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PRODUCTION UNCERTAINTY, ENTERPRISES' SOCIAL RESPONSIBILITY, AND INSTITUTIONAL HERITAGE IN A POST-SOVIET ECONOMY

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Abstract. The paper examines enterprises' motives for participating in infrastructure and social service provision in the Russian Federation. This common practice of the socialist era is still widely in operation among large and medium sized Russian firms. Using a stylized model we show that this activity can be largely related to firms' efforts to increase their operational reliability. A unique survey data shows that this materializes through more reliable infrastructure provision, stronger employee attachment, and better relations to authorities. Furthermore, physical and institutional heritage play a major role in firms' activities.

Keywords. Uncertainty, post-communist firm, social responsibility, econometric analysis.

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I. INTRODUCTION

Since the financial crisis of 1998 Russia's economy has been on path of previously unseen growth led by constantly increasing global energy prices. After the turbulent 1990s, the social and institutional conditions have stabilized during the presidency of Vladimir Putin. However, long term sustainable growth can not hang solely on energy prices and its positive externalities in the economy. The World Bank's World Development Report 2004 entitled "Making Services Work for the Poor" views efficient public service delivery as key ingredient for economic growth and poverty eradication. Firms' incentives to invest are reduced if their access to e.g. electricity is subject to daily blackouts – i.e., if its operational reliability is weak. The same concerns also labour: basic deficiencies in services such as health care and primary education reduce the quality of the labour force thus increasing labour costs and reducing productivity. Furthermore, citizens' inadequate access to daily necessities can create social imbalances in the society.

In Soviet Union, firms were a tool of carrying out the state's plans. The system hoped to reap economies of scale by designating certain localities to specialize in the production of a small variety of goods in large plants. In these localities, nearly everyone was employed by the single, large producer. The large firms were often assumed to participate in local infrastructure provision, e.g. energy and heat supply, as well as social service provision including housing, medical and day care. After the collapse of the Soviet system, some enterprises continued to supply public services and to maintain the local infrastructure. Majority of social assets had been shifted under municipal ownership by the end of 1997 (Leksin and Shvetsov 1998, Commander and Schankerman 1997). Major shift of responsibility has also occurred in the sphere of infrastructure. However, more than ten years after the law on divestiture of enterprises social assets, we still see remnants of the socialist system in modern Russia's firm activity (Haaparanta et al. 2003). Big industrial enterprises still provide social services and produce or support local infrastructure goods (this activity is referred as infrasoc participation henceforth).

Traditionally, explanations for the rationale of corporate social responsibility (CSR) vary from managers' altruism to firm reputation and strategy for differentiation (see

McWilliams et al., 2006, for a survey). Based on earlier companion papers[1] as well as on our new results, we argue that in Russia the seemingly altruistic infrasoc participation - as a form of corporate social responsibility[2] - can be reduced to a fully rational response by the enterprise sector to an unreliable operational environment. Naturally, whatever the benefits from infrasoc provision are, inherited physical facilities make the costs of providing it considerably smaller. Furthermore, a decades old practice within the society is not easily altered, especially as the public sector is poorly equipped to assume the responsibility of providing infrasoc services to the population. Thus both physical and institutional inheritance unquestionably has a role to play.

Our major argument is that firms are using infrasoc provision to maximize their operational reliability through various channels. Firstly, contributing to municipal infrastructure makes supply of it to the firm more reliable. Secondly, providing social services to workers in a surrounding where public provision of them is in weak shape, enables firms to attach their workers more strongly thus avoiding potential production problems after staff leave. Thirdly, we argue that infrasoc provision enhances relations between the firm and public sector which benefits firms through friendlier regulatory environment. We will present a theoretical model of firm optimization in an environment where it can affect its operational reliability through engagement in infrasoc provision. We find empirical evidence supporting many features the model poses.

The rest of the paper is organized as follows. Section 2 presents some descriptive data on the infrasoc provision of our sample firms and gives more background to the phenomenon as well as explains our hypotheses more thoroughly. Section 3 presents our model of firm optimization in an uncertain environment. In Section 4 we describe our data and empirical methodology, Section 5 presents our empirical evidence and Section 6 concludes.

[1] Juurikkala and Lazareva (2006a, 2006b), Solanko (2006) and Haaparanta et al. (2003) use the same survey data set.

[2] CSR has been defined e.g. as follows “actions on the part of the firm that appear to advance the promotion of some social good beyond the immediate interest of the firm or shareholders and beyond legal requirements” (McWilliams and Siegel (2001).

2. EXPLAINING FIRMS' INFRASOC PROVISION IN RUSSIA

In this section, we shed more light on the history of Russian firms' infrasoc provision as well as provide descriptive information from our survey data set. Following Reinikka and Svensson (2002), complementary capital can be defined as capital that provides support services necessary for the operation of productive private capital. Especially in low- and medium-income countries, complementary capital (e.g. transport infrastructure or utilities) is typically provided by state monopolies or publicly owned companies. To some degree, a firm can substitute for mediocre public services by investing privately in complementary capital (e.g. private electric power generators). Poor infrastructure and deficient public services have, indeed, lately received more attention in the economic literature as well as in policy discussions (World Bank 2004).

In Russia, infrastructure provision by enterprises has its roots in the planning of Soviet cities. A standardized model of Soviet municipal infrastructure, whereby a city of a certain size is linked to a certain number of electric power and heating plants, emerged as a by-product of central planning. The heating and power plants, as well as the other infrastructure, would be operated either by the city or by individual enterprises according to the plan (Hill and Gaddy 2003). In Russia, the crisis following the breakdown of the Soviet system in the beginning of 1990s led also to deterioration of the publicly provided infrastructure and social goods. There have not been enough funds to replace the public capital at rate of its physical depreciation. In addition to insufficient funds, also ambiguous property rights have partly led to poor maintenance of these facilities (Juurikkala and Lazareva 2006a). As a result, Russia has a low rating in infrastructure quality (EBRD 2004). This is also visible in our survey data[3] showing that firms in Russia have to operate in an environment where interruptions in basic infrastructure delivery cause serious problems for production (see Table 1).

[3] See Section 4 for the survey description.

Table 1. Interruptions in basic infrastructure in 2002

Industry	*% of firms that have experienced interruptions*	*Of those: % that regard the interruptions as significant*	*Mean / median length of interruptions, days*
Electricity	38.6	48.8	7.3 / 2
Water	30.0	32.0	8.1 / 3
Telephone	30.9	39.1	8.6 / 5
Gas	10.5	39.1	18.1 / 3
Heating	10.2	30.4	12.5 / 7

Even in today's Russia large enterprises are critically important in some areas of infrastructure provision. This is the case in e.g. heat provision where enterprises often continue to be the monopoly heat provider for the apartment blocks it used to own or for a whole district Solanko (2006). Besides producing own heat or electricity, many firms support public infrastructure construction or maintenance financially or otherwise (see Tables 2-4 for descriptive figures). Our survey data shows that larger firms in employment terms are more likely to produce heat and especially electricity. Depending on firm size class, from one third up to sixty percent of sample firms are engaged in infrastructure provision somehow. There are also industry wide differences in infrastructure production. While most of firms in each industry produce heat, only in energy and fuel, steel and iron, and forestry and paper industries considerable amount of firms produce electricity. This is related to the production processes and size of firms in those industries. Excluding light industry (textiles etc.), firms are prominently involved in transport infrastructure provision (see Table 4).

Table 2. Firms support to construction or maintenance of municipal infrastructure

Form of municipal infrastructure	*% of firms giving financial support to maintenance or construction of*	*% of firms giving non-financial support to maintenance or construction of*	*% of firms giving either form of support*	*If firm owns necessary facilities, % of firms giving either form of support*
Municipal heating	10.9	10.2	16.6	18.0
Municipal electricity	7.7	7.7	11.9	11.1
Railroads not owned by firm	5.5	4.2	7.7	12.2
Local gas network	6.5	4.2	8.4	na
Municipal water system	10.6	9.4	17.3	na
Municipal waste collection	10.9	7.7	15.4	na
Roads outside plant area	19.9	10.4	24.1	na

Table 3. Infrastructure production and support by firm size

Number of employees	*Percentage of firms:*					
	Producing heat	*Producing electricity*	*Owning rail cars*	*Supporting road network*	*Supporting heating network*	*Supporting any form of infrastructure*
<500	72.9	1.4	11.4	27.1	17.1	44.3
500-800	67.7	4.6	20.0	17.7	11.5	39.2
800-1500	78.7	3.7	24.1	21.3	14.8	37.0
1500-5000	87.8	2.7	43.2	29.7	24.3	50.0
>5000	80.0	25.0	70.0	45.0	30.0	60.0

Table 4. Infrastructure production and support by industry

Industry	*% of firms producing heat*	*% of firms producing electricity*	*% of firms owning rail cars*	*% of firms supporting road network*
Power and fuel	80.0	40.0	100	20.0
Iron and steel	81.8	22.7	100	45.5
Chemicals	66.7	3.7	75.0	37.0
Machinery	66.7	0.0	37.9	20.6
Forestry, paper	86.1	11.1	88.9	36.1
Construction materials	80.0	4.4	66.7	22.2
Light industry (textiles etc.)	68.2	0.0	0.0	11.4
Food processing	93.3	6.7	37.5	25.0
Other	54.2	0.0	25.0	16.7

Similar history concerns also social services provision. Basic legal documents that required divestiture of housing and the bulk of social assets within six months after the privatization of a firm were adopted in 1992-1993. Instead of immediate privatization, the assets were divested to the local authorities, who then became responsible for the provision of the services. It has to keep in mind, however, that the social assets embedded in the firms were never legally in the firms' ownership. During the mass privatization in the early 1990s, these assets were under the federal ownership and were transferred under municipal ownership. During this process the local authorities had considerable negotiating powers. Transferring the ownership of enterprises social assets' was supposed to be finished by the end of 1997 and that goal was almost completed. Some 80% of housing stock, kindergartens, medical services, sports facilities and children's summer camps coupled with some 60 - 70% of recreation facilities were shifted under municipal

ownership in 1993-1997. The variation between regions, and especially between municipalities, was however very large, as the share of municipalized assets might vary between 15% and 100% (see Juurikkala and Lazareva 2006a).

Our survey data, however, show that the large industrial firms still provide a wide array of social services or continue to finance them despite the divestiture process. There are also substantial differences across the interviewed firms and different types of assets in how fast and to what extent divestiture has taken place. Furthermore, many of the firms have no intention of divesting all their assets. Rather they intend to invest in the package of fringe benefits they provide to their employees (and in many cases also to users outside the firm). Over 90 % of the surveyed firms had at least some kind of social assets in 1990, and over 90 % still provided or supported at least one service in 2003, though the scale of the firms' participation in social service provision has diminished significantly during the last decade. Interestingly, every sixth of the surveyed firms had in their balance housing facilities built *after* the collapse of the Soviet regime. It is also striking that in over a half of the firms that offer housing, users are not just employees and their families (see Table 5). Furthermore, according to our survey, despite the fact that many firms receive some payment for the provided social services, virtually every firms' business manager's view is that none of the social asset provision is profitable to the firm.

Table 5. Firms' social service provision (managers' view)

Percentage of firms having provisions	*Housing*	*Medical care*	*Daycare*	*Recreation*	*Other*	*At least one*
1990	78.5	76.7	69.8	38.2	84.4	94.6
2002 (assets built after 1990)	15.1	na	2.0	4.7	17.6	32.4
Have or provide support in 2002	55.7	90.8	26	73.3	76.5	97.8
Have on balance	34.2	67.1	10.4	20.8	76.5	91.8
Support assets transferred to municipality	5.0	4.0	6.7	0.3	na	14.1
Direct financial aid to employees	22.0	42.1	8.9	58.7	na	76.2
Other form of support	11.4	8.2	3.0	4.5	na	22.0
Of those giving any support, users not only employees and their families	55.6	38.7	41.9	29.4	na	62.3

What are the rationales for continued engagement in infrasoc provision? Firstly, the necessary infrasoc capital - as major share of other capital as well - of Russian firms is largely inherited from the Soviet era when it was constructed to serve possibly the whole locality. Thus, a major physical and institutional heritage has occurred (see Solanko, 2006, for more discussion). The answers of the interviewed general managers interviewed give plenty of anecdotic evidence on the institutional heritage. For most of the firms the main reasons for selling firm produced heat outside were either traditions or social responsibility as the enterprise may be the sole provider of heat for its neighbourhood. Furthermore, without the massive physical heritage facilities necessary to produce infrasoc goods, and especially its over capacity, it is highly unlikely that firms in Russia would be engaged in infrasoc provision in such an extent. Investment costs required by infrasoc provision would not be covered by the incomes and benefits they produce.

Secondly, and most importantly, we argue that major part of firms' infrasoc provision relates to firms' efforts to increase their operational reliability in a highly insecure operation environment. With infrasoc participation, firms can tackle three sources of uncertainty. First is the physical environment which relates to complementary capital. As Table 1 showed, considerable part of firms are experiencing interruptions in basic infrastructure supply. Thus, firms try to increase the reliability of local infrastructure provision in order to utilize their own capital input to the fullest. Firms try to mend the public provision by financial or non-financial support or by producing the infrastructure good itself. Second source of insecurity lies within the firm, i.e. labour force. As social service production by the state to which it is mandated is of weak quality in Russia, workers value its provision by the employer highly. By providing workers with social services, the firm is able to attach its staff more strongly and to keep them from shifting to another employer and possibly even to induce labour[4].

Third source of uncertainty originates in the actions of the local authorities. In their analysis of Russian fiscal federalism, Lavrov, Litwack, and Sutherland (2000) argue that regions and localities in Russia favour large incumbent firms capable of providing public

goods. As cash-constrained regional and local governments must provide traditional public goods such as education and health care, as well as heating and road upkeep, local administrations have an incentive to cooperate with local enterprises in providing statutory public services. Thus there are prerequisites for enterprise-municipal cooperation where municipality can secure the fulfilment of its mandates better and extract more resources to itself while infrasoc participating firm extracts beneficial treatment from municipality authorities.

There is abundant anecdotic evidence of authorities offences towards dissident firms in Russia, but on the other hand at least as abundant evidence that good relations to authorities makes firm's daily operations considerably smoother. Thus, we argue that firms gain preferential treatment from authorities, if they participate in municipal infrasoc provision, but on the other hand face a threat of some sort of sanctions should they dissociate themselves from it. This mechanism relates also to the inheritance factor. It could be unwise for the firms not to utilize the scale benefits from the production facilities they have inherited. Many enterprises use the existing capacity to serve their own need and provide the rest to outsiders in exchange for some form of compensation. Social assets may also be used to lobby for authorities' help to protect firms from competition as shown by Juurikkala and Lazareva (2006a).

3. THEORETICAL MODEL

In this section, we construct a stylized model grasping some the above mentioned aspects of Russian firms' infrasoc provision. We consider a generalized approach to one presented in McKenna (1985, Ch. 4.2.). The firm faces different production breakdown, efficiency and delay risks with probability $1-q(I,S)$, where I is firm's expenditure in infrastructure like roads, regional communication, and energy network etc. S is the unit value of expenditure on social and health conditions of workers in the firm. These partly firm specific expenditures help the firm to increase its operation efficiency and lower the risk of production problems. Thus the probability of good state is an increasing function of

[4] See a thorough discussion in (Juurikkala and Lazareva 2006b).

infrastructure and social expenditures, i.e. $q = q(I,S)$ with $q_S, q_I > 0$. These are the key assumptions of our model.

We take somewhat unorthodox approach as we consider firm's maximization problem with respect to expected utility instead of expected profit directly. We argue that this approach is valid due to following reasons. First, operational risks in Russia are considerable and clearly larger concerning both the level of risk and losses. Thus, we are able to grasp this uncertainty better than under the standard risk neutrality assumption. Secondly, risk neutrality assumption requires perfect capital markets which are well known to lack in Russia. Thirdly, the form of firm ownership and its relationship to localities matter in firm performance. Thus risk neutrality can not be assumed among the firms having a large stake in. To keep the model as simple as possible we consider capital input as fixed and concentrate on complementary operating capital which can be thought, at least in our case, to affect mainly the probability of the good production state in the short run. However we assume that the firm have some asset incomes R to cover the loses involved with the bad production state.

Next we present the model and give the conditions under which firm's infrasoc provision decreases the breakdown probability. We pay also attention to firm's risk-aversion and implications of uncertainty to firm's labour demand. Also some wage level effect results on investments are provided.

3.1. The model

Assume that the firm maximizes expected utility form good and bad states in following in way.

$$\underset{(L,I,S)}{MAX}\{U(\pi) = q(I,S)U(\pi_1) + (1-q(I,S))U(\pi_2)\}$$

where

$$\pi_1 = Q(e(S)L) - (w+S)L - I + R$$

$$\pi_2 = -(w+S)L - I + R$$

are the profits in good and bad state ($\pi_1 > \pi_2 > 0$), and R incomes from other sources. $Q(e(S)L)$ is a typical concave production function. $e(S)$ is a concave labour input efficiency function with argument of firm's social investments *S*. Thus *S* is measured with monetary terms increasing the efficiency of firm's workers. It can be directly added to the cost side of firms operations like the given wage level *w*. Note also that investment in infrastructure, *I*, is also measured in monetary terms - and added to firm's costs - but it does not enter in the firm's production function directly, but only indirectly via the expected utility presentation of production uncertainty. This means that investments in *I* does not increases the firm's production like *S* but it increases the probability of good operation state of firm.

The maximization problem in details is

$$\underset{(L,I,S)}{MAX}\{U(\pi) = q(I,S)U[Q(e(S)L) - (w+S)L - I + R] + (1 - q(I,S))U[-(w+S)L - I + R]\}$$

The first order conditions under assumption that interior maximization solution exists are

A1) $$\frac{\partial U}{\partial L}|_{L=L^*} = qU'(\pi_1^*)[Q'e(S) - w - S] + (1-q)U'(\pi_2^*)[-w - S] = 0.$$

B1) $$\frac{\partial U}{\partial I}|_{I=I^*} = q_I U(\pi_1^*) - qU'(\pi_1^*) - q_I U(\pi_2^*) + qU'(\pi_2^*) - U'(\pi_2^*) = 0.$$

C1) $$\frac{\partial U}{\partial S}|_{S=S^*} = q_S U(\pi_1^*) + qU'(\pi_1^*)[Q'e'L - L] - q_S U(\pi_2^*) + qU'(\pi_2^*)L - U'(\pi_2^*)L = 0.$$

The conditions imply that

A2) $$[w+S][qU'(\pi_1^*) + (1-q)U'(\pi_2^*)] = qU'(\pi_1^*)Q'e(S)$$

$$\Rightarrow$$

$$w + S = Q'(e(S)L^*)\frac{q(I,S)U'(\pi_1^*)e(S)}{q(I,S)U'(\pi_1^*) + (1-q(I,S))U'(\pi_2^*)}.$$

B2)
$$q_I U(\pi_1^*) - q_I U(\pi_2^*) - qU'(\pi_1^*) + qU'(\pi_2^*) - U'(\pi_2^*) = 0$$

$$\Rightarrow$$

$$\frac{q_I(I^*,S)}{q(I^*,S)} = \left[\frac{U'(\pi_1^*) - (1-\frac{1}{q(I^*,S)})U'(\pi_2^*)}{U(\pi_1^*) - U(\pi_2^*)}\right].$$

C2)
$$q_S U(\pi_1^*) - q_S U(\pi_2^*) + qU'(\pi_1^*)[Q'e'L - L] + qU'(\pi_2^*)L - U'(\pi_2^*)L = 0$$

$$\Rightarrow$$

$$\frac{q_S(I,S^*)}{q(I,S^*)} = L\left[\frac{-U'(\pi_1^*)(Q'e'-1) - (1-\frac{1}{q(I,S^*)})U'(\pi_2^*)}{U(\pi_1^*) - U(\pi_2^*)}\right].$$

3.2. Implications of results

Condition A2) says the firm's optimal wage level for the labour input is less than the level of its contribution to output since $0 < \frac{q(I,S)U'(\pi_1^*)e(S)}{q(I,S)U'(\pi_1^*) + (1-q(I,S))U'(\pi_2^*)} < 1$ if $e(S) \le 1$.

As the firm pays social and health costs of its workers, the optimal wage level is still down pressed

A3) $$w > w^* = Q'(e(S)L^*)\frac{q(I,S)U'(\pi_1^*)e(S)}{q(I,S)U'(\pi_1^*) + (1-q(I,S))U'(\pi_2^*)} - S.$$

However the low wage level increases labour demand but typically the level of employment under product uncertainty is less than in the case of certainty, since (for details, see Appendix I)

$$\frac{dL^*}{dq} = \frac{-[U'(\pi_1^*)Q'e(S) + [U'(\pi_2^*) - U'(\pi_1^*)](w+S)]}{qU''(\pi_1^*)(Q'e(S) - w - S)^2 + qU'(\pi_1^*)Q''e(S) + (1-q)U''(\pi_2^*)(-w-S)^2} > 0.$$

Note that under risk neutrality $(U'(\pi_2^*) - U'(\pi_1^*) = 0)$ we still have $\frac{dL^*}{dq} > 0$.

Condition B2) can easily be transformed to elasticity presentation

B3) $$\varepsilon_{qI^*} = \frac{q_I(I^*,S)I^*}{q(I^*,S)} = I^*\left[\frac{U'(\pi_1^*) - (1 - \frac{1}{q(I^*,S)})U'(\pi_2^*)}{U(\pi_1^*) - U(\pi_2^*)}\right].$$

The sign of ε_{qI^*} is always *positive* since the numerator is always positive as

$$U'(\pi_1^*) > 0 \geq (1 - \tfrac{1}{q(I^*,S)})U'(\pi_2^*).$$

This happens naturally when the risk of production breakdown is high, i.e. $q(I,S)$ is close to zero. Note also that under risk-neutrality the result is valid.

Lastly, condition C2) can also be given an elasticity interpretation

C(3) $$\varepsilon_{qS^*} = \frac{q_S(I,S^*)S^*}{q(I,S^*)} = S^*L\left[\frac{-U'(\pi_1^*)(Q'e'-1) - (1 - \frac{1}{q(I,S^*)})U'(\pi_2^*)}{U(\pi_1^*) - U(\pi_2^*)}\right].$$

The sign of ε_{qS^*} depends on sign of $-U'(\pi_1^*)(Q'e'-1) - (1 - \frac{1}{q(I,S^*)})U'(\pi_2^*)$. The increase of social and health expenditures of a firm will decrease the probability of production breakdown, i.e. ε_{qS^*}>0, if

$$0 < \left[\frac{1 - \frac{1}{q}}{1 - Q'e'}\right]U'(\pi_2^*) \leq U'(\pi_1^*).$$

The sign of numerator is always negative and obtains a larger (negative) value when q is close to zero. With respect to this the firm values highly the large efficiency and production gains from social and health expenditures, i.e. $Q'e' > 1$. Typically in post-communist firms marginal productivity of labour input Q' is low ($0 < Q' < 1$) but labour input efficiency gains can still be high ($e' > 1$) making their product to be larger than one. Note that case $Q'e' < 1$ means that production and efficiency gains of social investments in labour input are at low level. Either the investments are at too low level or they are excess making the expenditure in them even harm causing (ε_{qS} <0). Note that there can be many different threshold levels of Q' and e' that make their product $Q'e'$ larger than one. It is expected that in different firms their combination also varies. In many cases production technology is harder to adjust than labour input efficiency.

In risk neutral case, the $\varepsilon_{qS} > 0$ condition is $\frac{1}{q} = Q'e'$. Comparing this to risk aversion case we observe $(1-\frac{1}{q})/(1-Q'e') > 1$ ratio allows even for $U'(\pi_1^*) > U'(\pi_2^*)$ case indicating the importance of marginal utility of good state for the firm. Note also that there exists a "trade off" between $(1-\frac{1}{q})$ and $(1-Q'e')$. When the probability of good state is evident, that is $q \to 1$, productivity gains from S can be low, $Q'e' \to 1$.

To sum-up we observe that positive non-breakdown condition (ε_{qI} >0) for infrastructure investments is always valid, but cases exist when expenditures in social and health care are non optimal. Evidently *I* and *S* have different roles in the firm. Due the complex model setting the sign of wage change effects on investments (dS/dw and dI/dw) are ambiguous (see Appendix II). Only when the firm is risk neutral the increase in wage level decreases infrastructure and social investments, i.e. $dI/dw < 0$ and $dS/dw < 0$.

4. DATA AND EMPIRICAL METHODOLOGY

Survey data used in this paper comes from a firm survey conducted among large Russian industrial enterprises in April-June 2003. The survey was organized by a joint research team of Helsinki School of Economics, Bank of Finland Institute for Economies in

Transition (BOFIT), and the Centre for Financial and Economic Research (CEFIR) in Moscow. The survey focused on enterprises' role in providing social services and infrastructure. The survey, therefore, includes many questions on firm's involvement in the provision of a wide variety of social services, assessments of public infrastructure items, generation of heat and electricity as well as regulation and competition. In contrast, detailed balance sheet data was not collected. Firm performance indicators and employment figures were obtained from Gnosis data base.

The survey covered 404 large and medium-sized industrial enterprises in 40 regions in Russia. Apart from energy production and minerals extraction which were excluded, the sample is representative of industrial distribution (in 2-digit level) in Russia. The majority of firms in the sample employ between 500 and 5000 employees. For a thorough discussion of the survey design and implementation see Haaparanta et al. (2003). Our empirical methods consists of OLS and Probit regressions. Descriptions and descriptive statistics of main variables used can be found in the Appendix III.

5. EMPIRICAL EVIDENCE

In this section, we will present our empirical evidence. Although our data does not allow to test our model directly, we are able to get a sense on how the data is in line with the model's features. We will start off with firm performance analysis to see how the firm's infrasoc activity is reflected into its performance. We are using common explanatory variables from performance literature coupled with our unique survey variables on firms' infrasoc participation. After the performance analysis we will turn our attention to the three channels of firm's infrasoc participation in enhancing firm's operational reliability.

5.1. Firm performance and infrasoc participation

Our model above suggested that the elasticity of good state probability with respect to infrastructure expenditures is positive but with respect to social expenditures the positive elasticity is not warranted. Now, if our model assumptions are correct, we would expect that higher infrastructure expenditures reflect into higher profits in real life data. This leads us to performance analysis. In this section, we will present the results from our

simple performance regressions where our focus is on the infrasoc variables. As we are here mostly interested in infrasoc variables, we do not go in details into the standard performance analysis.

There are other quite recent papers building on firm survey evidence from Russia but this literature has paid little attention to the question of social services and infrastructure. Brown and Earle (2000) use a measure of regional (subject of Russian Federation) transport infrastructure quality and find clear positive effect of its better quality on total factor productivity. Concerning developing countries, apart from the World Development Report, the role of infrastructure on firm level performance has been examined e.g. by Reinikka and Svensson (2002)[5]. A theoretical paper by Röller and Zhang (2005) envisages a transition country framework and examines how an *exogenously* given requirement to bundle social services to employee compensation may harm efficiency via soft budget constraints. In contrast to Röller and Zhang, we examine the case where firms *endogenously* choose to provide social services.

In this context use profit per employee (*eprofit*) as the dependent variable which is a measure of productivity. One percent of performance variable's tails is removed to exclude the most evident outliers. In the Russian case this is virtually a necessity due to major discrepancies between the firms. Table 10 in the Appendix IV gives results of similar performance analysis when using sales per employee as the dependent variable. Our main results are not altered. The standard control variables[6] we are using are capital, finance, internationality, geographical location, size of municipality (1000 inhabitants), market power, ownership[7] and industry. We proxy the level of capital with a dummy variable (invest) indicating whether the firm carried out major investments during 2000-2002. Internationality of a firm is measured as the percentage of firm sales exported in

[5] Reinikka and Svensson (2002) show that poor public infrastructure, as proxied by unreliable and inadequate electricity supply, significantly reduces private investment. For Russia see e.g. http://www.moscowtimes.ru/article/1009/42/368028.htm

[6] For example, Carlin et al (2001) use similar set of variables.

[7] A dummy was constructed for the largest shareholder (insiders, private, state, foreign, other). The category 'insiders' includes employers and managers and the category 'private' includes both private individuals and

2002. Financing situation of a firm is proxied with the interest rate it would have to pay for a short term bank loan.

To stay in focus, we do not report or discuss three control dummies (industry, location and market power) although they are included in the regressions. We also tested for another standard variable, tightness of competition (proxied by firms' view on the number of serious rivals) - both domestic and foreign, but found it systematically insignificant and it is thus omitted from the reported regressions. However, we include - though not explicitly report – a dummy for firm's market power which is another variable proxying the firm's competition environment[8]. Soft budget constraints (proxied by any sort of financial assistance from the state) were left out from our reported regressions as we did not find any significant effect on performance for it.

Our results suggest (see Table 6 on page 21) that private and state owned firms perform worse than the insider owned firms (benchmark dummy) on the average. This result somewhat contradicts Estrin and Angelucci (2003) who were not able to find clear performance differences between insider and outsider owned firms. Furthermore, also Djankov and Murrell (2002) find that there is no notable difference in the performance between insider and outsider owned firms while both perform clearly better than the state owned firms in the CIS countries. There are at least two major technical differences that might be causing the discrepancy between our results and the above two studies concerning insider versus outsider owned firm performance. First of all, our measure of ownership (majority shareholder) differs from the Estrin and Angelucci (ibid.) who use majority ownership and from Djankov and Murrell (ibid.) who have derived their synthesis results from studies that mostly use continuous ownership variables measured in percent of ownership. Secondly, the time scope of these studies is mostly prior to the

private Russian companies. The category 'state' includes all three levels of government in Russia. Large Russian firms are typically controlled by a single type of owner.

[8] Following Carlin et al. (2001), our market power dummy is based on firm's own view on how much its sales would decline if it would unilaterally increase its main products' prices by ten percents. Carlin et al. found that market power has some positive effect on sales and productivity growth but a negative effect on cost-reducing restructuring. While our results of market power on profit per employee were insignificant, we found a negative effect on sales per employee (see Table 10 in the Appendix IV).

Russian 1998 financial crisis. The crisis might have wiped out the worst performing insider owned firms thus excluding them from our survey sample gathered in 2003[9].

Our proxy for the level of capital fails to show significance. Financial constraints of the firm has the expected sign and it is highly significant. Riskier firms in banks' view, i.e. those who have to pay higher interest for loans, perform worse. Naturally, the direction of causality is ambiguous but this result could relate to the importance of financial constraints suggested by Estrin and Bevan (2003). Furthermore, larger size of municipality seems to serve firms performance better. Finally, we find evidence that the larger the share of exports in firm sales, the better it is performing.

Concerning our unique infrasoc variables, we have four different explanatory infrasoc variables each depicting somewhat different aspect of the phenomenon. First, as a variable reflecting firm's own infrastructure production, we have a dummy (*elec_prod*) with value of one if the firm produced its own electricity in 2002 and zero otherwise. Secondly, we have the variable (*railsup*) capturing the feature of firm's support to municipal infrastructure supply. The variable is coded as one, if firm provided any financial or non-financial support to municipal railway system in 2002, zero if none. Thirdly, to analyze social service provision we have the dummy variable (*house02*) coded as one if firm provided housing or financed housing of its workers in 2002. Finally, we test the effect of problems in infrastructure delivery on performance. This is controlled with a variable depicting the number of interruption days in municipal heat delivery experienced by the firm in 2002.

According to our results it seems that while production and support of infrastructure is positively connected to performance[10], social service provision to employees seems to be a burden. The coefficient on housing provision is negative. The coefficients are positive for railway support and electricity production when regressing on profit per employee in

[9] Estrin and Angelucci (ibid.) explicitly note that the 1998 crisis is likely to distort many variables they use.

2002. The coefficients of these three infrasoc dummies are quite large taking into account that the mean of profit per employee is 18.9. We also find strong evidence on negative effect of infrastructure interruptions on performance. Furthermore, we find evidence that interruptions experienced in electricity delivery have a negative effect on performance (see Table 10 in the Appendix IV).

Naturally, a potential bias arises in OLS estimates as infrastructure supply and performance are determined simultaneously. We are able to partly alleviate this endogeneity problem by running regressions with the same independent variables with 2003 performance figures. The main results remain unchanged. With infrasoc variables the results concerning infrastructure reappear with even larger coefficients but the housing provision variable becomes insignificant.

How do these results then coincide with our model implications? First, our model suggests unambiguously positive elasticity for the good state probability on infrastructure expenditures. Our clearly positive results of infrastructure expenditures on both 2002 and 2003 clearly support this feature of the model. In our model, positive elasticity for *q* with social expenditures would require quite strong condition (*Q'e'>1,* see page 14). We interpret our empirical results so that this condition is not satisfied as marginal productivity in Russia is low and efficiency gains from social expenditures are too small to reverse their product to be above one. Why are the firms then continuing to provide social services? One explanation could be that stopping social service provision would probably result in mass leave of workers from the firm as well as worsen firm's relations with the authorities. Thus, firms might be somehow locked up in "bad equilibrium" generated by the Russian social and institutional conditions.

5.2. Operation reliability: participation in infrastructure provision

As our model suggests, firms are interested in their *expected* profits. When they are choosing infrastructure *participation*, they only know that this affects positively the

[10] This result is in line with Brown and Earle (2000) in the sense that firms acknowledge the importance of functioning transport infrastructure to their performance and are thus willing to participate in its supply.

probability of no delivery disturbances and thus better profit. It would be tempting to find out whether participation in infrastructure provision diminishes interruptions, but cross sectional data do not allow to test this as there is most likely a lag in the effectiveness.

Based on the performance analysis of the previous sub-section the interruptions in municipal infrastructure provision affect firm performance negatively. However we will show that interruptions in municipal infrastructure provision affect firms' *participation* in investments positively. As firms realize the negative effect of interruptions into their daily operation, they react by increasing their participation in infrastructure provision in order to improve their own operation reliability. Participation in heat provision is the most widespread way of private infrastructure provision, and therefore we will first concentrate on it.

The column three in the Table 6 (on next page) reports the results of a Probit regression of firm's support to municipal heat supply. The dependent variable (*heatsup*) is constructed from the survey data so that it is coded one if the firm provided financial or non-financial support to municipal heat supply in 2002. Results show that heat interruptions have a positive effect on supporting municipal heat provision. Increase of ten interruption days in heat delivery increases the probability of supporting municipal heat delivery by four percents on the average. Furthermore, interruptions experienced in water delivery increase the probability of firm supporting it by approximately a percent per interruption day (see Table 10 in the Appendix IV).

Concerning control variables for heat delivery support, interesting result is that municipality size (coded in thousands) seems to decrease the probability of support. This is probably related to the fact that larger cities are generally older and their infrastructure systems were influenced less by the consequences of Soviet planning. Secondly, state and foreign majority ownership seem to increase considerably the probability of heat and

Table 6. Infrasoc variables and performance[a]

	OLS		*Probit[b]*
	eprofit02	eprofit03	Heatsup
Elec_prod	54.75	73.13	
	(2.38)**	(2.05)**	
Railsup	28.42	37.91	
	(2.16)**	(2.34)**	
House02	-10.62	2.67	
	(-2.02)**	(0.26)	
Heat interruption days	-0.55	-1.97	0.004
	(-1.89)*	(-5.46)***	(2.22)**
LNemp02			-0.036
			(-0.76)
LNsales02			0.059
			(1.88)*
Invest	0.88	12.56	-0.050
	(0.12)	(1.16)	(-0.68)
Interest	-2.06	-3.84	0.009
	(-2.90)***	(-3.51)***	(1.72)*
Population	0.0032	-0.0013	-0.0002
	(1.86)*	(-0.54)	(-2.21)**
Export02	0.31	0.43	0.0001
	(1.75)*	(1.78)*	(0.11)
Owner (insiders as the omitted category)			
Owner: Private	-19.48	-23.31	-0.006
	(-2.93)***	(-2.46)**	(-0.11)
Owner: State	-18.16	-38.00	0.210
	(-2.00)**	(-2.34)**	(2.12)**
Owner: Foreign	-26.04	-39.77	(dropped)
	(-1.11)	(-1.89)*	
Owner: Other	-22.57	-30.91	-0.025
	(-2.31)**	(-2.34)**	(-0.31)
Constant	33.15	93.34	
	(1.21)	(2.05)**	
No. of observations	229	229	188
Prob > F / Chi^2	0.0002	0.000	0.048
R^2 / Pseudo R^2	0.32	0.30	0.20

a. t- and z-values for OLS and probit in parantheses, heteroskedasticity robust standard errors used in all regressions. Federal District, industry and market power dummies included in all regressions but not reported.
b. Results concerning the probit regression are reported in average marginal effects on Prob(y=1) and their z-values. Marginal effects were obtained through Stata's "margeff" module.
***Significant at 1% level, **Significant at 5% level, *Significant at 10% level.

water delivery support, respectively. We also found some supporting results concerning gas delivery but they are left unreported due to rather high sensitivity to control variables.

5.3. Operation reliability: participation in social service provision

Our model indicates that also social services affect positively the probability of a good state, i.e. $q_S > 0$. This can be justified e.g. through better worker health. Furthermore, if social service provision is weak from the authorities' side, enterprises may use social service provision as an attachment tool. Thus, service provision is an operation reliability enhancer as it helps to retain the labour force in the firm. Stopping the provision might result in a mass labour shift from the firm, especially in locations where labor market is tight.

Juurikkala and Lazareva (2006b) obtained a result supporting our operational reliability argument. They show that firms use social services as non-wage benefits to employees in tight labour markets in order to increase labour attachment and thus decrease labour turnover. Improved labour attachment increases productivity and decreases labour costs as the money and time costs from replacing resigned workers diminish. This rationale for social service provision is a part of Russia firms' infrasoc provision that is also quite standard practise in advanced capitalist countries. Further, Juurikkala and Lazareva (ibid.) show that the strongest effect in labour turnover reduction concerns the blue collar workers and that improved access to local service provision diminishes the share of non-wage benefits.

We will test the effect of the magnitude of a firm's social service provision on labor turnover if a firm ceased to provide social services with an ordered probit regression where the dependent variable is considered as a proxy for q_S in our model. Ordered probit model considers a dependent variable for which the discrete responses are presented in order with quantitative interpretation (see e.g. Wooldridge, 2002). We constructed the dependent variable from the following survey question (distribution of the 399 answers in parentheses):

IF YOU STOP PROVIDING YOUR EMPLOYEES WITH ALL SOCIAL SERVICES, KEEPING TO THE SAME SALARY LEVEL, HOW MANY EMPLOYEES APPROXIMATELY WOULD LEAVE YOUR FIRM?

1. *None (203=51%)*
2. *Less than 10% (123=31%)*
3. *10-20% (44=11%)*
4. *20-30 % (15=4%)*
5. *30-50% (10=2%)*
6. *More than 50% (4=1%)*

Half of the sample firms expect to lose workers if they simply divested all of their social service provision. For almost a fifth of the firms, the staff loss would be more than ten percent which is likely to cause some problems for firm operations. In the ordered probit model the independent variable of most interest is the total rouble book value of social service facilities divided by sales in 2002 (*allsocial_persales*). Our results give a strong positive coefficient to this aggregated social service variable.

Table 7 shows the regression results along with marginal effects and their p-values for the social service magnitude variable. One unit increase in the social service facilities per sales would increase the probability of 10-20% of the labour force leaving the

Table 7. Ordered probit regression on testing social service provision for operation reliability

Ordered probit on Labour leave after divestment[a]		***Marginal effects and P-values of variable coefficients[b]***					
		Answer 1	*Answer 2*	*Answer 3*	*Answer 4*	*Answer 5*	*Answer 6*
Allsocial_persales	0.383	-0.135	0.048	0.052	0.015	0.014	0.007
	(2.14)**	0.013	0.025	0.016	0.064	0.069	0.156
LNemp02	-0.005						
	(-0.03)						
LNsales02	0.027	Observations	248				
	(0.27)	Pseudo R^2	0.04				
LNpopulation	0.073	Prob > Chi^2	0.06				
	(1.03)						

a. z-values in parentheses. Dummies for ownership, Federal district and industry included but not reported.
b. Marginal effects and P-values obtained with Stata's "meoprobit" module by Cornelissen (2006), reported only for *allsocial_persales* variable as others turned out insignificant.

enterprise after divestment by approximately five percents (answer 3). At the same time, it would decrease the probability of no mass leave by approximately fourteen percents (answer 1). Thus, with higher level of social service provision, the firm is able to retain larger labour force. Thus, this result gives some support to our model's assumption that social service provision should be viewed also as firm's means to increase operation reliability via keeping hold of its staff.

5.4. Operation reliability: relations with the public sector

Above we have shown evidence that firms use infrasoc participation as means to increase operational reliability via more reliable infrastructure delivery and labour attachment. The third channel for increasing operational reliability is related to coping with the authority risk. By authority risk we mean all arbitrary and potentially harmful activity that authorities may exercise over enterprises. In an environment characterised by insecure property rights, rigid rules with large possibilities for interpretation and poorly functioning juridiciary a local bureaucrat may either greatly facilitate or greatly harm private business operations.

On the other hand, in such an environment a poor local administration may easily be captured by private interests. As our survey results show, infrastructure-providing enterprises are on the average larger than other enterprises. And, especially in a transition economy, size tends to come with connections and influence. An influential firm would typically be a large firm, employing a large share of the local population and consequently affecting directly the local wellbeing and political mood. An influential firm has good opportunities to engage in what Frye (2002) describes as elite exchange: enterprises which receive favourable treatment also provide some benefits to state agents.

There are several possible reasons for the public sector to be interested in cooperation with enterprises in the provision of public goods and complementary capital. The self-evident reason is of course that the local public sector in Russia has very little money available for new investments, and it is in everyone's interest to use existing capacity whenever possible. Even if a municipality could manage public infrastructure without the

help of local enterprises, maintaining close relations probably enables local politicians to obtain some private benefits.

The mismatch between considerable expenditure requirements and the lack of own revenues at the regional level also results in peculiar forms of public goods provision. In their analysis of Russian fiscal federalism, Lavrov, Litwack, and Sutherland (2000) argue that regions and localities in Russia favour large incumbent firms capable of providing public goods. As cash-constrained regional and local governments must provide traditional public goods such as education and health care, as well as heating and road upkeep, local administrations have an incentive to cooperate with local enterprises in providing statutory public services.

One channel for informal budget operations is to have large firms contribute directly to the provision of some public services such as road maintenance or health care. In exchange, regional governments may tolerate large tax arrears with no expectation of ever being paid. At the regional level, everyone is happy, i.e. firms roughly pay in some form most of the taxes they would otherwise have to pay, consumers get better public services, and regional leaders have independent discretion over budget operations. The obvious loser is the federal government, which is effectively deprived of its share of tax revenue, (see also Haaparanta and Juurikkala 2004). Frye (2002) offers survey evidence that the economic playing field in Russia is tilted in favour of large enterprises (which typically provide infrasoc goods) and against smaller de novo firms, especially at the regional level.

There is evidence that firms engaged in infrasoc provision have been able to extract favours from the local government. First of all, Juurikkala and Lazareva (2006a) show that enterprises have been able to use their social assets as leverage to extract benefits from the local public sector. Juurikkala and Lazareva (ibid.) find that firms which divested their social assets later received more financial benefits from the local authorities, especially in poor localities. They also find that firms operating in tighter competition situation divested later, suggesting that social assets are used to lobby for authorities' help to protect firms from competition. Also Solanko (2006) found evidence that firms

involved in heat provision were more likely to receive financial benefits from the authorities. We refer to these results as an evidence for the third channel of increasing operational reliability, i.e. increasing the probability of the good state via a combination of infrasoc provision and public relations.

Our survey data allows us to directly test ability to affect authorities' decision making, i.e. state capture. We constructed a dummy variable getting value one, if the general manager estimated his enterprise having any influence on local/regional decision making. A simple Probit regression was used to test for determinants of firms' ability to capture the local/regional administration. The results reported in the first two columns of the Table 8 suggest that participation in infrasoc provision enhances the firms' chances to influence public decision-making. As expected, larger enterprises in smaller jurisdictions have higher probability of influencing activities by local/regional authorities. Ownership does not seem to be a decisive factor. Compared to insider owned enterprises, only foreign owned firms differ in having significantly smaller probability to affect authorities. But clearly, enterprises supporting municipal heating systems have significantly higher probability to have an effect on local/regional decision making.

Therefore, engagement in infrasoc provision helps enterprises to maintain good relations with the local administration and to extract benefits from it. But as expected, the local administrations are not passive but rather they have every incentive to ensure continuity of firms' infrasoc provision. The survey data offer us an indirect measure to proxy for administration's bargaining power. We are able to construct dummy variables on the expected consequences after hypothetical infrasoc divestment. Thus, *worse_heat* has an outcome of one if general manager thinks their relations with local authorities would worsen and/or firm's taxes unrelated to heating system would increase if firm divested from the heating boilers. Variable *worse_medic* is constructed similarly for medical facilities divestment. We use these variables as additional explanatory variables to explain firms' infrasoc provision.

Table 8. Infra-social participation and public relations

PROBIT[a]	*munic_capture*	*regio_capture*	*Heat prov*	*Medic facil*
LNpopulation	-0.048	-0.034	-0.080	-0.006
	(-1.67)*	(-1.24)	(-3.25)***	(-0.17)
LNemp02	0.106	0.065	0.089	-0.015
	(1.70)*	(1.05)	(1.49)	(-0.19)
LNsales02	0.028	0.044	-0.008	0.063
	(0.66)	(1.09)	(-0.21)	(1.13)
Invest	-0.072	-0.051	0.071	0.023
	(-0.82)	(-0.62)	(0.85)	(0.23)
Owner: Private	-0.023	0.087	0.126	0.110
	(-0.33)	(1.25)	(1.88)*	(1.32)
Owner: State	-0.130	0.065	0.063	0.018
	(-1.21)	(0.58)	(0.61)	(0.14)
Owner: Foreign	-0.240	-0.030	-0.151	0.098
	(-2.09)**	(-0.23)	(-1.49)	(0.58)
Owner: Other	0.045	0.130	0.216	0.432
	(0.27)	(0.83)	(1.95)*	(4.73)***
Heat support	0.164	0.210		
	(1.75)*	(2.18)**		
Heat_pre90			0.263	
			(3.07)***	
Worse_heat			0.137	
			(2.17)**	
Medic_pre90				-0.056
				(-0.53)
Worse_medic				0.189
				(2.25)**
Prob > Chi^2	0.04	0.02	0.000	0.03
Pseudo R^2	0.11	0.12	0.36	0. 19
No. of observations	237	239	175	158

a. Probit regression results are reported in average marginal effects on Prob(y=1) and with their z-values. Heteroskedasticity robust standard errors used. Federal district, industry and market power dummies included but not reported.

In the case of heat provision, we use heat provision to outsiders as the dependent dummy variable while the independent medical variable is a dummy for a positive book value of medical facilities. The results are given in the columns three and four of Table 8. Regressions show that if firm expects worse authority relations after hypothesized divestment from heat provision, it is fourteen percent more probable to provide it than a firm that do not perceive this threat. For medical service provision the effect is some nineteen percents. Thus, the threat of worsening authority relations seems to be partly

keeping the current system in operation. Besides staff leave, the authority risk might be another reason for firms' locking up in bad equilibrium of producing non-profitable social services. The results are in line with Solanko (2006) who shows that heat provision by Russian enterprises is largely explained by relations with the local public sector and by inherited factors. The inheritance factor is also addressed in Table 8 through dummy variables coded as one if firm had heating boilers and medical facilities already in the socialist time (*heat_pre90* and *medic_pre90*). Interestingly, while heat provision is strongly explained by inheritance the medical provision is not, probably reflecting the smaller capital intensity of medical provision.

6. CONCLUSIONS

The practice of firms' participation in infrastructure and social service provision was initiated under the Soviet Union regime but it is still visible in current Russia despite the end of the socialist regime almost twenty years ago. Utilizing a theoretical model and a unique survey data from large Russian enterprises, the main target of paper was to grasp the rationality behind this activity for the firms that nowadays operate in market driven economy. The main idea of our model is to explain the firms' infrasoc participation through the argument that via infrasoc participation the firm is able enhance its operation reliability.

Based on earlier related studies as well as our new results, we are inclined to believe that the complex system of Russian firms' infrasoc provision can be largely reduced to two factors. The first one - physical and social/institutional inheritance - is exogenous in nature. While institutional practices linger on in the background, the costs of infrasoc participation are considerably cheaper with inherited capital and even outside provision is rational also for small compensation. The second rationale is the one introduced in our model, i.e. firm's effort to increase its operational reliability. This factor materializes through various channels. With infrasoc participation firms try to improve the reliability of municipal infrastructure delivery to secure smooth production, to increase the commitment level of employees in order to prevent staff loss, and aim at better public

relations in order to gain more friendly regulatory atmosphere. Our survey data gives empirical support to all these features.

The firm provision of infrasoc goods is likely to continue as long as public sector is unable to carry out its mandates, Russian institutions remain weak, and facilities inherited by firms from the Soviet times are usable. Should these results be taken as good or bad news for a developing economy? The resulting equilibrium will unavoidably be one characterised by close relations between the local public sector and large industrial enterprises. Even though that may be efficient in the short term, it will certainly hinder the growth of SMEs and new start-ups in the industrial sector. This may result in less competition and possibly less efficiency in the longer term. On the other hand, currently Russian public sector is still in such a poor condition that without firms' participation, many citizens might be deprived of their daily necessities taken as granted in more advanced capitalist countries.

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Appendix I

Applying implicit theorem to condition A1) holding I and S fixed gives

$$dqU'(\pi_1^*)[Q'e(S)-w-S]-dqU'(\pi_2^*)[-w-S]+$$

$$qU''(\pi_1^*)[Q'e(S)-w-S]^2\,dL+qU'(\pi_1^*)Q''e(S)dL+$$

$$+(1-q)U''(\pi_1^*)[-w-S]^2\,dL=0.$$

Collecting terms dL and dq on left and on right hand side of equation leads to

$$[qU''(\pi_1^*)(Q'e(S)-w-S)^2+qU'(\pi_1^*)Q''e(S)+(1-q)U''(\pi_1^*)(-w-S)^2]dL=$$

$$-[U'(\pi_1^*)(Q'e(S)-w-S)+U'(\pi_2^*)(w+S)]dq,$$

and dividing on both sides entails that

$$\frac{dL^*}{dq}=\frac{-[U'(\pi_1^*)Q'e(S)+[U'(\pi_2^*)-U'(\pi_1^*)](w+S)]}{[qU''(\pi_1^*)(Q'e(S)-w-S)^2+qU'(\pi_1^*)Q''e(S)+(1-q)U''(\pi_1^*)(-w-S)^2]}.$$

Numerator is negative since $\pi_2<\pi_1$ and $[U'(\pi_2^*)-U'(\pi_1^*)]>0$. Denominator is also negative since $U(.)$ and $Q(.)$ functions are concave, thus $dL^*/dq>0$.

Appendix II

Differentiating first order condition B1) with respect to w and $I = I^*$ gives

$$qU'(\pi_1^*)[-L]dw+qU''(\pi_1^*)[-L][Q'e'-1]Ldw$$

$$-q_IU'(\pi_2^*)[-L]dw+qU''(\pi_2^*)[-L]Ldw-U''(\pi_2^*)[-L]Ldw$$

$$+q_{II}U(\pi_1^*)dI-q_IU'(\pi_1^*)dI-q_IU'(\pi_1^*)dI+qU''(\pi_1^*)dI$$

$$-q_{II}U(\pi_2^*)dI+q_IU'(\pi_2^*)dI+q_IU'(\pi_2^*)dI+qU''(\pi_2^*)dI$$

$$+U''(\pi_2^*)dI=0.$$

Collecting terms for *dw* on right hand side and for *dI* on left hand side of the equation leads to

$$q_{II}[U(\pi_1^*) - U(\pi_2^*)]dI + 2q_I[U'(\pi_2^*) - U'(\pi_2^*)]dI$$

$$+q[U''(\pi_1^*) + U''(\pi_2^*)]dI + U''(\pi_2^*)dI$$

$$= q_S L[U'(\pi_1^*) - U'(\pi_2^*)]dw + qL^2[U''(\pi_1^*)[Q'e' - 1] + U''(\pi_2^*)(1 - \tfrac{1}{q})]dw.$$

If the firm is close to risk neutral agent, i.e. $U'' \approx 0$, then $dI/dw < 0$ if $q_{II} > 0$.

Differentiating first order condition C1) with respect to $S = S^*$ and w gives

$$q_S U'(\pi_1^*)[-L]dw + qU''(\pi_1^*)[-L][Q'e' - 1]Ldw$$

$$-q_S U'(\pi_2^*)[-L]dw + qU''(\pi_2^*)[-L]Ldw - U''(\pi_2^*)[-L]Ldw$$

$$+q_{SS}U(\pi_1^*)dS + q_S U'(\pi_1^*)[Q'e' - 1]LdS$$

$$+q_S U'(\pi_1^*)[Q'e' - 1]LdS + qU''(\pi_1^*)[Q'e' - 1]^2 L^2 dS + qU'(\pi_1^*)[Q''e']LdS$$

$$-q_{SS}U(\pi_2^*)dS - q_S U'(\pi_2^*)[-L]dS + q_S U'(\pi_2^*)LdS + qU''(\pi_2^*)[-L]LdS$$

$$-U''(\pi_2^*)[-L]LdS = 0.$$

Collecting terms for *dw* on right hand side and for *dS* on left hand side of equation leads to

$$q_{SS}[U(\pi_1^*) - U(\pi_2^*)]dS + q_S L[2U'(\pi_1^*)[Q'e' - 1] + 2U'(\pi_2^*)]dS$$

$$+qL[U''(\pi_1^*)[Q'e' - 1]^2 L + U'(\pi_1^*)[Q''e'] - (1 - \tfrac{1}{q})U''(\pi_2^*)L]dS$$

$$= q_S L[U'(\pi_1^*) - U'(\pi_2^*)]dw + qL^2[U''(\pi_1^*)[Q'e' - 1] + U''(\pi_2^*)(1 - \tfrac{1}{q})]dw.$$

If firm acts close to risk neutral agent, i.e. $U'' \approx 0$, then $dS/dw < 0$, if $q_{SS} > 0$, $Q'' < 0$, and $e'' < 0$.

Appendix III

Table 9. Description of main variables

Dependent variables[a]

	Description	Obs	Mean	Std.Dev	Min	Max
eprofit02	Profit per employee in 2002	359	18.87	47.47	-83.95	274.96
eprofit03	Profit per employee in 2003	359	19.83	65.16	-139.89	490.31
esales02	Sales per employee in 2002	376	318.78	266.85	3.90	1527.80
esales03	Sales per employee in 2003	369	435.59	418.84	15.28	2580.20
munic_capture	Dummy=1if firm admits to have ability to influence relevant local / regional legislation	375	0.44	0.50	0	1
regio_capture		386	0.36	0.48	0	1
Heat prov	Dummy=1if firm provides heat to outsiders	404	0.41	0.49	0	1
Heat support	Dummy=1 if firm provided non- or financial support to municipal heating system	403	0.17	0.37	0	1
Medic facil	Dummy=1 if firm has medical facilities in its books	341	0.34	0.48	0	1

Independent variables

	Description	Obs	Mean	Std.Dev	Min	Max
LNemp02	Log of employment in 2002	390	6.82	0.92	1.79	10.50
LNsales02	Log of sales in 2003	375	12.24	1.32	7.90	16.13
Population	Population of firm's municipality in 1000s	401	1239.77	2265.88	15.6	8304.6
Invest	Dummy=1 if firm has had major capital investments in 2000-2002	402	0.82	0.38	0	1
Interest	Estimated annual interest firm would have to pay for a short term bank loan	333	20.19	4.46	0	39
Export02	Share of exports of all sales in 2002, in %	399	11.29	20.73	0	100
Elec_prod	Dummy=1 if firm produces electricity	404	0.04	0.21	0	1
Railsup	Dummy=1 if firm provided non- or financial support to municipal railway system	403	0.08	0.27	0	1
Heat_pre90	Dummy=1 if firm had heating boilers already in Soviet times	403	0.58	0.49	0	1
Heat interr. days	Number of interruption days in municipal heat supply to firm	399	1.16	6.48	0	90
Worse_heat	Dummy=1 if manager believes heat divestment --> worse relations and/or higher taxes	276	0.27	0.44	0	1
Allsocial_persales	Book value of all social services in 2002 divided by sales	362	0.09	0.52	0	7.03

House02	Dummy=1 if firm owned or supported staff housing in 2002	404	0.39	0.49	0	1
Medic_pre90	Dummy=1 if firm had medical facilities already in Soviet times	403	0.77	0.42	0	1
Worse_medic	Dummy=1 if manager believes medical divestment --> worse relations and/or higher taxes	301	0.19	0.40	0	1

a. Note that heatprov and heatsup are also used as independent variables

Appendix IV

Table 10. Additional results on infrasoc and performance

	OLS		*Probit*[b]
	esales02	esales03	watersup
Elec_prod	175.72	375.68	
	(1.49)	(2.24)**	
Railsup	165.45	271.42	
	(2.39)**	(2.85)***	
House02	-63.36	-68.97	
	(-2.08)**	(-1.31)	
Electricity interruption days	-2.68	-4.18	
	(-2.92)***	(-3.43)***	
Water interruption days[a]			0.011
			(2.92)***
LNemp02			0.010
			(0.18)
LNsales02			0.024
			(0.69)
Invest	53.85	61.25	-0.055
	(1.55)	(0.91)	(-0.78)
Interest	-14.65	-28.54	0.004
	(-3.88)***	(-5.04)***	(0.67)
Population	0.01	0.005	-0.00003
	(1.21)	(0.32)	(-1.74)*
Export02	1.09	1.55	-0.002
	(1.06)	(1.09)	(-1.23)
Owner (insiders as the omitted category)			
Owner: Private	-71.67	-42.49	-0.012
	(-2.29)**	(-0.80)	(-0.24)
Owner: State	-128.01	-213.95	0.119
	(-2.19)**	(-3.36)***	(1.07)
Owner: Foreign	65.24	7.14	0.485
	(0.51)	(0.05)	(2.91)***

Owner: Other	-75.04	-109.67	-0.101
	(-1.75)*	(-1.57)**	(-1.92)*
Market Power (sales drop >10% after unilateral 10% increase in prices as omitted category)			
Market Power: sales drop =10%	13.04	-10.18	-0.013
	(0.29)	(-0.15)	(-0.19)
Market Power: sales drop <10%	-87.55	-190.18	0.084
	(-1.91)*	(-2.48)**	(1.06)
Market Power: no sales drop	-104.78	-191.09	0.065
	(-2.97)***	(-3.60)***	(0.77)
Constant	438.50	840.24	
	(3.69)***	(4.62)***	
No. of observations	236	231	184
Prob > F / Chi^2	0.000	0.000	0.002
R^2 / *Pseudo* R^2	0.41	0.43	0.28

a. Water interruptions omitted from the performance analysis as it turned out insignificant