ELSEVIER

Economic Systems 31 (2007) 412–422

ECONOMIC SYSTEMS

www.elsevier.com/locate/ecosys

Corruption: Theory and evidence from the Russian Federation

Manouchehr Mokhtari [a,*], Irina Grafova [b]

[a] *1204 Marie Mount Hall, School of Public Health, University of Maryland-College Park, College Park, MD 20742, United States*

[b] *335 George Street, School of Public Health, University of Medicine and Dentistry of New Jersey, New Brunswick, NJ 08903, United States*

Received 7 July 2006; received in revised form 8 January 2007; accepted 26 April 2007

Abstract

In this paper, we provide theory and evidence on the problem of corruption in the Russian Federation. Our theoretical model indicates that in the presence of official corruption, the numbers of tax inspection (collection) employees could be inversely related to per capita tax collection. Our empirical analysis supports our theoretical model, shedding light on one of the most intractable problems in the Russian Federation.

JEL classification: P2; H2; H3

Keywords: Economic transition; Corruption; Tax collection

1. Introduction

The 1993 Russian Constitution created a federation of 89 heterogeneous subjects, while removing the Soviet command system that had harnessed the centrifugal forces in Russia for half a century (see Table 1). This has led to both positive and negative outcomes. Similar to the implementation of its central command system, Russia's tumultuous moves towards a market based system have been based on trial and error rather than a blueprint (Gregory and Lazarev, 2002; Lazarev and Gregory, 2003; Shleifer and Treisman, 2000). In the 1990s, the profound weakness of the Russian Federations's fiscal system was a catalyst to empowerment of its sub-national authorities, as well as regional tax inspectors. By the late 1990s, shortfalls in tax

* Corresponding author. Tel.: +1 301 405 3299.
E-mail address: mokhtari@umd.edu (M. Mokhtari).

0939-3625/$ – see front matter
doi:10.1016/j.ecosys.2007.04.003

Table 1
Total taxes owed, including arrears and deferrals, by region (sub-nationals)

	Regions	Total tax debts			Arrears (*nedoimka*)			Deferrals		
		Consolidated budget		Federal share (%)	Consolidated budget		Federal share (%)	Consolidated budget		Federal share (%)
		Million rubles	%		Million rubles	%		Million rubles	%	
1	Republic of Adygeya	181	0.1	65	85	0.0	58	96	0.4	72
2	Republic of Bashkortostan	14000	5.4	33	13213	5.6	34	787	3.4	11
3	Republic of Buriatia	789	0.3	70	744	0.3	71	44	0.2	43
4	Republic of Altai	238	0.1	85	234	0.1	85	4	0.0	65
5	Republic of dagestan	520	0.2	49	464	0.2	47	56	0.2	69
6	Ingush republic	32	0.0	48	30	0.0	48	2	0.0	49
7	Kabarda-Balkar republic	1236	0.5	75	1179	0.5	77	57	0.2	37
8	Republic of Kalmykia	352	0.1	71	327	0.1	70	25	0.1	78
9	Karachayevo-Circassian Republic	324	0.1	59	316	0.1	59	7	0.0	61
10	Republic of Karelia	1351	0.5	54	1143	0.5	54	208	0.9	51
11	Republic of Komi	4561	1.8	70	4254	1.8	70	308	1.3	60
12	Republic of Mari El	614	0.2	76	582	0.2	76	32	0.1	69
13	Republic of Mordovia	896	0.3	74	852	0.4	75	44	0.2	64
14	Republic of Sakha	3233	1.2	71	3045	1.3	75	188	0.8	8
15	Republic of North Osetia	376	0.1	56	375	0.2	56	1	0.0	84
16	Republic of Tatarstan	7516	2.9	53	7106	3.0	54	410	1.7	51
17	Republic of Tyva	94	0.0	54	82	0.0	56	12	0.1	42
18	Udmurt Republic	1404	0.5	66	1339	0.6	66	65	0.3	51
19	Republic of Khakasia	1046	0.4	74	989	0.4	74	57	0.2	72
20	Chuvash Republic	1165	0.4	75	1012	0.4	76	152	0.7	68
21	Altai Krai	2061	0.8	79	1962	0.8	80	98	0.4	55
22	Krasnodar Krai	3806	1.5	58	3426	1.5	56	380	1.6	73
23	Krasnoyarsk Krai	7036	2.7	66	6465	2.7	67	571	2.4	46
24	Primorski Krai	3326	1.3	47	3049	1.3	48	277	1.2	38
25	Stavropol Krai	2095	0.8	63	1767	0.7	63	329	1.4	62
26	Khabarovsk Krai	3399	1.3	61	3109	1.3	65	291	1.2	11
27	Amur Oblast	1660	0.6	54	1555	0.7	55	105	0.4	32
28	Arkhangelsk Oblast	2382	0.9	65	2178	0.9	65	204	0.9	60

Table 1 (*Continued*)

	Regions	Total tax debts			Arrears (*nedoimka*)			Deferrals		
		Consolidated budget		Federal share (%)	Consolidated budget		Federal share (%)	Consolidated budget		Federal share (%)
		Million rubles	%		Million rubles	%		Million rubles	%	
29	Astrakhan Oblast	710	0.3	74	621	0.3	76	89	0.4	57
30	Belgorod Oblast	1712	0.7	66	1523	0.6	67	189	0.8	62
31	Bryansk Oblast	1336	0.5	61	1001	0.4	61	336	1.4	61
32	Vladimir Oblast	1568	0.6	57	1510	0.6	57	58	0.2	55
33	Volgograd Oblast	3302	1.3	51	3081	1.3	51	221	0.9	52
34	Vologda Oblast	1690	0.7	61	1474	0.6	62	216	0.9	54
35	Voronezh Oblast	3283	1.3	66	3146	1.3	66	137	0.6	51
36	Ivanovo Oblast	1638	0.6	68	1411	0.6	69	226	1.0	62
37	Irkutsk Oblast	6370	2.5	67	6042	2.6	66	329	1.4	75
38	Kaliningrad Oblast	690	0.3	51	648	0.3	49	42	0.2	72
39	Kaluga Oblast	767	0.3	56	753	0.3	56	15	0.1	47
40	Kamchatka Oblast	928	0.4	52	914	0.4	52	15	0.1	71
41	Kemerovo Oblast	10989	4.2	72	8953	3.8	74	2036	8.7	63
42	Kirov Oblast	1940	0.7	57	1860	0.8	57	80	0.3	52
43	Kostroma Oblast	1160	0.4	76	1103	0.5	77	57	0.2	58
44	Kurgan Oblast	894	0.3	69	826	0.4	70	68	0.3	60
45	Kursk Oblast	2278	0.9	64	2157	0.9	63	121	0.5	79
46	Leningrad Oblast	2079	0.8	60	1693	0.7	65	386	1.6	39
47	Lipetsk Oblast	819	0.3	52	640	0.3	57	179	0.8	33
48	Magadan Oblast	1419	0.5	53	1395	0.6	53	24	0.1	53
49	Moscow Oblast	15896	6.1	74	15273	6.5	76	623	2.7	36
50	Murmansk Oblast	2708	1.0	62	2494	1.1	65	215	0.9	28
51	Nizhny Novgorod Oblast	8065	3.1	71	7266	3.1	71	799	3.4	71
52	Novgorod Oblast	461	0.2	55	388	0.2	58	72	0.3	41
53	Novosibirsk Oblast	3028	1.2	64	2891	1.2	63	137	0.6	89
54	Omsk Oblast	2733	1.1	66	2550	1.1	70	183	0.8	19
55	Orenburg Oblast	4042	1.6	66	3545	1.5	63	497	2.1	86
56	Oryol Oblast	448	0.2	52	411	0.2	53	37	0.2	43
57	Penza Oblast	1275	0.5	58	1200	0.5	60	74	0.3	37
58	Perm Oblast	4894	1.9	62	4795	2.0	63	99	0.4	18

59	Pskov Oblast	534	0.2	62	515	0.2	63	19	0.1	36
60	Rostov Oblast	4874	1.9	55	4616	2.0	56	258	1.1	38
61	Ryazan Oblast	1601	0.6	74	1572	0.7	75	29	0.1	45
62	Samara Oblast	12420	4.8	63	11062	4.7	62	1357	5.8	76
63	Saratov Oblast	3349	1.3	67	3048	1.3	69	301	1.3	41
64	Sakhalin Oblast	1678	0.6	56	1519	0.6	57	159	0.7	47
65	Sverdlovsk Oblast	10246	4.0	73	9505	4.0	75	741	3.2	51
66	Smolensk Oblast	1558	0.6	50	1538	0.7	50	20	0.1	41
67	Tambov Oblast	1000	0.4	58	768	0.3	61	232	1.0	47
68	Tver Oblast	2425	0.9	65	2274	1.0	65	151	0.6	55
69	Tomsk Oblast	1762	0.7	64	1579	0.7	67	182	0.8	47
70	Tula Oblast	2051	0.8	59	1944	0.8	60	108	0.5	44
71	Tumen Oblast	1472	0.6	60	1409	0.6	59	63	0.3	69
72	Ulianovsk Oblast	2690	1.0	80	2536	1.1	81	154	0.7	59
73	Chelyabinsk Oblast	7220	2.8	65	5954	2.5	66	1266	5.4	60
74	Chita Oblast	932	0.4	58	773	0.3	60	159	0.7	49
75	Yaroslavl Oblast	3022	1.2	64	2966	1.3	65	56	0.2	38
76	City of Moscow	17134	6.6	49	16766	7.1	49	367	1.6	31
77	City of St.-Petersburg	3457	1.3	60	3236	1.4	62	221	0.9	35
78	Jewish AO	194	0.1	59	167	0.1	60	27	0.1	56
79	Aginsk-Buriat AO	20	0.0	52	16	0.0	47	3	0.0	72
80	Komi-Perm AO	89	0.0	56	84	0.0	57	5	0.0	49
81	Koryak AO	180	0.1	66	177	0.1	66	3	0.0	57
82	Nenets AO	120	0.0	42	118	0.1	41	2	0.0	55
83	Tajmyr AO	324	0.1	58	222	0.1	59	102	0.4	56
84	Ust-Orda Buriat AO	30	0.0	66	28	0.0	64	2	0.0	100
85	Khanty-Mansi AO	14476	5.6	53	10612	4.5	68	3864	16.5	11
86	Chukotka AO	468	0.2	55	466	0.2	55	2	0.0	9
87	Evenk AO	61	0.0	79	59	0.0	80	1	0.0	55
88	Yamal-Nenets AO	8810	3.4	76	7610	3.2	78	1200	5.1	67
	Russian Federation	259010	100.0	62	235583	100.0	63	23427	100.0	47

revenues led to significant strategic behavior by strong regional governors who unofficially controlled the federal tax inspectors in their regions (OECD, 2000). Inability of the federal authorities to match private sector pay for their tax inspectors created less incentive for tax collection and fertile ground for corruption among the tax inspectors.

Scholars agree that the Russian Federation (RF) is marred by inappropriate fiscal incentives and corruption. Inappropriate fiscal incentives and corruption are the cause of laggard economic development in the RF (Shleifer, 1997). In particular, lack of well-defined tax rights and enforcement, corruption, and sub-national resistance to federal tax collection are creating negative economic outcomes (Berkowitz and Li, 2000; Treisman, 2003; Shleifer and Treisman, 2000; Cai and Treisman, 2004; Ponomareva and Zhuravskaya, 2004). In this paper, we demonstrate that corruption among tax inspection employees is negatively associated with the tax collection in the RF.

Our theoretical model shows that, in the presence of official corruption, the numbers of tax inspection employees could be inversely related to the per capita tax collection. Our empirical analysis, which is based on a unique data set from the Russian regional governments, support our theoretical findings and sheds light on one of the most intractable and contentious issues in the RF.[1]

In Section 2, we present a model that captures the motivation of corrupt tax inspectors to accept bribes. In Sections 3 and 4, we present our regional dataset and our econometric analysis of the underlying issues, respectively. Concluding comments are provided in Section 5.

2. Modeling corruption

Shleifer and Vishny (1993) propose the structure of government institutions and the political process as determinant of level of corruption.[2] In line with their propositions, we note that several striking features of the Russian transition are significantly influencing the degree of corruption among its tax inspectors. First, the transition towards a market-based economy has created large pockets of profitable opportunities, wherein private sector pay significantly exceeds that of public employees—a tantamount to the government acceptance of official bribe taking to supplement public meager wages. Second, a substantial increase in wealth inequality has made it very profitable for the rich to evade paying taxes by paying a small fee; hence, in effect, supplying corruption. Third, low government wages and wage arrears have left public employees in a dire situation with no proper recourse. Finally, tax inspection employees are allowed to *negotiate* the actual tax payments by taxpayers that owe a substantial amount of taxes. Hence, for understanding the official corruption among the tax inspectors, we allow for bribes in the tax inspectors' profit function. Theoretical analysis provides the plausible conditions under which increasing the number of tax inspectors leads to a decrease in the tax revenue for the government.

Consider an economy where the taxpayers face tax rate t while receiving taxable income Y. In this economy, the tax payers tend to hide their true income Y, report S ($<Y$) as their true income, and pay $t(S)[<t(Y)]$ to the government. Tax inspectors are supposed to discover Y and collect $t(Y)$ for the government.

In this economy, the tax inspectors maximize their own expected profit, which consists of wages W from the government and bribes $b(Y)$ from the taxpayers $[W + b(Y) < t(Y)]$, i.e., if they

[1] We believe that our empirical models are local approximations to a complex situation in the RF.

[2] They also propose that the illegality of corruption and the need for secrecy cause higher distortion than official taxation.

discover Y. The probability of discovering Y by the tax inspectors is q, which positively depends on the number of per capita tax inspectors, $q = q(m)$. Similarly, per capita tax revenue r positively depends on the probability of discovering the true income, $r = r(q)$. Moreover, the probability that a tax inspector exhibits *non-corrupt* (honest) behavior is h. Conversely, $(1 - h)$ is the probability that this tax inspector behaves in a *corrupt* (dishonest) manner. The tax inspectors can change h at will. Higher values of h lead to more per capita tax revenue r for the government, $r = r(h)$. In the absence of corruption, increasing the number of per capita tax inspectors (m) may increase per capita tax revenue (r); however, in the presence of corruption, the converse could hold as well, i.e., $(\mathrm{d}r/\mathrm{d}m) < 0$.

Given the above, the government expected tax revenue is $q[ht(Y) + (1-h)t(S)] + (1 - q)t(S)$, if Y is not known with certainty and is $[ht(Y) + (1 - h)t(S)]$, if Y is known with certainty. In the presence of corruption, if the tax inspector discovers Y, he lets the taxpayer pay $t(S)$ to the government and bribe $b(Y)$ to the tax inspector (himself), such that, $t(S) + b(Y) < t(Y)$.

The government handles this type of corruption by changing the number of per capita tax inspectors m and/or by changing the probability of tax inspectors being fired p. This implies that, for a proactive government such as this, the expected per capita tax revenue r is given by

$$r = (1 - p)\{q[ht(Y) + (1 - h)t(S)] + (1 - q)t(S)\} + pt(Y). \tag{1}$$

We assume that p negatively depends on r and that the tax inspectors know this $(\partial p/\partial r < 0)$. Given this knowledge, to maximize profit, tax inspectors change their behavior by changing h.

We will show that the equilibrium level of h negatively depends on m, i.e., $\mathrm{d}h/\mathrm{d}m < 0$. This allows us to show that

$$\frac{\mathrm{d}r}{\mathrm{d}m} = \left(\frac{\partial r}{\partial q}\right)\left(\frac{\mathrm{d}q}{\mathrm{d}m}\right) + \left(\frac{\partial r}{\partial h}\right)\left(\frac{\mathrm{d}h}{\mathrm{d}m}\right)$$

or

$$\frac{\mathrm{d}r}{\mathrm{d}m} = r'_q\left(\frac{\mathrm{d}q}{\mathrm{d}m}\right) + r'_h\left(\frac{\mathrm{d}h}{\mathrm{d}m}\right)$$

takes a negative value under certain circumstances. That is, we may observe that the higher the number of per capita tax inspectors the lower the per capita tax revenue.

First, we note that h and q directly influence per capita tax revenue. Letting $x'_z = \partial x/\partial z$ and $x''_{zz} = \partial^2 x/\partial z \partial z$, this is represented by:

$$r'_h = (1 - p)[t(Y) - t(S)]q > 0, \tag{2}$$

$$r'_q = (1 - p)h[t(Y) - t(S)] > 0, \tag{3}$$

and that

$$r''_{hh} = 0, \tag{4}$$

$$r''_{hq} = (1 - p)[t(Y) - t(S)] > 0. \tag{5}$$

Second, we note that, apart from the risk of being fired, the tax inspector's expected bribe is $q(1 - h)b(Y)$. Taking his wage W and the probability of being fired p into account, the tax inspector's expected income is $[W + q(1 - h)b(Y)](1 - p)$. Hence, the tax inspector's problem is:

$$\max[W + q(1 - h)b(Y)](1 - p) \tag{6}$$

s.t.

$$p = p(h), \tag{7}$$

and

$$r = r(h, q). \tag{8}$$

This maximization problem yields

$$-p'_r r'_h[W + q(1-h)b(Y)] - (1-p)qb(Y) = 0, \tag{9}$$

as the first order condition. Given $p = p[r(h,q)]$ and $r = r(h,q)$, the sign for $\mathrm{d}h/\mathrm{d}q$ may be obtained by taking the full differential of the first order condition (9), that is,

$$\begin{aligned}&[-p''_{rr}(r'_h)^2 A + p'_r r'_h qb(Y) + qb(Y)\, p'_r r'_h]\mathrm{d}h \\ &\quad + [(-p''_{rr} r'_h r'_q A - p'_r r''_{hq} A - p'_r r'_h(1-h)b(Y) - (1-p)b(Y) + p'_r r'_q qb(Y)]\mathrm{d}q = 0\end{aligned} \tag{10}$$

where $A = W + q(1-h)b(Y)$. Solving for $\mathrm{d}h/\mathrm{d}q$ leads to:

$$\frac{\mathrm{d}h}{\mathrm{d}q} = \frac{\{[p''_{rr} r'_h r'_q + p'_r r''_{hq}]A + [p'_r r'_h(1-h) - (1-p) + p'_r r'_q q]b(Y)\}}{[2\,p'_r r'_h qb(Y) - p''_{rr}(r'_h)^2 A]}, \tag{11}$$

which is negative ($\mathrm{d}h/\mathrm{d}q < 0$) if we note that the probability of being fired p is inversely related to the per capita tax revenue, such that, $p'_r < 0$ and $p''_{rr} > 0$.We can rewrite $\mathrm{d}r/\mathrm{d}m = r'_q(\mathrm{d}q/\mathrm{d}m) + r'_h(\mathrm{d}h/\mathrm{d}m)$ to obtain

$$\frac{\mathrm{d}r}{\mathrm{d}m} = r'_q\left(\frac{\mathrm{d}q}{\mathrm{d}m}\right) + r'_h\left(\frac{\mathrm{d}h}{\mathrm{d}q}\right)\left(\frac{\mathrm{d}q}{\mathrm{d}m}\right) \tag{12}$$

where $r'_h(\mathrm{d}h/\mathrm{d}q)(\mathrm{d}q/\mathrm{d}m)$ reflects the *corruption effect* and, as we just have shown, it is negative. On the other hand, $r'_q(\mathrm{d}q/\mathrm{d}m)$ reflects the *non-corruption effect*, which is positive. Therefore, when $|r'_h(\mathrm{d}h/\mathrm{d}q)(\mathrm{d}q/\mathrm{d}m)| > r'_q(\mathrm{d}q/\mathrm{d}m)$, an increase in the number of per capita tax inspectors will lead to a decrease in per capita tax revenue $\mathrm{d}r/\mathrm{d}m < 0$. Clearly, empirical analysis would be the crucial factor in shedding light on the actual direction of change, in this respect.

3. Data

The main sources of data are Goskomstat (1998), the Central Bank of Russia (1997), and the Ministry of Taxation and Fees. The Ministry of Finance also provided previously unpublished data not available from the above sources. While there are 89 regions in the RF, lack of observations on some of the variables left us 72 regions with complete data (see Table 1 for the full list of the regions and the data on tax arrears). Table 2 reports descriptive statistics for the main variables not reported in Table 1, as well as some of the variables that were used as instruments in the later analysis.

Descriptive statistics in Table 2 show that average sub-national revenue for the 72 regions included in our data set was 3655 million (old) rubles. Ninety percent of this revenue was obtained by retaining taxes collected at the sub-national level. However, the relative value of Federal transfers to the sub-national government revenue is 9.7 percent, which is more than twice the same ratio for the VAT collection retained in the region. This suggests that federal transfers have substantive impact on the sub-national revenues.

Table 2
Descriptive statistics: sub-national data in the Russian Federation

Variable		Mean (standard deviation)
Financial variables		
RS	Sub-national government revenue (millions of ruble)	3655.70 (2866.34)
TR	Transfers from Federal Budget to sub-national governments (millions of ruble)	354.34 (269.51)
VAT	VAT collection retained in the region (millions of ruble)	157.46 (145.43)
OR	Tax collection (excluding VAT) retained in the region (millions of ruble)	3149.85 (5284.20)
Demographic variables		
POP	Size of population in each region	1,635,347 (1,231,597)
DP	Number of people per square kilometer	31.95 (41.38)
PEN	Percentage of pensioners in the region	19.49 (4.97)
Structure of the region		
TP	Number of enterprises per capita in the region	0.018 (0.0)
SP	Number of small enterprises per capita in the region	0.004 (0.002)
NC	Number of credit agencies in the region	12.34 (11.53)
NR	Number of tax inspection employees per capita	0.0013 (0.0003)
NF	Number of credit agencies per capita in the region	0.00003 (0.00001)
Geographic variables		
L	Distance of sub-national capital city from Moscow (in kilometers)	2465.91 (2837.11)
S	Area of the region (in thousand square kilometers)	199.11 (419.76)
Type	Geographical categorization (e.g. Northern, Central, Volga region, etc.)	6.27 (3.24)
TZ	Minus lowest average monthly temperature	13.66 (8.74)
DT	Difference between the highest and lowest monthly average temperature	30.30 (8.10)

Note: Includes descriptive statistics for the variables that were used as instruments as well.

Given the nature of negotiable fiscal federalism in the RF, we allow sub-national tax effort to be measured by the inverse of tax arrears and tax deferrals to the sub-national governments, i.e., $E = 1/(\text{tax arrears} + \text{tax deferrals} + 1)$.[3] This reflects the fact that reduction in tax arrears and tax deferrals may reflect increased vigilance in collecting taxes.[4] However, the sub-national tax arrears are not uniformly distributed (Table 1). The top 30 sub-national governments with tax arrears in excess of 1 percent are owed 77 percent of all tax arrears in the RF.[5] While a host of factors may have created arrears and their uneven distribution, intuition and our theoretical model are suggestive of the fact that government tax inspection employees may have had a substantive role in this as well. Controlling for these factors (e.g., instructional, geographical, and demographic factors) could allow us to gauge the impact of tax inspectors in this context. Given that tax inspection employees exercise considerable power in allowing for tax deferrals and collecting tax arrears, we expect a direct relationship between tax efforts (measured by E) and sub-national tax collection (OR).

[3] While there are many reasons other than effort of the tax collectors for why arrears are much higher in some regions than in others (e.g., the bargaining power of the tax payers), our experiment with various proxies for improving our tax effort indicator (E) led to similar empirical results. Ponomareva and Zhuravskaya (2004) find that, in addition to the liquidity problems in firms, the variation in tax arrears is also due to regional political resistance to federal tax collectors.

[4] Schaffer (1998) found that the tax inspection agencies (tax collectors) did not impose penalties on loss making firms for refusing to pay taxes.

[5] Data shows that, apart from seven regions, all of the other sub-national governments are owed money by their taxpayers. A data appendix and an extensive analysis of the problem of tax arrears in the RF are available upon request from the first author—also, see Mokhtari and Caner (2000).

4. Econometric analysis

To estimate the sub-national tax collection (OR) and the impact of corruption (NR), we approximated sub-national true tax capacity using a host of relevant variables and estimated:

$$\mathrm{OR}_i = g(E_i, \mathrm{NR}_i, \mathrm{TD}_i, \mathrm{PM}_i, \mathrm{PEN}_i, \mathrm{MASH}_i), \tag{13}$$

where for capturing the impact of corruption, we include the number of tax inspection employees per capita (NR) as an explanatory variable in this function. In addition to tax efforts (E), other included variables are:

- Per capita total tax debt (TD): This reflects, among other things, the tax capacity of a region—higher tax liabilities imply potential for higher tax collection.
- The number of small enterprises per capita (SP): Higher values of SP show better economic conditions and better potential for collecting taxes at the sub-national level.
- The share of people under the poverty line (*prozhitochnyi minimum*) per region (PM): This captures the lower capacity for taxation for the poverty-stricken areas.
- Percentage of pensioners per region (PEN): This also inversely influences tax capacity.
- Share of engineering (*mashinostroenie*) industry enterprises relative to the total number of enterprises (MASH): This, in effect, reflects how many military industrial enterprises are in the region. Given that the military industrial complex has been hit hard from the downward shift in the demand for their products, an inverse relationship between MASH and the sub-national tax collection is expected.

A priori, we expect $\partial\mathrm{OR}/\partial\mathrm{NR} < 0$, $\partial\mathrm{OR}/\partial E > 0$, $\partial\mathrm{OR}/\partial\mathrm{TD} > 0$, $\partial\mathrm{OR}/\partial\mathrm{SP} < 0$, $\partial\mathrm{OR}/\partial\mathrm{PM} < 0$, $\partial\mathrm{OR}/\partial\mathrm{PEN} < 0$, and $\partial\mathrm{OR}/\partial\mathrm{MASH} < 0$.

After approximating the above functional by their logarithmic equivalent,[6] estimation yields[7]:

$$\begin{aligned}\ln \mathrm{OR} = {} & \underset{(1.11)}{1.44} + \underset{(2.49)}{54.96}E - \underset{(3.71)}{0.84}\ln \mathrm{NR} + \underset{(1.33)}{0.11}\ln \mathrm{SP} + \underset{(2.29)}{0.46}\ln \mathrm{TD} - \underset{(2.66)}{0.019}\ln \mathrm{PM} \\ & - \underset{(1.68)}{0.11}\ln \mathrm{MASH} - \underset{(2.81)}{0.69}\ln \mathrm{PEN} + \hat{U}, \quad R^2 = 0.69\end{aligned} \tag{14}$$

where $\hat{U}$ is estimated residuals and t-ratios are reported in the parentheses. The reported coefficient estimate for ln NR is very robust to changes in the date for this variable—similar significant negative coefficient estimates are obtained when the ln NR values for any of the previous years (1996, 1995, or 1994) are used years in the regression. Apart from the intercepts, SP, MASH, and NF, coefficient estimates of other variables are statistically significant. Reported R^2 shows that, despite the fact that we are using cross section data, a large proportion (69 percent) of the variation in the dependent variables is explained by the explanatory variables.

[6] We approximate the above functional forms by their logarithmic equivalents. This allows us to mitigate the potential heteroskedasticity in our sub-national (cross section) analysis, enforce the fact that our variables take positive values, and read the coefficient estimates as elasticities. In our empirical specifications, however, we do not use log values of E. Linear values of E allows us to gauge different levels of effort (different elasticities), which are exerted by sub-national authorities.

[7] An earlier version of this paper, which is available from the authors upon request, includes an expanded explanation of the econometric modeling and estimation techniques used in this paper. It is, however, worth noting that, for estimating our OR equations, we replaced VAT and TD with their respective instrumental variables. In addition to all of the explanatory variables, instruments included "total number of firms in the region", "number of foreign firms in the region", and "yearly variation in temperature".

The estimates support the hypothesis that an increase in tax collection effort E has a positive impact on per capita tax collection (OR). Effort-elasticity of OR (=54.96E) attains a minimum of 0.005 for Kemerovo Oblast and a maximum of 1.68 for the Ingush Republic. Effort-elasticity of OR attains its average value of 0.1 for Pskov Oblast and the Republic of Dagestan. On average, for every 1-percent decrease in arrears and/or deferrals, i.e., 1 percent increase in efforts (E), per capita tax collection increases by 1/10 of 1 percent. Thus, solving the problem of tax arrears and tax deferrals at the sub-national level could have a significant and substantive impact on intergovernmental problems.

The estimates, which are only a local approximation to more complex dynamics, corroborate our observation that corruption is a significant problem in tax collection. Estimates show that an increase in the number of tax inspectors per capita (NR) has a negative effect on per capita tax collections. In particular, a 1 percent increase in the number of tax inspection employees per capita leads to a whopping 0.84 percent decline in sub-national tax collections. This indicates that, in terms of our model (Eq. (12)), the negative *corruption effect* $[r'_h(\mathrm{d}h/\mathrm{d}q)(\mathrm{d}q/\mathrm{d}m)]$ outweighs the positive *non-corruption effect* $[r'_q(\mathrm{d}q/\mathrm{d}m)]$, so that an increase in the number of per capita tax inspectors will lead to a decrease in per capita tax revenue $\mathrm{d}r/\mathrm{d}m < 0$. This finding also supports Shleifer and Vishny's (1993) proposition that corruption could be causing a higher distortion in the economic system than official taxation. Tax inspection employees' power to engage in negotiation with taxpayers for granting tax deferrals and ignoring tax arrears are detrimental to the tax collection process.[8]

The elasticity estimate for total tax debt indicates that for every 1-percent increase in the per capita tax liability only 0.46 percent is collected. This is consistent with the low tax compliance rate in Russia and shows the extent of the deficiency in the process of tax collection.

Signs and sizes of the estimated elasticity coefficients for the variables approximating poverty (PM, −0.019 and PEN, −0.69), post-communism economic vigor (SP, 0.11), and declining demand for large engineering/military complexes (MASH, −0.11) capture the historical dynamics of moving from a command system to a market system. Increases in the number of poor (PM) pensioners (PEN) and the erosion of demand for the large engineering/military complexes have had substantial negative impacts on tax collections. These findings confirm previous findings that regions with very large enterprises also have large (unpaid) tax debts (Treisman, 2003). On the other hand, we also find that the transition to a market system leading to a larger number of small enterprises has provided a larger tax base and OR (tax collection) for sub-national governments.

Estimates for the TR equation show that the coefficient estimates of OR, VAT, NF, and L have substantive impact on TR. The estimated coefficient for sub-national tax collection OR (−1.23) shows that at the low level of tax collection, any increase in OR leads to a larger contraction of federal transfers (TR). For example, for sub-national governments with low tax collection, every 1-percent increase in the sub-national tax revenue leads to 1.23 percent decrease in federal transfers. Thus, a higher tax collection effort is not a worthwhile activity for a sub-national government with low tax collection. However, when the OR increases beyond 2.22 [=1.23/(2)(0.77)] new rubles per person, TR increases as well. This suggests that after OR exceeds 2.22 rubles per person, sub-national authorities bargain for further transfers.

[8] This also resembles the principal-agent problem, where the agent is not fully serving the principal's objective.

5. Conclusion

In this paper, we provided theory and evidence on the problem of corruption in the Russian Federation. One of the main indications of our theoretical analysis is that in the presence of bribe taking by tax inspectors, increasing the number of tax inspectors might lead to lower tax revenues for the government.

Our major empirical finding in this paper indicates that corruption plays a significant role in reducing tax collection in Russia; we find that a higher number of tax inspection employees leads to a reduction in per capita tax collection. We also find that a decline in the demand for large military complexes and increased poverty, which reduce the tax base for a region, have decreased the ability of regions to collect taxes. Nonetheless, analysis shows that the transition to a market system, leading to a higher number of small enterprises, is providing a larger tax base for sub-national taxes. Holding everything else constant, the robust inverse relationship between the number of tax inspection employees and per capita tax collection buttresses our theoretical finding that corruption (tax theft) is a significant problem in the Russian fiscal system.

Acknowledgements

We are grateful to two referees and the editor for substantive comments and suggestions. We are also grateful to Mamak Ashtari, Arnold Hoitink, Marshall Goldman, Barry Ickes, Ulrich Thießen, Janet Wagner, and Ekaterina Zhuravskaya for helpful comments and discussions. We have benefited from the insightful comments of seminar participants at a number of universities, New Economic School (Moscow), and the IMF. Remaining errors are our own.

References

Berkowitz, D., Li, W., 2000. Tax rights in transition economies: a tragedy of the commons? J. Public Econ. 76, 369–398.

Cai, H., Treisman, D., 2004. State corroding federalism. J. Public Econ. 88, 819–843.

Central Bank of Russia, 1997. Bulletin of Bank Statistics, vol. 12. Central Bank of Russia, Moscow.

Goskomstat, 1998. Russian Regions. Goskomstat, Moscow.

Gregory, P., Lazarev, V., 2002. The wheels of a command economy: allocating Soviet vehicles. Econ. Hist. Rev. 55, 324–348.

Lazarev, V., Gregory, P., 2003. Commissars and cars: a case study in the political economy of dictatorship. J. Comp. Econ. 31, 1–19.

Mokhtari, M., Caner, S., 2000. The problem of arrears in the Russian federation. Russ. East Eur. Trade Fin. 36, 27–53.

OECD, 2000. OECD Economic Surveys 1999–2000: The Russian Federation. OECD, Paris.

Ponomareva, M., Zhuravskaya, E., 2004. Federal tax arrears in Russia: liquidity problems, federal redistribution or regional resistance? Econ. Trans. 12, 373–398.

Schaffer, M., 1998. Do firms in transition economies have soft budget constraints? A reconsideration of concepts and evidence. J. Comp. Econ. 26, 80–103.

Shleifer, A., 1997. Government in transition. Eur. Econ. Rev. 41, 385–410.

Shleifer, A., Treisman, D., 2000. Without a Map: Political Tactics and Economic Reform in Russia. MIT Press, Cambridge.

Shleifer, A., Vishny, R., 1993. Corruption. Q. J. Econ. 108, 599–617.

Treisman, D., 2003. Fiscal pathologies and federal politics: understanding tax arrears in Russia's regions. In: McLaren, J. (Ed.), Institutional Elements of Tax Design and Reform. World Bank, Washington, DC, pp. 49–67.