to the four main components of the transfer. The equalization extra entitlement is equal to $\eta_2(1 + r)(D_1 - D_2)$. The preference matching extra entitlement is equal to $(\eta_2 - \eta_1)(1 + r)D_2$. The decentralization extra entitlement is equal to $\frac{\lambda_1 + \lambda_2}{\lambda_1 + \lambda_2 + \mu_1 + \mu_2 + \gamma}(1 + r)D_1$. Finally, the political rent extraction extra entitlement is equal to $\frac{\gamma}{\lambda_1 + \lambda_2 + \mu_1 + \mu_2 + \gamma}(1 + r)D_1$. It is straightforward to see that the four components add up:

[19]The concavity of the logarithmic welfare function implies that the central government dislikes interregional inequality.

$$\eta_2(1+r)(D_1 - D_2) + (\eta_2 - \eta_1)(1+r)D_2 + \frac{\lambda_1 + \lambda_2}{\lambda_1 + \lambda_2 + \mu_1 + \mu_2 + \gamma}(1+r)D_1 +$$

$$\frac{\gamma}{\lambda_1 + \lambda_2 + \mu_1 + \mu_2 + \gamma}(1+r)D_1 = (1-\eta_1)(1+r)D_1 - \eta_1(1+r)D_2$$

This extra entitlement part of the transfer has two adverse effects on the fiscal discipline of subnational governments. Firstly, it provides the regions with incentives to borrow excessively in period 1 in order to receive a larger transfer in period 2 (since $\frac{\partial T_i}{\partial D_i} = (1 - \eta_i)(1 + r) > 0$). Secondly, it introduces strategic interaction between regions via the equalization and the preference matching components. Namely the transfer that region 1 is entitled to in the future depends on the policy decisions (amounts borrowed) by the other region: the more region 2 borrows, the less region 1 expects to receive in the form of a federal transfer ($\frac{\partial T_i}{\partial D_{-i}} = -\eta_i(1 + r) < 0$). This is because the fiscal capacity of the central government is finite and, when highly indebted, region 2 will look poorer so that transfers will be reallocated from region 1 to region 2. This means that region 1 now has incentives to borrow in order simply to defend the existing level of federal assistance.[20]

Certainly these problems leading to fiscal indiscipline will not arise if the central government could commit to never taking the indebtedness of the regional governments into account (or, more generally, to ignore moral-hazard-driven regional fiscal deficits, i.e. deficits triggered by deliberate policy choices of subnational governments). However such a policy

[20] Without incorporating an explicit balanced budget constraint for the central government Goodspeed (2002) focuses on the cases $\frac{\partial T_i}{\partial D_i} > 0$ and $\frac{\partial T_i}{\partial D_{-i}} = 0$ (independent transfer policy) or $\frac{\partial T_i}{\partial D_i} > 0$ and $\frac{\partial T_i}{\partial D_{-i}} > 0$ ("punishment" of region -*i* for excessive borrowing by giving more money to the other region *i*) effectively discarding the case of intensive competition for federal transfers with $\frac{\partial T_i}{\partial D_i} > 0$ and $\frac{\partial T_i}{\partial D_{-i}} < 0$.

stance may not be feasible due to the dynamic inconsistency problem (documented and modelled by Persson and Tabellini (1996) and Bordignon et al. (2001) among others). Faced with fiscal distress in a region the national government may find it beneficial to bail the distressed region out even if its only objective is maximizing social welfare in a federation (as stage 2 of the game also shows). If, for example, enforcement of a no-bailout policy means that local residents are denied basic public goods with schools being closed and salaries left unpaid, such moves can have a prohibitively high political cost. Clearly there may be additional arguments in favour of bailouts: for instance a default by one region can increase the cost of borrowing for all other regions in a federation, so neighbours themselves may be interested in providing the defaulting region with a bailout transfer.

Therefore under soft budget constraints, when regional policy choices affect the total amount of federal funding made available to the regional governments, a regional government's fiscal decisions are expected to depend on those of the government of the other region, or more generally other regions.

3.5. Strategic interaction. To understand the nature of such strategic interaction it is useful to look at the fiscal choices under the hard budget constraint first.

Proposition 2.Under the hard budget constraint the optimal levels of regional government debt are:

$$D_i^{HBC} = \frac{1}{(1 + \rho)(1 + r)}[T_i^{HBC} + t(y_i^{(2)} - \rho(1 + r)y_i^{(1)})] \tag{19}$$

Formula (18) shows two reasons for borrowing when transfers are predetermined and cannot be affected by the fiscal policies of the regional governments. Firstly regional governments borrow against specific future income. In this simple model the only source of future income available in period 2 and unavailable in period 1 is the federal transfer. In

reality future income can include returns on specific investment projects and other sources of revenue that are intrinsically difficult to model within such a simple framework.

Secondly, borrowing allows regional government expenditure to be smoothed intertemporally thus enabling the governments to run a countercyclical policy. The term $y_i^{(2)} - \rho(1 + r)y_i^{(1)}$ reflects the deviation of the current regional output $y_i^{(1)}$ from its forecasted value $y_i^{(2)}$ (expected output in the next period). This deviation is adjusted for the discount rate and the cost of borrowing. If the current regional output is below its expected (natural) value the regional government will find it optimal to borrow a positive amount of funds in order to smooth government expenditure over time. On the contrary when the regional economy outperforms its average standard it is optimal to repay the debt (effectively, to borrow a negative sum).

However the situation is totally different under the soft budget constraint:

Proposition 3. Under the soft budget constraint the optimal amount of borrowing is given by:

$$D_i^{SBC} = \frac{1}{(1 + \rho)(1 + r)\eta_i}[T_i^{HBC} + t(y_i^{(2)} - \rho(1 + r)\eta_i y_i^{(1)}) - \eta_i(1 + r)D_{-i}^{SBC}] \qquad (20)$$

Regional governments still borrow against specific future income and against higher expected tax revenue. However since part of the debt repayment in the next period is now potentially covered by an additional federal transfer, the combined present and future income can be positively affected by borrowing more today. Consequently the term $\frac{1}{(1 + \rho)(1 + r)}[T_i^{HBC} + ty_i^{(2)}]$ is multiplied by a coefficient $\frac{1}{\eta_i} > 1$. The coefficient $\frac{1}{\eta_i}$ represents the inverse of the magnitude of preferences for the local public good relative to preferences for the national public good, other region's preferences for local public goods and central government's propensity to extract political rent. When making a decision about

providing a region with a bailout the central government weighs preferences for local public goods (underprovided in the absence of bailout) against all other preference parameters. Therefore if η_i is low (i.e. the inhabitants of the region do not value the local public good highly enough) the central government will be reluctant to increase the transfer to region *i* unless local public goods provision plunges below all reasonable levels (formally speaking, as g_i approaches zero the objective function of the central government diverges to minus infinity). This is the key to understanding the intuition behind proposition 3. Indeed, when making a decision about borrowing, the regional government compares the negative effect of the distortion of intertemporal allocation of revenue against the benefits of increased federal funding (so that the chosen level of debt equalizes the marginal effects of the former and the latter). If η_i is high the central government quickly responds to the indebtedness of region *i* by providing substantial financial assistance, therefore the regional government need not borrow too much. If, on the contrary, η_i is low the central government will deny a bailout unless the regional government's debt obligation will make the level of provision of local public goods clearly unacceptable. In this case the central government will find itself obliged to provide financial assistance. Therefore the regional government is particularly inclined to overborrow. This explains why the extent of overborrowing under the soft budget constraint is inversely related to the parameter η_i.

For the empirical analysis the central question is that of how the government of region *i* will react to a change in the debt of other regional governments.

Proposition 4. The reaction curve for each region is downward sloping:

$$\frac{\partial D_i^{SBC}}{\partial D_{-i}^{SBC}} = - \frac{1}{1 + \rho} < 0 \qquad (21)$$

Regions will find it optimal to reduce their borrowing in response to an increase in the

borrowing of their neighbours. This is because region 1 is effectively borrowing against the future federal government transfer and borrowing by region 2 reduces this transfer. The amount of debt not covered by the transfer will have to be repaid out of regional government own revenue, which prevents regional authorities from borrowing even more.

3.6. Strategic interaction with a possibility of default. However the assumption of balanced budget in period 2 with no possibility of default on the regional government debt is crucial for this result. If a regional government can default on its debt and expects the federal government to repay the regional obligations, the reaction curve is likely to be upward sloping (i.e. $\frac{\partial D_i}{\partial D_{-i}} > 0$). By borrowing more in response to an increase in the other region's borrowing, the regional government will be "defending" the future federal transfer and at the same time will no longer balance the benefits of this strategy and the cost of repaying the debt out of its own future revenue.

To see that the reaction curves may indeed become upward sloping consider a simple situation[21] where the government of the first region when making the decision about borrowing anticipates that it can default on the debt and receive a bailout from the central government (possibly financed at the expense of reducing transfers to other regions), while the other region honours its obligations (otherwise the assumptions about the timing of the game repeat those made in subsection 3.1).

Proposition 5. Under the soft budget constraint, if the regional government anticipates a regional default with subsequent bailout and

[21] The assumptions are simplistic and mainly provide an example of the upward sloping reaction curve. Meaningful modelling of this game with a possibility of default is difficult as it implies strong ad hoc assumptions about the cost of regional default for the central and regional governments and about the bargaining procedure between the regions and the centre.

$$\frac{\lambda_i}{\mu_i} + \frac{\lambda_{-i}}{\mu_i} + \frac{\mu_{-i}}{\mu_i} + \frac{\gamma}{\mu_i} > \rho \tag{22}$$

the reaction curve will be upward sloping:

$$\frac{\partial D_i^{Def}}{\partial D_{-i}^{SBC}} = \frac{\eta_i}{1-\eta_i(1+\rho)} > 0 \tag{23}$$

For the condition (22) to hold it is sufficient that $\lambda_i + \lambda_{-i} + \mu_{-i} + \gamma > \mu_i$ and hence it holds for all empirically relevant cases. Hence empirically the strategic interaction and competition for federal transfers can imply either negative or positive spatial correlation in the regions' borrowing patterns with no strong prior about the sign, while under the hard budget constraint the spatial correlation is zero in this model. It should also be noted that even when the reaction curves are downward sloping the equilibrium level of regional government debt under the soft budget constraint can several times exceed that under the hard budget constraint. In fact under some plausible assumption the model predicts excessive subnational debt equal to 11% GDP in the equilibrium (see appendix 1 for an example and calibration).[22]

The next section looks for empirical evidence of the strategic interaction between regions as predicted by the model by examining the borrowing decisions of Russian regional governments in the mid 1990s.

IV. Empirical evidence

4.1. The strategy. If regions make their borrowing decisions strategically competing for transfers then borrowing by a regional government is expected to depend on borrowing by its neighbours (the exact definition of neighbours will be given later). The basic specification is thus:

[22] Subnational government debt levels are typically lower, but this is largely because of constraints on subnational borrowing imposed by the central government (see Singh and Plekhanov (2005) for overview and empirical analysis). For instance in Sweden where prior to 2000 local government borrowing was unconstraint and budget constraints were soft the subnational government debt reached 30% GDP (von Hagen et al., 2000).

$$D_i = \alpha + \varphi \sum_{j \in J_i} w_{ij} D_j + \gamma X_i + \varepsilon_i \quad \text{(R1)}$$

where D_i is the (logarithm of) the debt of region i, J_i is the set of neighbours of region i (indexed by j) and X is the set of control variables. The borrowing by region i is therefore assumed to be a function of a weighted average of borrowing decisions of its neighbours. Defining $w_{ij} \equiv 0$ for non-neighbours one can express system of equations (R1) in matrix form, where W is an $N*N$ weighting matrix:

$$D = \alpha + \varphi WD + \gamma X + \varepsilon \quad \text{(R2)}$$

Applying OLS to equation (R2) will result in bias and inconsistency since neighbours' borrowing D_j is a function of the dependent variable D_i and hence the right hand side variable D_j and the error term ε_i are correlated. However equation (R2) can be inverted and consequently estimated by concentrated maximum likelihood:

$$D = (I - \varphi W)^{-1}\alpha + (I - \varphi W)^{-1}\gamma X + (I - \varphi W)^{-1}\varepsilon \quad \text{(R3)}$$

One difficulty with this approach is the possibility that spurious evidence of spatial correlation in the dependent variable can may be obtained if in fact simply the error terms in equation (R1) are spatially correlated, i.e. some common shocks simultaneously affect neighbours' borrowing decisions in the absence of any actual strategic interaction between the policy-makers. From the econometric point of view, if the error terms ε_i are assumed to be independently distributed across regions when in fact they are spatially correlated, the estimated spatial lag coefficient ρ can appear to be statistically significantly different from zero even in the absence of any spatial lag dependence (i.e. spatial dependence in the dependent variable). This is because the error term is a component of the dependent variable and spatial correlation in the error term will be partially channelled into perceived spatial correlation in the dependent variable. Formally, assume the error term to have spatial

dependence of the same form:

$$\varepsilon = \lambda W\varepsilon + \nu \quad \text{(R4)}$$

where W is the weighting matrix as before and ν is the idiosyncratic component of the error term. Inverting system (R4) yields:

$$\varepsilon = (I - \lambda W)^{-1}\nu \quad \text{(R5)}$$

There are two fundamentally different solutions to the problem of spurious spatial lag dependence. The first one, implemented by Case et al. (1993), is to substitute ε from system (R5) into system (R3) and estimate the resulting system of equations (R6) allowing for spatial lag and spatial error dependences simultaneously:

$$D = (I - \varphi W)^{-1}\alpha + (I - \varphi W)^{-1}\gamma X + (I - \varphi W)^{-1}(I - \lambda W)^{-1}\nu \quad \text{(R6)}$$

However, as Anselin (1988) and Anselin et al. (1996) point out, simultaneous maximum likelihood estimation of parameters φ and λ based on the same weighting matrix W is numerically unstable and often unreliable.[23] An alternative approach adopted by Brueckner (1998) is to estimate the spatial lag model (R3) and the spatial error model (R7) separately:

$$D = \alpha + \gamma X + (I - \lambda W)^{-1}\nu \quad \text{(R7)}$$

and to test the hypothesis of no spatial correlation in the error term ($\lambda = 0$) using a robust Lagrange Multipliers [LM] test developed by Anselin et al. (1996).[24] Failure to reject the null hypothesis of $\lambda = 0$ justifies the validity of the spatial lag model (R3). This paper adopts the latter approach since the data reveal no spatial autocorrelation in the error term.

4.2. Control variables. The model suggests that the control variables should include at least measures of regional income and regional government revenue, proxies for the

[23] Other parameters (α, γ, σ^2) can be estimated by OLS given φ and λ and hence they can be concentrated out of the likelihood function.

[24] A form of spatial dependence in the error term alternative to specification (R4) is the spatial moving average (Huang, 1984): $\varepsilon = \psi W\nu + \nu$. The LM tests of no spatial error dependence are robust to moving average or autoregressive spatial dependence in the error term under the alternative hypothesis (Anselin et al., 1996).

preferences for public goods and factors likely to affect the cost of borrowing. A number of other factors unaccounted for in the simple model in section III are also likely to affect borrowing decisions.

Therefore the explanatory variables firstly include two main components of the revenue side of regional budgets: regional government revenue[25] and federal transfers to the regions. Since transfers predominantly serve the same deficit closing purpose as borrowing, the coefficient on this variable is expected to be negative. By contrast, the effect of higher regional government revenue is ambiguous: on the one hand higher revenue demonstrates higher ability to repay the debt and may encourage borrowing; on the other hand regions with lower revenue may have higher borrowing needs. By the same token the effect of higher GRP can go either way. These three variables apart from measuring regional income and regional government revenue are also likely determinants of the cost of borrowing.

Insofar as private investment and public investment are substitutes, governments of regions relatively unattractive to investors will be more limited in the possibility to have major projects financed out of private sources and thus may need to borrow more. The relative attractiveness of regions for private investors is proxied by indices of investment risk and investment potential compiled by the Expert, a Russian weekly magazine. Also, regions with larger populations are expected to borrow more.

Politics may play a role. The election year dummy (equal to one if the elections of governor were held in a given region in a given year)[26] was everywhere highly insignificant

[25] Regional government revenue aggregates the regional government and local governments within the region since regional governments had substantial discretion over intraregional revenue sharing (see OECD (2000) and Freinkman and Plekhanov (2005) for details).

[26] If elections were held during the first quarter, the previous year was coded as an election year to reflect the fact that the borrowed money was aimed at enhancing public good provision in the run-up to the elections.

and hence was dropped.[27] Another dummy variable shows if the governor of the region was in political opposition to the central authorities.[28]

The level of public infrastructure and economic development can be expected to have a twofold effect on regional government borrowing. Indicators that reflect the general level of development and at the same time cannot be affected by regional government spending in the short run (such as life expectancy at birth) or measure infrastructure beyond the immediate responsibility of the regional government (such as the number of landline phones per 1,000 population in urban areas) are likely to affect borrowing positively since more economically advanced regions will find it easier to borrow and will enjoy preferential terms and conditions as a result of a lower perceived risk. In contrast, measures of public sector infrastructure that is the direct responsibility of the government are likely to affect borrowing negatively: particularly bad situation with basic health care (proxied by the lack of doctors per 10,000 people) or with basic transportation network (proxied by the percentage of roads with advanced (asphalt) surface) may urge the government to invest more in these sectors and, unless federal transfers cover this additional investment, the funds will be raised by means of borrowing. All these infrastructure and development indicators also play a role of proxies for regional preferences for national and local public goods.

Desai et al. (2003) and Freinkman and Plekhanov (2005) showed that the fiscal behaviour of Russian regions may differ substantially depending on the availability of rent revenue derived from explicit and implicit taxation of extraction of mineral resources,

[27] Akhmedov and Zhuravskaya (2004) find strong evidence of political fiscal cycles in Russian regions but emphasize that these cycles are very short-lived so that pre-election fiscal expansions and post-election fiscal contractions can cancel each other out within one year.

[28] Wibbels (2003) finds positive correlation between the level of state indebtedness and the competitiveness of regional politics in the United States in the 1840s. However in the majority of Russian regions governors were appointed prior to 1996 and the competitiveness of regional politics could not be measured based on the election results. The variable measuring the competitiveness of regional elections proved to be highly insignificant in the subsequent years.

primarily oil and gas. Following these studies the share of fuel industry in total regional industrial output is included as an explanatory variable to control for possible effects of government revenues in the form of rent on regional fiscal policies.

Finally, even once all these factors are taken into account there may remain substantial unobserved heterogeneity in regional characteristics that may affect borrowing decisions. But insofar as these region-specific factors are time-invariant and affect regional borrowing to the same extent every year, the problem of unobserved heterogeneity can be alleviated by including the lagged value of regional debt that already incorporates fixed regional effects.

4.3. Choice of neighbours. Since the number of parameters in the weighting matrix substantially exceeds the number of observations available,[29] the parameters of the weighting matrix W must be chosen a priori rather than estimated, in other words, regions must be assigned neighbours according to a certain rule.

The analysis considers all four definitions of neighbours common in the literature on strategic interaction between subnational governments. The first approach defines regions as neighbours if they share a border.[30] Such a classification is attractive since firstly neighbouring regions usually have similar economies and geographical conditions, and secondly some transfer programmes are earmarked for certain geographical areas (e.g., for the regions of the Far North). Therefore competition for transfers and strategic interaction between neighbouring regions is expected to be more intense than between regions situated far apart.

The second approach also uses the geographical principle but weighs the importance of different neighbours by their population. Brueckner (1998) reports that the adoption of

[29] For 79 regions a symmetric matrix will have 79*78* ½ = 3081 parameters.
[30] With the exception of the enclave region of Kaliningrad, in which case the closest regions of Pskov and Smolensk are coded as neighbours.

growth control measures by the cities of California exhibits spatial interdependence only when a population-weighted neighbours matrix is used.

The third approach assigns neighbours according to per capita regional income, assuming that strategic competition for federal transfers takes place between the regions with similar income levels. In the case of borrowing as the dependent variable the exogeneity of the income-based weighting matrix seems to be a rather innocuous assumption.[31] The 1995 per capita GRP values were adjusted for differences in the purchasing power of the rouble in different regions using the subsistence minimum indicator – the cost of a fixed bundle of basic goods and services in different regions. The weights of regions were set to be inversely proportional to the difference between the PPP-adjusted per capita GRPs with the cut-off distance of ±25% of the annual subsistence minimum.

Case et al. (1993) report evidence of spatial dependence of expenditure choices made by the US states both for the geographically and economically defined neighbours. However by far the strongest evidence of strategic interaction was obtained for ethnically similar regions, whereby neighbours were defined using the proportion of black population in the state. The ethnic similarity is unlikely to be the driver of strategic interaction in the case of Russia, however some studies found profound differences in political and fiscal behaviour between ethnic republics and other (administrative) types of regions (Treisman (1996, 1998), Freinkman and Yossifov, 1999). Therefore the hypothesis of strategic interaction between ethnically diverse regions can be still tested using the index of ethnolinguistic fractionalization [ELF] to construct the neighbours matrix.[32] The ELF index shows the

[31] See Anselin (1988) for the discussion of the problems arising in the presence of endogenous weights.
[32] The ELF index is a standard measure of ethnic diversity in cross-country empirical studies. For instance it was employed by Mauro (1995) and many subsequent studies of growth and fiscal behaviour of governments.

probability that two randomly chosen individuals belong to different ethnolinguistic groups.[33]

Finally since the studies by Case et al. (1993) and Brueckner (1998) together find evidence of strategic interaction in regional decision-making using four different definitions of neighbours, a sceptical reader may believe that the spatial lag estimation procedure is intrinsically biased towards positive evidence of strategic interaction. To dismiss such concerns Case et al. (1993) showed that if neighbours are defined using the alphabetical list of regions without any economic intuition attached, there is absolutely no evidence of spatial dependence of policy choices. This paper replicates "the neutrality test" using alphabetically defined neighbours.[34]

4.4. Data. The approach is implemented using the data on 79 Russian regions[35] in 1996. Several studies (e.g., Lavrov et al. (2001), de Figueiredo and Weingast (2001), Rosefielde and Vennikova, 2004) have hypothesized that regional government budget constraints in Russia were soft but have not tested this claim formally. The individual sources for all variables are listed in appendix 2 and table 1 reports some descriptive statistics. It is straightforward to see that regional government borrowing has remarkably high cross-regional variation to be explained.

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[33] The weights are constructed as follows:

$$w_{ij} = \begin{cases} \dfrac{\alpha_{ij}}{|\ ELF_i\ -\ ELF_j\ |}, & |\ ELF_i\ -\ ELF_j\ | \leq\ 0.15 \\ 0, & |\ ELF_i\ -\ ELF_j\ | >\ 0.15 \end{cases}$$

α_{ij} are chosen so that $\sum_j w_{ij} = 1, \forall i$

[34] Each region has thus two alphabetical neighbours with equal weights attached. The first and the last regions on the list are considered neighbours. Latin characters transliteration was used.

[35] Nine autonomous districts (all except Chukotka) and Chechnya are excluded due to data unavailability (many indicators such as GRP were not computed for these regions until 2000).

Table 1. Descriptive statistics for selected variables						
Variable	*Mean*	*St. deviation*	*Median*	*Min*	*Max*	*k of variation*
Income and public finance						
Debt in 1996, mln. RUR	159 946	389 149	68 647	0	2 726 017	243%
Debt in 1996, % of GRP	0.8%	1.5%	0.4%	0.0%	10.0%	188%
Debt in 1995, mln. RUR	60 312	239 497	2 400	0	1 906 709	397%
GRP, bln. RUR	24 600	35 100	14 800	834	237 000	143%
Per capita GRP, thous. RUR	11 538	7 283	9 533	2 781	57 776	63%
Monthly subsistence minimum, thous. RUR	374	153	330	217	1 161	41%
Per capita GRP as a multiple of annual subsistence minimum	2.59	1.15	2.44	0.67	9.08	44%
Regional government revenue, % of GRP	20%	8%	18%	13%	66%	40%
Regional government pre-transfer revenue per capita, thous. RUR	1 813	1 747	1 369	224	13 115	96%
Regional government expenditure per capita, thous. RUR	2 433	2 002	1 864	1 113	14 242	82%
Federal transfers, % of GRP	5.4%	5.8%	3.5%	0.1%	27.8%	107%
Federal transfers per capita, thous. RUR	487	602	340	26	4 352	124%
Demographics						
Population, thous. people	1 861	1 515	1 361	91	8 664	81%
Share of economically active population	0.47	0.05	0.47	0.25	0.57	11%
Urbanization (% of urban population)	68.8%	13.1%	69.3%	24.0%	100.0%	19%
Index of ethnolinguistic fractionalization, 1989	0.33	0.20	0.29	0.05	0.85	61%
Regional development and the structure of regional economy						
Investment potential index	1.20	1.75	0.77	0.11	14.76	146%
Investment risk index	1.10	0.27	1.05	0.66	2.15	25%
Percentage of roads with advanced (asphalt) surface, 1995	67%	26%	70%	2%	100%	39%
Number of doctors per 10,000 people, 1995	42.3	9.3	42.0	18.4	77.5	22%
Landline phones per 1,000 urban population, 1995	133.1	42.9	125.9	24.3	353.4	32%
Life expectancy at birth, years	65.70	2.31	66.10	55.40	71.50	4%
Infant mortality, per 1,000 born	18.2	5.0	17.3	11.3	36.4	27%
Registered crime per 100,000 population, 1995	1 890	631	1 803	391	3 588	33%
Percentage of schoolchildren forced to start classes in the afternoon ("second shift"), 1995	24.7	5.2	25.1	12.2	39.8	21%
Share of fuel industry in industrial output, %	10.1%	14.8%	2.5%	0.0%	80.2%	147%
Note: As of year 1996, unless otherwise indicated, based on 79 observations. 1,000 RUR pre-1997 corresponds to 1 RUR post-1997. For sources see appendix 2.						

The year 1996 is chosen for three reasons. Firstly, this was the first year when regions started borrowing actively. This is clear from table 1: in 1995 almost half of the regional governments completely refrained from borrowing (with the median being very close to zero). In 1996 most regions engaged in borrowing and the median borrowing increased by 28.6 times in nominal terms (24.3 times in real terms). Therefore the year 1996 provides a unique opportunity to examine the determinants of *initial* decisions to borrow.

Secondly, 1996 was the year of presidential elections. With the central government being relatively weak and elections promising to be close, Moscow tried to secure support of the regions and ensure generous funding for the local public sector. Therefore it is commonly argued that regional government budget constraints were particularly soft in 1996. The approach developed in this paper allows this claim to be tested formally. Finally, reliable data on regional government borrowing are available only starting from 1995.

4.5 Results. The results are reported in table 2. The data support the hypothesis that regional government constraints were soft: when the geographical principle is used to define neighbours the spatial lag coefficient φ is statistically significant at the 10% level (column A).[36] It is economically significant too: a regional government responds to a 10% increase in average borrowing by the neighbours by a 1.9% increase in its own borrowing, other things being equal. There is also evidence of strategic interaction between regions with similar incomes (the spatial lag coefficient is significant at the 10% level using both the Wald and the LM tests, see column C): a regional government responds to a 10% increase in average borrowing by regions with similar per capita income by a 2.3% decrease in its own borrowing, other things being equal. These reaction patterns are further analyzed in the next

[36] The statistical significance of the spatial correlation coefficients rises substantially if the oppositional governor dummy is excluded from the specification. In 1996 this dummy took value 1 only for eight regions since in many regions the governors were still those appointed earlier by the president.

subsection.

Table 2. Spatial dependence in borrowing decisions					
Method	*Spatial lag model estimated by maximum likelihood*				
Dependent variable	*Debt, Log*				
Definition of neighbours	*geographical*	*population weighted*	*income*	*ethnicity*	*alphabetical*
Column	**A**	**B**	**C**	**D**	**E**
Lagged debt, Log	0.258 (0.062)***	0.256 (0.062)***	0.239 (0.062)***	0.254 (0.061)***	0.256 (0.062)***
Regional government revenue, Log	0.972 (1.275)	0.949 (1.305)	0.597 (1.404)	1.175 (1.366)	0.899 (1.351)
GRP, Log	0.529 (1.250)	0.667 (1.291)	1.415 (1.414)	0.115 (1.916)	0.736 (1.320)
Federal transfers, Log	-0.434 (0.375)	-0.424 (0.369)	-0.430 (0.357)	-0.527 (0.356)	-0.452 (0.363)
Population, Log	1.573 (1.096)	1.529 (1.130)	1.282 (1.168)	2.069 (1.695)	1.594 (1.131)
Index of investment potential	-1.525 (0.208)***	-1.572 (0.210)***	-1.645 (0.214)***	-1.633 (0.219)***	-1.626 (0.227)***
Index of investment risk	-0.400 (1.151)	-0.472 (1.190)	-0.849 (1.216)	-0.474 (1.251)	-0.513 (1.221)
Oppositional governor	-2.134 (1.176)*	-2.194 (1.145)*	-2.063 (1.154)*	-2.264 (1.131)**	-2.208 (1.147)*
Roads (% with advanced surface)	-0.029 (0.014)**	-0.029 (0.014)**	-0.025 (0.015)*	-0.027 (0.013)**	-0.028 (0.014)*
Doctors (per 10,000 people)	-0.019 (0.054)	-0.019 (0.055)	-0.021 (0.054)	-0.015 (0.054)	-0.016 (0.056)
Telephonization (landline phones per 1,000 population, urban areas)	0.029 (0.010)***	0.031 (0.010)***	0.034 (0.009)***	0.034 (0.010)***	0.034 (0.010)***
Life expectancy	0.283 (0.104)***	0.306 (0.105)***	0.259 (0.114)**	0.267 (0.134)**	0.299 (0.114)***
Share of the fuel industry in industrial output	-0.042 (0.032)	-0.041 (0.033)	-0.037 (0.032)	-0.025 (0.047)	-0.038 (0.032)
Constant	-32.196 (12.862)**	-35.031 (13.240)***	-36.154 (12.977)***	-25.864 (25.519)	-34.651 (13.430)**
φ *(spatial correlation coefficient)*	0.186 (0.112)*	0.110 (0.117)	-0.227 (0.130)*	-0.268 (0.472)	-0.008 (0.057)
Variance ratio (pseudo R^2)	0.64	0.63	0.64	0.61	0.63
Number of observations (regions)	79	79	79	79	79
LM test of no spatial lag dependence ($\varphi = 0$): χ^2 (p-value)	2.75 (0.098)*	1.04 (0.31)	3.32 (0.07)*	0.30 (0.59)	0.02 (0.89)
LM test of no spatial correlation in error term ($\lambda = 0$): $\chi 2$ (p-value)	0.93 (0.34)	0.22 (0.64)	1.1 (0.29)	1.34 (0.25)	0.15 (0.70)
Notes: For coefficients robust standard errors in parentheses. For tests p-values in parentheses. Values significant at 10% level are marked with *, at 5% -- with **, at 1% -- with ***.					

There is no statistically significant evidence of strategic interaction between similarly ethnically fractionalized regions (column D), nor is there evidence that the "influence" that neighbours exercise on each other's regional fiscal policy is proportional to their size in terms of population (column B). As expected, when neighbours are defined alphabetically the spatial lag parameter is almost equal to zero (-0.008) and is highly statistically insignificant, proving that the estimation procedure itself is "neutral" (see column E).

The null hypothesis of no spatial correlation in the error term cannot be rejected for any specification and therefore the spatial lag model (R3) appears to be valid. The signs of most control variables are consistent across specifications and with prior expectations. Not surprisingly the stock of debt exhibits positive inertia. Borrowing is higher in the regions with lower investment potential (i.e. in the regions likely to be unpopular with private investors). Poorer government financed public infrastructure (poor quality roads and lack of doctors) tended to result in higher borrowing. At the same time more intensive borrowing was associated with higher levels of economic development (better penetration of landline phones and higher life expectancy). Oppositional governors borrowed less, possibly because they were less hopeful about possible bailout from the central government that did not share their political views. Other variables generally had expected signs but did not reach statistical significance.

4.6. Allocation of transfers and strategic interaction. Note that the implied reaction curves are upward sloping in the case of geographically defined neighbours ($\frac{\partial D_i}{\partial D_{-i}} > 0$) and

downward sloping in the case of income-based weighting matrix ($\frac{\partial D_i}{\partial D_{-i}} < 0$).[37] However this seeming contradiction is in fact consistent with the theoretical analysis that predicted that reaction curves could have either negative or positive slope.

The model implies that the slope will be negative if transfers to the neighbours are mutually exclusive, i.e. the share of all federal transfers allocated to a pool of neighbours remains broadly constant over time. A situation with a positive slope may arise when all "neighbours" can receive additional bailouts simultaneously and the cost of these bailouts will be shared by other regions in the federation. As a result, a share of all federal transfers allocated to a certain pool of neighbours will change over time depending on whether a certain group of regions turn out to be recipients of additional federal assistance or have to finance it for other regions. Hence different signs for geographical and income-based neighbours could be explained by the transfer allocation mechanism. Graphs 1 and 2 show that this is indeed the case.

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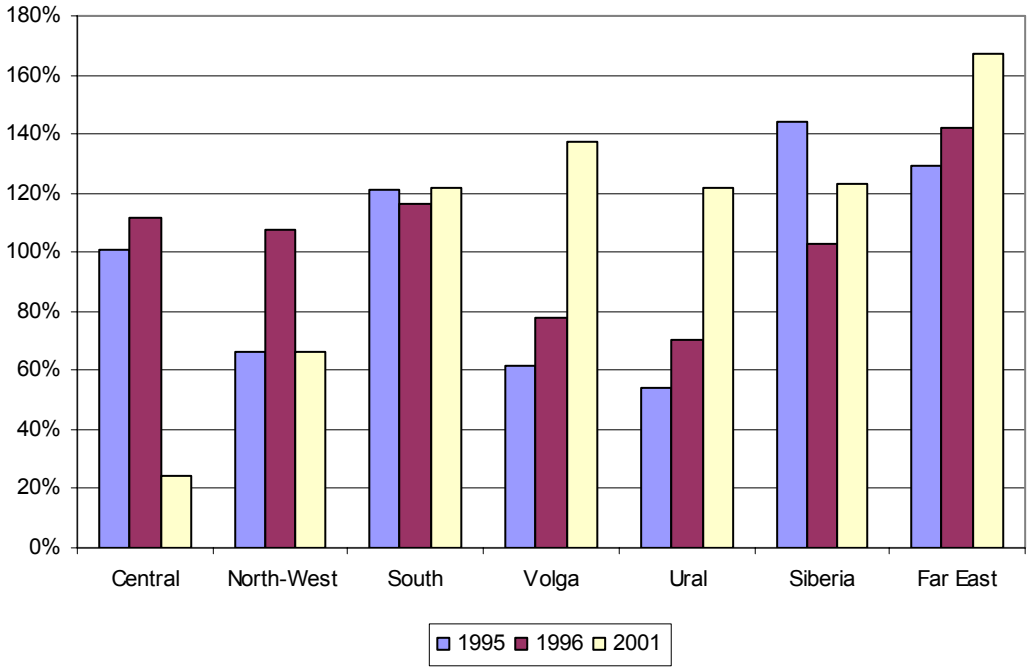
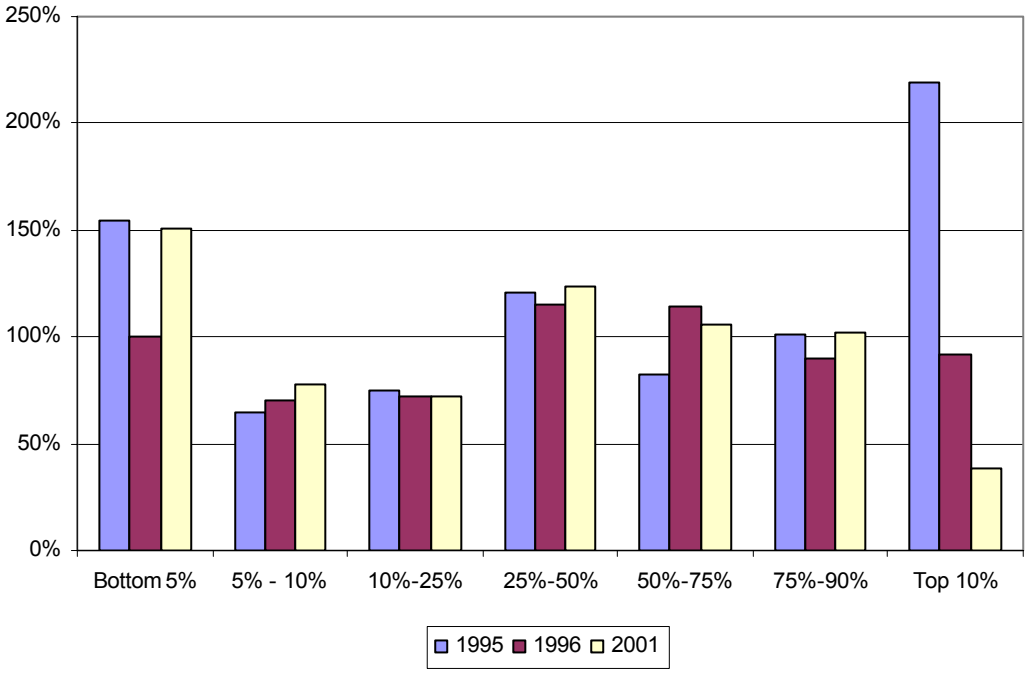
[37] The empirical specification uses logarithms. However $\frac{\partial \ln D_i}{\partial \ln D_{-i}} = \frac{\partial D_i}{\partial D_{-i}} \frac{D_{-i}}{D_i} \Rightarrow$

$sign(\frac{\partial \ln D_i}{\partial \ln D_{-i}}) = sign(\frac{\partial D_i}{\partial D_{-i}} \frac{D_{-i}}{D_i})$ as long as $D_{-i} > 0$.

Graph 1. Average federal transfer as % of the national average, by federal districts



Graph 2. Average federal transfer as % of the national average, by income groups

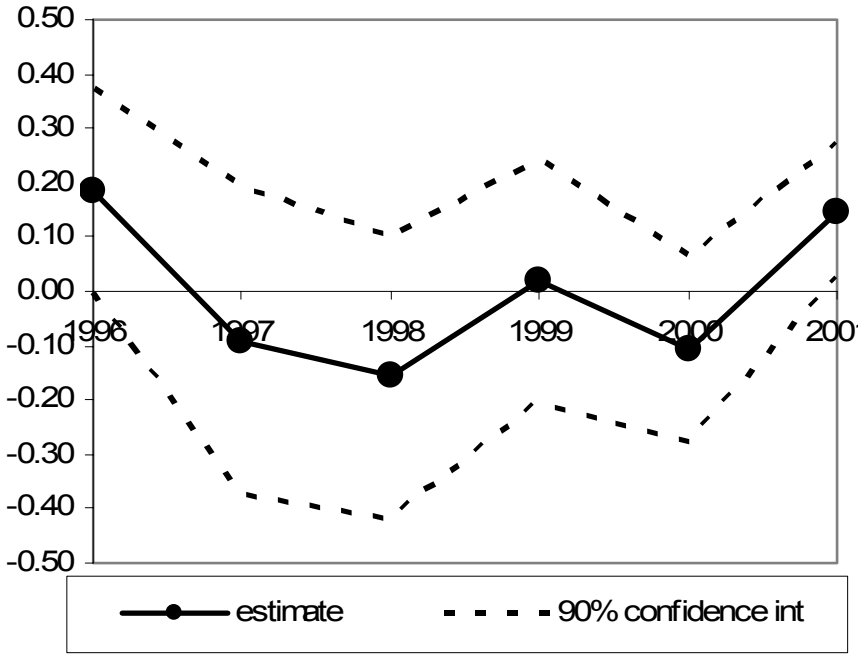


First all regions were classified into seven geographical areas coinciding with federal districts (okrugs) introduced in the late 1990s. The ratio of an average federal transfer within each district to the national average was remarkably volatile with the exception of the Southern Federal District where it was almost constant. Then all regions were classified into seven groups according to the real per capita PPP-adjusted GRP in 1995 (the poorest 5% forming the leftmost group and the richest 10% forming the rightmost one). Graph 2 reveals a striking difference: with the exception of the richest regions whose share of transfers was constantly falling, the average transfers within other 6 groups remained very stable suggesting that if regions with similar income competed for federal transfers then, unlike geographical neighbours, they played a zero sum game.

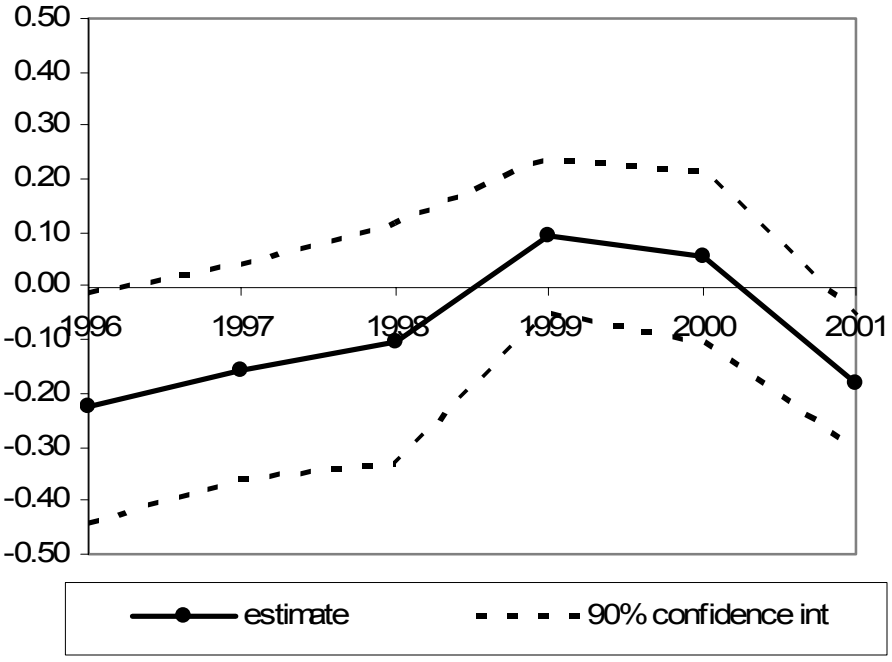
This important difference in the transfer allocation patterns is likely to explain the difference in the type of strategic interaction between geographical neighbours (characterized by positive spatial correlation) and income-based neighbours (characterized by negative spatial correlation). The observed link between the patterns of transfer allocation and the type of strategic interaction between regional governments also reinforces the conclusion that the revealed strategic interaction is indeed driven by competition for federal transfers under the soft budget constraint and not by expenditure competition due to spillover effects or electoral accountability under the hard budget constraint.

4.7. Five years later. When the spatial lag estimation is repeated for the subsequent years the following picture emerges (see graphs 3 and 4). There is no compelling evidence of strategic interaction between the regions in 1997-2000; however the 2001 results mimic those for 1996 suggesting that the regional government budget constraints became soft again. There are two possible explanations of this pattern: a statistical one and a political economy one.

Graph 3. Spatial lag coefficient: neighbours defined by income



Graph 4. Spatial lag coefficient: geographically defined neighbours



The data on subnational government borrowing for the interim period, especially for 1998-2000, were very noisy. Following a sharp depreciation of the national currency the book value of the foreign denominated debt increased sharply. Therefore the recorded borrowing of regional governments during this period could often reflect exchange rate adjustments beyond regional governments' control rather than explicit policy choices. The exchange rate stabilized in 2000 and therefore the data from 2001 onwards are not affected.

On the other hand, the budget constraints of the regional governments could be indeed harder in 1997-2000. In 1997 the federal government entered the period of fiscal distress struggling to finance its short term obligations issued to finance the public sector in the run-up to the 1996 presidential elections.[38] As the oil price plunged the federal government defaulted on its debt in 1998, the national currency started an abrupt depreciation loosing over 75% of its value over the next two years. The acute financial crisis eroded the central government revenue base. With the central government in the state of default and struggling to raise revenue the regional governments could hardly expect generous bailouts from Moscow and therefore their budget constraints may indeed have hardened as the estimation suggests.

With oil prices on the rise and the financial crisis left behind the federal government finance looked healthy again in 2001 (and subsequent years) making the no-bailout policy much less credible and possibly reinstating the bailout expectations on the part of the regional governments. As a result the budget constraints may have become soft again with regions making their borrowing decisions strategically.

If the political economy explanation is valid, the observed pattern for the Russian regions is similar to that identified by Bordignon and Turati (2003) for the Italian regions: Italian regional government budget constraints were generally soft but hardened during the

[38] The cost of borrowing (the rate of return on the GKOs, the short term obligations) reached 160% per annum.

period 1992-1997 when the central government struggled to comply with the European Monetary Union admission criteria and regional governments could not and expect generous federal bailouts.

V. Comparison of different empirical approaches

5.1. Applying the Bordignon-Turati approach. The objective of this section is to compare the results obtained using the suggested approach to testing for soft budget constraints for subnational governments with the results obtained using the alternative approaches surveyed in section II. However only the approach developed by Bordignon and Turati (2003) [BT] can be performed on Russian data: Rodden's (2000) approach requires estimation of VAR models from long time series (at least 20 years of data should be available), while the procedure implemented by Lewis (2003) requires a high rate of defaults on subnational government debt whereas in Russia regional defaults were not very common and those that took place were triggered by the 1998 financial crisis and sharp depreciation of the national currency, i.e. circumstances beyond regional governments' control. The approach by Pettersson-Lidbom and Dahlberg (2003) uses binary variables identifying all cases of bailout provision to individual regions. While such data are available for Swedish municipalities due to the existence of a formal application procedure for the relief grants, in Russia bailouts were implicit in federal transfer allocation rather than explicitly formalized. By contrast, the BT procedure does not rely on very specific data. Moreover, it can be implemented on a year by year basis facilitating the comparison of the results.

The essence of the BT procedure is to estimate the system of equations (5)-(6) having chosen appropriate explanatory variables for per capita subnational government expenditure and valid instruments for per capita federal transfers. The choice of variables that explain the amount of per capita federal funding made available to the regions follows Bordignon and

Turati (2003): the measures of political alignment of the interests of the federal and regional authorities are the dummy variables for oppositional governor and for the year of regional elections, the measure of the regional tax base is pre-transfer regional government revenue per capita, the measures of general fiscal burden are the share of economically active population (the lower the share of economically active population the higher the share of young and elderly and hence the higher the fiscal burden) and the degree of urbanization since per capita costs of providing basic services such as education and health care are higher in rural areas. The size of the region is measured in terms of population and is included to test whether per capita transfers are distributed more generously to small regions (because bailing them out costs less in absolute terms) or to big regions (because they are too big to fail as Wildasin (1997) suggests).

This exhausts the BT recommendations. However a very significant degree of unobserved heterogeneity in both regional needs and bargaining powers of the regions is likely to remain. In order to explain these differences better the lagged values of per capita federal transfers are also included. They also serve two other purposes. Firstly, when forming expectations about the current year's transfers regional governments are most likely to use last year's transfers as a benchmark. Secondly, it seems logical to use the lagged transfers as a regressor for the purposes of comparison since the subnational government debt regressions estimated earlier also included lagged dependent variable.

Table 3. Application of the Bordignon-Turati procedure			
Method	*IV*		*OLS*
Dependent variable	*Federal transfers per capita, log*	*Regional government expenditure per capita, log*	
Stage	*1 out of 2*	*2 out of 2*	*1 out of 1*
Column	**A**	**B**	**C**
Federal transfers per capita, Log			0.080 (0.022)***
Expected federal transfers per capita, Log		0.051 (0.022)**	
Federal transfers per capita, log Lag 1	0.517 (0.094)***		
Regional government pre-transfer revenue per capita Log	-0.153 (0.155)		
Population, Log	-0.228 (0.087)**		
Share of economically active population	0.661 (1.788)	0.327 (0.556)	0.191 (0.544)
Elections year	0.058 (0.112)	-0.006 (0.034)	-0.019 (0.032)
Oppositional governor	-0.262 (0.179)	-0.058 (0.042)	-0.051 (0.049)
Urbanization	0.002 (0.007)		
Regional government expenditure per capita, log Lag 1		0.701 (0.066)***	0.665 (0.063)***
GRP per capita, Log		0.199 (0.099)**	0.258 (0.094)***
Cumulative government debt burden per capita, Log		0.013 (0.011)	0.014 (0.010)
Registered crime (per 100,000 population)		-0.00003 (0.00004)	-0.00001 (0.00004)
Second shift at school, %		0.0066 (0.0044)	0.0080 (0.0044)
Roads (% with advanced surface)		-0.0008 (0.0009)	-0.0003 (0.0008)
Doctors (per 10,000 people)		0.0012 (0.0023)	0.0003 (0.0023)
Telephonization (landline phones per 1,000 population, urban areas)		0.0006 (0.0005)	0.0006 (0.0005)
Life expectancy		0.0013 (0.0101)	0.006 (0.010)
Infant mortality (per 1,000 born)		0.00003 (0.00353)	0.0007 (0.0034)
Constant	4.100 (1.362)***	-0.016 (1.234)	-0.821 (1.221)
R^2	0.77	0.94	0.95
Number of observations (regions)	79	79	79
Notes: For coefficients robust standard errors in parentheses. Values significant at 10% level are marked with *, at 5% -- with **, at 1% -- with ***.			

The second stage regression (explaining per capita regional government expenditure) includes the predicted federal transfers (fitted values from the first stage regressions) and (following the BT recommendations) various measures of regional economic development level (crime rate, school capacity, number of doctors per capita, quality of roads, landline phones penetration rate, life expectancy, and infant mortality) as well as GRP per capita, the debt burden of the regional government (measured by per capita cumulative borrowing over the previous years) political variables (the oppositional governor dummy and the elections year dummy) and the share of economically active population. The lagged value of per capita regional government expenditure is also included.

5.2. Results. Table 3 summarizes the results obtained for the year 1996. As in BT (2003) the results of one stage OLS regression of regional government expenditure on federal transfers and control variables are also reported (column C), although they suffer from expectations bias if regional expectations about federal funding indeed influence spending decisions (see McCallum (1976) for details of instrumental variables [IV] estimation of rational expectations models). Column B shows the results of IV estimation,[39] which suggest that a 10% increase in expected federal transfers per capita is estimated to lead to a 0.52% increase in regional government expenditure. This effect is statistically significant at the 1% level suggesting that in 1996 Russian regional government budget constraints were soft. This coincides with the conclusion obtained earlier using the new approach.

In the subsequent years the two methods pointed towards the same conclusions (see table 4 for the summary) with the exception of 2001. In this year the BT procedure does not support the earlier finding that the regional government budget constraints softened again. The disagreement about the status of regional government budget constraints in 2001 may be

[39] Column A reports the first stage results.

for two reasons. The first is a potential misspecification of one of the underlying regression equations. For instance the BT procedure relies on the choice of strong valid instruments for per capita federal transfers (McCallum, 1976), which is itself a challenging task.

The second reason is purely statistical: the disagreement may be due to a type I error of the new approach or type II error of the BT approach because both inevitably happen with positive probability. Both approaches test the null hypothesis of the hard budget constraint. If budget constraints are indeed hard there is still a 10% chance that the spatial correlation procedure will reject this hypothesis in favour of the soft budget constraint (if the test uses the 10% significance level). If budget constraints are in reality soft the BT test may fail to reject the null hypothesis of hard budget constraints and the probability of this happening is hard to establish since the power of the test depends on how soft the budget constraints are.

Table 4. Comparison of the results of two different empirical approaches

Approach	*Bordignon-Turati*			*This paper*	
Year	Coefficient of transfers	Coefficient of expected transfers	SBC or HBC?	SBC or HBC?	Same conclusion?
1996	0.080 (0.022)***	0.051 (0.022)**	SBC	SBC	Yes
1997	0.021 (0.013)*	-0.033 (0.042)	HBC	HBC	Yes
1998	0.005 (0.021)	-0.005 (0.023)	HBC	HBC	Yes
1999	0.047 (0.015)***	0.014 (0.014)	HBC	HBC	Yes
2000	0.013 (0.020)	0.007 (0.020)	HBC	HBC	Yes
2001	0.034 (0.029)	0.020 (0.027)	HBC	SBC	No

Note: Robust standard errors in parentheses. Values significant at 10% level are marked with *, at 5% -- with **, at 1% -- with ***

Faced with conflicting empirical results and in the absence of a third independent applicable test one is limited to making a judgement about the status of budget constraints on the basis of case studies of intergovernmental fiscal relations in Russia. It has been mentioned

in subsection 4.4 that the general consensus in the literature points towards soft budget constraints. Furthermore, Kurlyandskaya and Nikolayenko (2005) in the Center for Fiscal Policy survey of the current decentralization arrangements in Russia specifically name soft budget constraints for regional governments as one of the major problems that need to be addressed (p. 20). Dabla-Norris and Wade (2002) in their overview of decentralization reforms in the transition economies point out that of all economies in transition Russia and Ukraine were characterized by particularly soft subnational government budget constraints. Therefore it seems more likely that it is the BT procedure that fails to diagnose the softness of budget constraints in 2001 while the proposed method identifies them correctly.

VI. Conclusion

The dynamic inconsistency of a no-bailout policy leaves no room for an easy solution to the problem of soft budget constraints for subnational governments resulting in fiscal indiscipline. Different measures aimed at alleviating the problem of soft budget constraints have been more successful in some countries and less successful in others, so that in order to assess the effectiveness of such measures it is crucial to be able to assess the softness of budget constraints for subnational governments under different decentralization arrangements.

The methods of empirical analysis suggested in the literature in recent years have usually relied on very specific data and thus cannot be broadly applied. Or, when broadly applicable, they have required a rather strong assumption of rational expectations. Therefore the set of existing methods is not sufficient to address the issue. This paper has made an attempt to bridge the gap between the theory of soft budget constraints for subnational governments and the empirical work by suggesting a new approach to testing for the soft budget constraint.

The suggested approach is based on the notion of strategic interaction between regions

competing for potential federal bailouts under soft budget constraints. A simple model shows that under soft budget constraints regional governments' decisions to borrow will depend on other regional governments' decisions to borrow, while under hard budget constraints and low subnational fiscal autonomy borrowing decisions (as well as other fiscal decisions) should not depend on those of the neighbours. Thus to test for soft budget constraints for subnational governments one can test for a non-zero spatial correlation coefficient in a spatial lag model of regional government borrowing. This approach complements the existing ones and has the advantages of being non-data-intensive and not relying on the rational expectations assumption. The method can be applied to cross-sectional or panel data and is suitable for a large number of countries characterized by relatively low subnational fiscal autonomy (in particular, very limited freedom to levy taxes at the subnational level is a prerequisite for a meaningful interpretation of the results).

The developed methodology was implemented using the data on borrowing by seventy-nine Russian regional governments in 1996 (the year of presidential elections and the first year of intensive borrowing by the Russian regions). The empirical analysis confirmed that budget constraints faced by regional governments were soft. Namely, spatial lag estimation revealed that regional governments responded significantly positively to increases in borrowing by their geographical neighbours and significantly negatively to increases in borrowing by regions with similar income. The difference in the slopes of the empirical reaction curves is consistent with the predictions of the theoretical model. The analysis of the allocation of transfer across regions revealed that the shares of the overall amount of federal transfers accruing to regions with similar income were constant over time resulting in a zero-sum game of competition for transfers and negatively sloped reaction curves. This was not the case for geographical neighbours, all of which could enjoy simultaneous increases (or

decreases) in federal funding, which explains the positive spatial correlation coefficient in the case of geographical neighbours. The fact that the nature of strategic interaction between regions depended on the patterns of federal transfer allocation provides another piece of evidence in support of the soft budget constraint hypothesis.

In the subsequent years (1997-2000) no evidence of soft budget constraints was found. This could be due to hardening of subnational government budget constraints during the years of severe fiscal distress for the federal government. Once federal finance recovered from the 1998 crisis and low oil prices the regional government budget constraints seem to have become soft again: the spatial lag coefficients estimated for 2001 mimic those for 1996.

Fighting soft budget constraints is not an easy task. The Russian federal government made emphasis on tightening control over regional finance in the early 2000s. This measure may achieve hard budget constraints and it will be interesting to check empirically in the future if it has succeeded. However, international experience suggests that, unless coupled with credible commitment to transparent and strictly formula-based allocation of transfers, it may fail.

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Appendix 1. Proofs

Section 3.2. Decision making. The regional government maximizes:

$$\max_{c_i^{(2)}} \beta_i \ln c_i^{(2)} + (1-\beta_i)\lambda_i \ln(\tau y_i^{(2)} + \tau y_{-i}^{(2)} - T_i - T_{-i} - C^{(2)}) +$$

$$(1-\beta_i)\mu_i \ln(t y_i^{(2)} + T_i - D_i(1+r) - c_i^{(2)}) + (1-\beta_i)(1-\lambda_i-\mu_i)\ln[(1-t-\tau)y_i^{(2)}] \quad (14)$$

The first order condition is:

$$\frac{\partial V_i^{(2)}}{\partial c_i^{(2)}} = \frac{\beta_i}{c_i^{(2)}} - \frac{(1-\beta_i)\mu_i}{t y_i^{(2)} + T_i - D_i(1+r) - c_i^{(2)}} = 0 \quad (A1)$$

Hence[40]

$$c_i^{(2)} = \frac{\beta_i}{\beta_i + \mu_i(1-\beta_i)}[\, t y_i^{(2)} + T_i - D_i(1+r)] \quad (A2)$$

This yields the following expression for the optimal value of the regional government's objective function at the second stage:

$$V_i^{(2)} = \beta_i \ln c_i^{(2)} + (1-\beta_i)\lambda_i \ln[\tau y_i^{(2)} + \tau y_{-i}^{(2)} - T_i - T_{-i} - C^{(2)}] +$$

$$(1-\beta_i)\mu_i \ln[t y_i^{(2)} + T_i - D_i(1+r) - c_i^{(2)}] + (1-\beta_i)(1-\lambda_i-\mu_i)\ln[(1-t-\tau)y_i^{(2)}] =$$

$$const + (\beta_i + (1-\beta_i)\mu_i)\ln[t y_i^{(2)} + T_i - (1+r)D_i] \quad (A3)$$

where *const* is a term independent of T_i and D_i.

Proposition 1. The optimal transfer policy. The central government maximizes:

$$\max_{C^{(2)}, T_1, T_2} \beta \ln C^{(2)} + \tfrac{1}{2}(1-\beta)(\lambda_1+\lambda_2)\ln[\tau(y_1^{(2)} + y_2^{(2)}) - T_1 - T_2 - C^{(2)}] +$$

$$\tfrac{1}{2}(1-\beta)\mu_1 \ln[t y_1^{(2)} + T_1 - D_1(1+r) - c_1^{(2)}] + \tfrac{1}{2}(1-\beta)\mu_2 \ln[t y_2^{(2)} + T_2 - D_2(1+r) - c_2^{(2)}] \quad (16)$$

---

[40] It is straightforward to see that $\frac{\partial^2 V_i^{(2)}}{\left(\partial c_i^{(2)}\right)^2} < 0$ so that the second order condition for maximum is satisfied.

Plugging in $c_i^{(2)}$ as defined by equality (A2) one obtains the following first order conditions:[41]

$$\frac{\partial V^{(2)}}{\partial C^{(2)}} = \frac{\beta}{C^{(2)}} - \frac{\frac{1}{2}(1 - \beta)(\lambda_1 + \lambda_2)}{\tau(y_1^{(2)} + y_2^{(2)}) - T_1 - T_2 - C^{(2)}} = 0 \tag{A4}$$

$$\frac{\partial V^{(2)}}{\partial T_1} = \frac{\frac{1}{2}(1 - \beta)\mu_1}{ty_1^{(2)} + T_1 - D_1(1 + r)} - \frac{\frac{1}{2}(1 - \beta)(\lambda_1 + \lambda_2)}{\tau(y_1^{(2)} + y_2^{(2)}) - T_1 - T_2 - C^{(2)}} = 0 \tag{A5}$$

$$\frac{\partial V^{(2)}}{\partial T_2} = \frac{\frac{1}{2}(1 - \beta)\mu_2}{ty_2^{(2)} + T_2 - D_2(1 + r)} - \frac{\frac{1}{2}(1 - \beta)(\lambda_1 + \lambda_2)}{\tau(y_1^{(2)} + y_2^{(2)}) - T_1 - T_2 - C^{(2)}} = 0 \tag{A6}$$

Equations (A4)-(A6) imply that:

$$\frac{2\beta}{C^{(2)}} = \frac{(1 - \beta)\mu_1}{ty_1^{(2)} + T_1 - D_1(1 + r)} = \frac{(1 - \beta)\mu_2}{ty_2^{(2)} + T_2 - D_2(1 + r)} \Rightarrow \tag{A7}$$

$$C^{(2)} = \frac{2\beta}{(1 - \beta)\mu_1}[\, ty_1^{(2)} + T_1 - D_1(1 + r)] \text{ and} \tag{A8}$$

$$T_2 = \frac{\mu_2}{\mu_1} T_1 + D_2(1 + r) - \frac{\mu_2}{\mu_1} D_1(1 + r) - ty_2^{(2)} + \frac{\mu_2}{\mu_1} ty_1^{(2)} \tag{A9}$$

Plugging $C^{(2)}$ from (A8) and T_2 from (A9) into the first order condition (A4) and denoting $\gamma = 2\frac{\beta}{1 - \beta}$ yields:[42]

$$T_1 = \frac{1}{\lambda_1 + \lambda_2 + \mu_1 + \mu_2 + \gamma}[\mu_2 t(y_2^{(2)} - y_1^{(2)}) + (\mu_1 - \mu_2)ty_2^{(2)} + \tag{A10}$$

$$\mu_1\tau(y_1^{(2)} + y_2^{(2)}) - (\lambda_1 + \lambda_2)ty_1^{(2)} - \gamma ty_1^{(2)} + (\lambda_1 + \lambda_2 + \mu_2 + \gamma)(1 + r)D_1 - \mu_1(1 + r)D_2]$$

$$T_2 = \frac{1}{\lambda_1 + \lambda_2 + \mu_1 + \mu_2 + \gamma}[\mu_1 t(y_1^{(2)} - y_2^{(2)}) + (\mu_2 - \mu_1)ty_1^{(2)} + \tag{A11}$$

[41] The second order conditions for maximum are satisfied. The derivation is available upon request.
[42] $\beta \neq 1$, see footnote 17.

$\mu_2\tau(y_1^{(2)} + y_2^{(2)}) - (\lambda_1 + \lambda_2)ty_2^{(2)} - \gamma ty_2^{(2)} + (\lambda_1 + \lambda_2 + \mu_1 + \gamma)(1 + r)D_2 - \mu_2(1 + r)D_1]$

Substituting $\eta_i = \dfrac{\mu_i}{\lambda_i + \lambda_{-i} + \mu_i + \mu_{-i} + \gamma}$ one obtains equations (17) and (18).

Proposition 2. Borrowing without strategic interaction. If transfers are not revised as part of the game the maximization problem of the regional government is:

$$\max_{c_i^{(1)}, D_i} [\beta_i \ln c_i^{(1)} + (1 - \beta_i)\mu_i \ln(ty_i^{(1)} + D_i^{HBC} - c_i^{(1)}) + \tag{15}$$

$\rho(\beta_i + (1 - \beta_i)\mu_i)\ln[t\, y_i^{(2)} + T_i^{HBC} - (1 + r)D_i^{HBC}]$

The first order conditions are:[43]

$$\frac{\partial V_i}{\partial c_i^{(1)}} = \frac{\beta_i}{c_i^{(1)}} - \frac{(1 - \beta_i)\mu_i}{ty_i^{(1)} + D_i^{HBC} - c_i^{(1)}} = 0 \tag{A12}$$

$$\frac{\partial V_i}{\partial D_i^{HBC}} = \frac{(1 - \beta_i)\mu_i}{ty_i^{(1)} + D_i^{HBC} - c_i^{(1)}} - \rho(1 + r)\frac{\beta_i + (1 - \beta_i)\mu_i}{ty_i^{(2)} + T_i^{HBC} - (1 + r)D_i^{HBC}} = 0 \tag{A13}$$

From condition (A12):

$$c_i^{(1)} = \frac{\beta_i}{(1 - \beta_i)\mu_i + \beta_i}[ty_i^{(1)} + D_i^{HBC}] \tag{A14}$$

Hence:

$$D_i^{HBC} = \frac{1}{(1 + \rho)(1 + r)}[T_i^{HBC} + t(y_i^{(2)} - \rho(1 + r)y_i^{(1)})] \tag{19}$$

Proposition 3. Borrowing with strategic interaction. If the expected federal transfer is a function of regional borrowing ($T_i^{SBC} = T_i(D_i^{SBC}; D_{-i}^{SBC})$) the first order condition (A13) undergoes the following modification (while condition (A12) remains unchanged):[44]

[43] The second order conditions for maximum are satisfied. The derivation is available upon request.
[44] Since regional governments fail to take into account the impact of their borrowing on the national public good provision there is no additional term in the first order condition (A15).

$$\frac{\partial V_i}{\partial D_i^{SBC}} = \frac{(1 - \beta_i)\mu_i}{ty_i^{(1)} + D_i^{SBC} - c_i^{(1)}} - \rho[1 + r - \frac{\partial T_i^{SBC}}{\partial D_i^{SBC}}]\frac{\beta_i + (1-\beta_i)\mu_i}{ty_i^{(2)} + T_i^{SBC} - (1+r)D_i^{SBC}} = 0 \qquad \text{(A15)}$$

From formula (18):

$$\frac{\partial T_i^{SBC}}{\partial D_i^{SBC}} = (1 - \eta_i)(1 + r) \text{ and also} \qquad \text{(A16)}$$

$$T_i^{SBC} = T_i^{HBC} + (1 - \eta_i)(1 + r)D_i^{SBC} - \eta_i(1 + r)D_{-i}^{SBC} \qquad \text{(A17)}$$

Therefore:

$$D_i^{SBC} = \frac{1}{(1 + \rho)(1 + r)\eta_i}[T_i^{HBC} + t(y_i^{(2)} - \rho(1 + r)\eta_i y_i^{(1)}) - \eta_i(1 + r)D_{-i}^{SBC}] \qquad (20)$$

Proposition 4. The reaction curves. Follows directly from differentiating expression (20) with respect to D_{-i}^{SBC}.

Proposition 5. The reaction curves with a possibility of default. The first order condition (A15) should be modified to account for the fact that the debt will not be repaid by the region. Using equality (A16) one obtains:

$$\frac{\partial V_i}{\partial D_i^{Def}} = \frac{(1-\beta_i)\mu_i}{ty_i^{(1)} + D_i^{Def} - c_i^{(1)}} - \rho(1 + r)\,\eta_i\frac{\beta_i + (1-\beta_i)\mu_i}{ty_i^{(2)} + T_i^{SBC}} = 0 \qquad \text{(A18)}$$

Using expressions (A14) and (A17) one solves for D_i^{Def}:

$$D_i^{Def} = \frac{t[y_i^{(2)} - \rho(1+r)y_i^{(1)}] + T_i^{HBC} - \eta_i(1+r)D_{-i}^{SBC}}{(1+r)[\eta_i(1+\rho) - 1]} \qquad \text{(A19)}$$

Differentiating (A19) yields:

$$\frac{\partial D_i^{Def}}{\partial D_{-i}^{SBC}} = \frac{\eta_i}{1 - \eta_i(1+\rho)} \qquad (23)$$

$$\frac{\eta_i}{1-\eta_i(1+\rho)} > 0 \text{ if}$$

$$\eta_i = \frac{\mu_i}{\lambda_i + \lambda_{-i} + \mu_i + \mu_{-i} + \gamma} < \frac{1}{(1+\rho)} \tag{A20}$$

Dividing the numerator and the denominator of the left hand side of (A20) by μ_i one obtains inequality (22).

Example: A symmetric equilibrium with identical regions. To illustrate the situation when Nash reaction curves are downward sloping but the regional government debt under the soft budget constraint is clearly excessive consider the case of two identical regions. Also assume that the rate of interest and the discount rate coincide so that $\rho = \frac{1}{(1+r)}$. As follows from equation (19), under the hard budget constraint each region will borrow (subscripts *i* are dropped due to regions being identical):

$$D^{HBC} = \frac{1}{(2+r)}[T^{HBC} + t(y_i^{(2)} - y_i^{(1)})] \tag{A21}$$

Assuming no temporary deviations of income ($y_i^{(2)} = y_i^{(1)} = y$) each region borrows:

$$D^{HBC} = \frac{T^{HBC}}{(2+r)} \tag{A22}$$

An appropriate simplification of equation (20) gives the condition for a symmetric Nash equilibrium under the soft budget constraint:

$$D^{SBC} = \frac{1}{(2+r)\eta}[T^{HBC} + t(y - \eta y) - \eta(1+r)D^{SBC}] \Rightarrow \tag{A23}$$

$$D^{SBC} = \frac{1}{\eta}[T^{HBC} + t(1-\eta)y] = \frac{2+r}{\eta}D^{HBC} + \frac{1-\eta}{\eta}ty >> D^{HBC} \tag{A24}$$

To estimate the actual extent of overborrowing, suppose that governments are benevolent ($\beta = \gamma = 0$) and the preference parameters for the national and local public goods

are $\lambda = 0.25$ and $\mu = 0.15$ respectively (with the Cobb-Douglas preferences this would correspond to the optimal size of the public sector equal to 40% GDP). Further assume that the tax rates t and τ are balanced in such a way as to eliminate the vertical fiscal imbalance (and hence there is no decentralization component in the transfers). Under these assumptions the transfers would have been zero *on average* under the hard budget constraint (although depending on the realization of regional incomes *in particular years* redistribution by means of intergovernmental transfers would have still taken place).

In this case the excessive subnational government debt under the soft budget constraint is equal to $\frac{1-\eta}{\eta}$ times the regional government own revenue ty. Calculations reveal that this amounts to 223% of own government revenue. Subnational government own revenue varies across countries but in most cases constitutes at least 5% GDP implying that the excessive subnational government debt adds up to 11% GDP.

Appendix 2. Data sources

The data are taken from Regiony Rossii ("Regions of Russia" [RR], Goskomstat official statistical yearbook) 2002 and earlier years, with the following exceptions:

Data on regional debt: Freinkman et al. (1999), Annex Table 4; Institute for Fiscal Policy, Moscow (available at http://www.budgetrf.ru); The Ministry of Finance of the Russian Federation for years after 2000 (available at http://www.minfin.ru).

Electoral data for Russian regions: Vybory glav ispolnitelnoy vlasti subyektov Rossiyskoy Federatsii. 1995-1997. Elektoralnaya statistika, Moscow: Ves Mir, 1997. ("The elections of the governors of the regions of the Russian Federation. 1995-1997. Electoral statistics"); Central Election Commission of the Russian Federation (available at http://www.cikrf.ru).

Fiscal data on regional and municipal budgets: Finansy v Rossii [FvR] ("Finance in Russia", Goskomstat official statistical edition) 1996, 1998, 2000; The Ministry of Finance of the Russian Federation for years after 2000 (available at http://www.minfin.ru); and the World Bank staff.

Data on ethnic composition of population: Rossiyskiy Statisticheskiy Ezhegodnik [RSE] ("The statistical yearbook of Russia", Goskomstat official statistical yearbook) 2002.

Indices of investment risk and investment potential by regions: Expert, #39 (398) 19 October 1998, available at http://www.expert.ru.

Subsistence minimum: RR 2002 and earlier years and World Bank Staff estimates.