

Imitations and Innovations in a Transition Economy¹

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Introduction

It is widely believed that Russian firms do not innovate. This belief is based on the conjecture that Russian firms should conduct R&D and introduce absolutely new products with the same intensity as do firms from the developed countries. At the same time, “distance to frontier” theory suggests that firms from countries, located far from the technological frontier, can grow quite fast not by introducing absolutely new technologies, but by copying technologies and products, developed in other countries (Acemoglu et. al 2002a,b). In many cases such development by imitation strategy can produce faster growth rates than attempts to grow by doing innovations.

By using two different statistical sources, this paper shows that the overall innovation and imitation rate in Russia is not that low. Russian statistical office Goskomstat reports that about 9% of all enterprisers innovate every year.⁴ The small enterprise level survey, which we conducted together with the Institute of Economies in Transition, produces a slightly higher number: more than 40% of enterprisers report being involved in innovative activities in the last tree years. In line with distance to frontier theory, more than half of Russian enterprisers, which report doing innovations, in fact simply imitate foreign or other firms products, or introduce well-known technologies.

Competition with either domestic or foreign products is the main factor, which stimulates both innovations and imitations. At the same time, credit constraints are the major obstacles to innovations. Interestingly, those firms, which innovate, in comparison to those, which imitate, pay special attention to relaxing credit constraints. Such firms are usually better in terms of corporate

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⁴ In this paper we will use the words “firm” and “enterprise” interchangeably. Russian official statistics does not allow firms to report consolidated balance sheet information, and collects data separately from each establishment. Exact ownership structure of each establishment is not known, so we view them as separate firms.

governance. They also more often complain about unavailability of external financing, but these complains can rather be explained by the fact that such firms look for external finance more often than imitating firms.

When asked directly, firms rarely complain that quality of their personnel and management is an obstacle to innovations and imitations. At the same time the probability to imitate is positively correlated with presence of managers, which received some training abroad. It appears that imitating firms follow “westernization” strategy: they copy both western technologies and managerial techniques. Education of managers is less important in the case of firms, which report introducing only absolutely new products or technologies. This finding is a bit at odds with the theory, which claims that managing innovations is more complicated than managing imitations. At the beginning of transition, in countries such as Russia there was shortage of good management, while good personnel, which is able to conduct R&D, was available. It is possible that Russian management is better in managing innovations, produced by domestic human capital, than in managing imitations of products, developed by foreign human capital. Therefore, imitating firms pay special attention to education of managers.

We should notice that, as it often happens in transition economies, the quality of our data is far from perfect, and our findings can be at best considered as suggestive. Nonetheless, they allow making several conclusions. There are two factors, which can help to increase innovation and imitation rates in Russia. These factors are: building better financial system, which require improvements in corporate governance, and improving education of managers. It is often believed that quality of management is more important for innovation-based strategy than for imitation-based strategy. In reality the situation is probably even more complicated. Quality of management is so poor in countries, located far from the technological frontier, that even imitation-based strategy requires substantial investment in education of management. Preserving relatively strong competition, particularly with imported products, is one more factor, which will help to stimulate innovations.

The paper is organized as follows. In the next section we provide some descriptive information on innovative activities of Russian firms. Section 3 describes theoretical basis for

regression analysis and results, obtained in other studies. Section 4 briefly describes data sources, and construction of variables. Section 5 analyses the results of regression analysis, and Section 6 concludes.

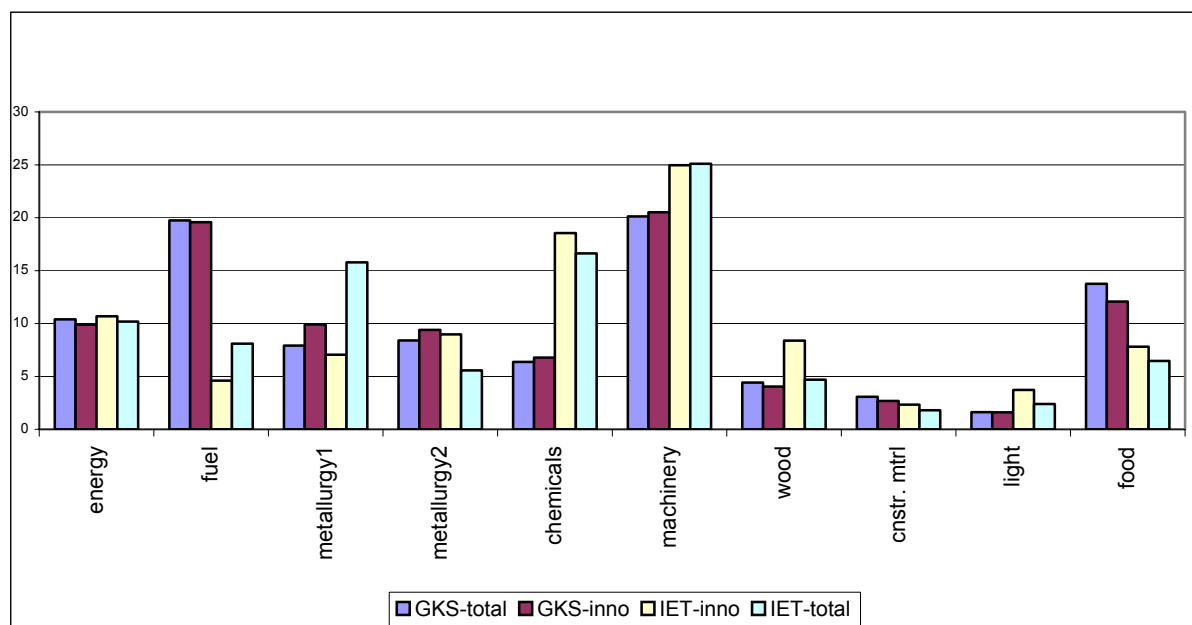
Basic Facts about Innovative Activities of Russian Firms.

The data on innovations, which we use in this study, are coming from two different sources. The first one is the enterprise survey, conducted specially for this paper by S. Tsukhlo from the Institute of Economics of Transition (IET). The innovation questioner was sent by mail to the sample of 1200 firms, which usually participate in the monthly surveys conducted by S. Tsukhlo, and 724 responded to the questioner. Most of firms, included in the sample, existed in pre-transition period. The sample is slightly biased toward machinery and chemicals in expense of fuel industry. The original sample of firms, to which the questioner was sent, is also biased toward metallurgy, but these firms had low response rate. Graph 1 compares the industrial breakdown of this dataset with the industrial composition of the Russian industry, reported in the official statistics. The GKS-total variable corresponds to the industrial breakdown, reported standard Goskomstat industrial statistics for 2001. The IET-total variable is the breakdown of industrial production of firms, to which the IET questioner was sent. The questioner does not have questions on output, so production data are obtained by merging the IET dataset and the Russian firms' registry.⁵ The IET-innovations variable reports breakdown of production of firms, which responded to the innovation questioner. As in the case of the total IET sample, production was obtained by merging IET sample with the firm registry.

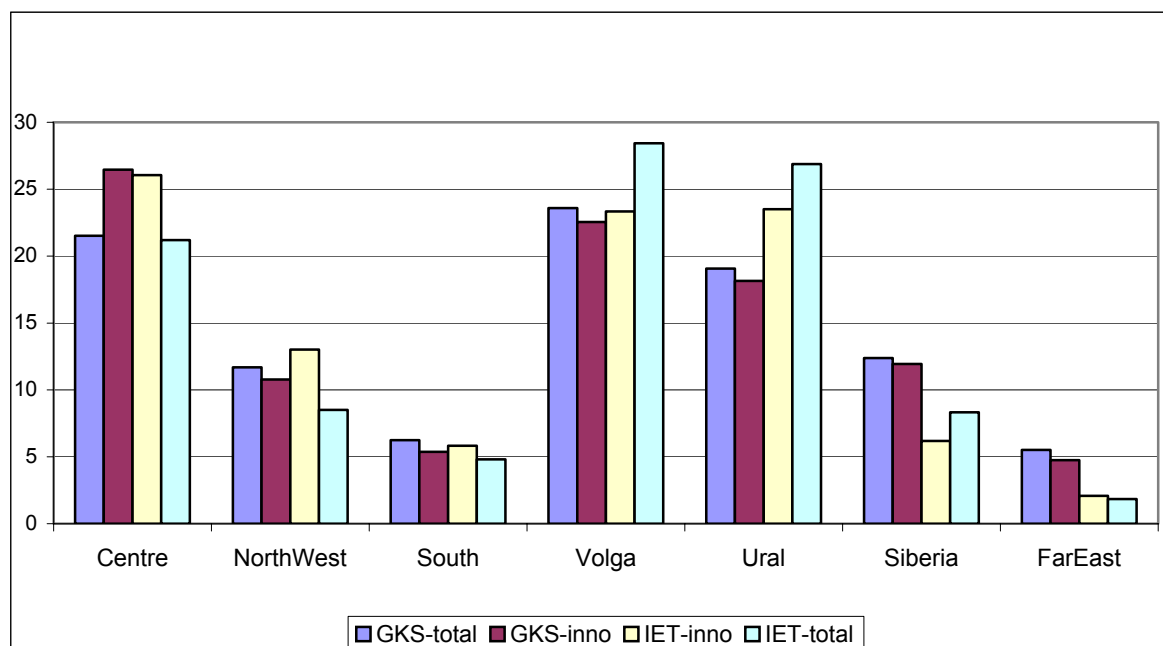
Graph 2 reports regional breakdown of the IET sample and its comparison to the Goskomstat data. Again, both samples are more or less representative, with slight bias toward Ural region, in expense of Siberia and Far East. Such geographical bias is a natural result of the bias of the industrial breakdown toward machine building sector, because a large percentage of Russian machine building is located in Volga and Ural regions.

⁵ More details on the registry data will be reported in the next section.

.Graph 1 industrial composition of the datasets



Graph 2 Regional composition of the datasets



The IET questioner contains questions about types of innovative activities, goals of innovative activities, sources of funding, and obstacles to innovations. The survey shows that about 87% of firms are involved in innovative activities in the last three years. This number looks too high, particularly in comparison to the official statistics (see below). It seems to be consistent with other non-official survey data. Krasnochtchekova (2000) provides data from The Russian Economic Barometer (REB) survey of innovative activities of firms in 1993-96. According to REB, the

percentage of firms, which were involved into either product or process innovation in these years, was fluctuating between 58-63 percent. The REB sample is similar in nature to our sample, and the hypothesis that in the early 2000s the percentage of firms, involved in innovations, increased by about 25% in comparison with 1990s sounds reasonable. Nonetheless, the statistics on the number of firms that innovate in this dataset can be biased upward. It can happen because firms, which are not involved in innovation activities, may have lower incentives to respond than the firms, which are involved in innovative activities. If we assume that all firms, which have not replied to the survey questioner, are not involved into innovative activities, then the resulting percentage of innovative firms will be equal to 41%. As we will show below, this number is still higher than the one in the Goskomstat data.

Another characteristic of innovation activities, used in this survey, is difference in innovation rate with 1980s. Enterprisers were asked whether they think that today they innovate more or less than in 1980s. About 36% of enterprises responded that their innovation rate increased since the Soviet times.

The second data set was constructed using Russian Statistical Agency “Goskomstat” publications on innovation activities of Russian firms in 2001 and 2000. These publications summarize the results of innovation surveys, which Goskomstat conducts on the annual basis. The publication does not give a lot of details on the sample, but it appears that the original database covers about 25000 Russian firms. The sample of firms is representative for the Russian industry, and closely follows the industrial and regional breakdown of the overall Russian industry (see Graphs 1 and 2, variable GKS-innovations). The publication divides all firms on those with innovations, and others, and provides summary tables for the two groups of firms. Most information is either by industry, or by region, or both. At the end of the 2001 publication there is a list of firms, which were involved into innovative activities in the last three years. This list includes brief descriptions of innovations. The publication contains a lot of other information on firms, involved in innovative activities, such as sources of finance, total spending on innovation activities, etc. This data, however, are available only in summary tables, and not available on the firm level.

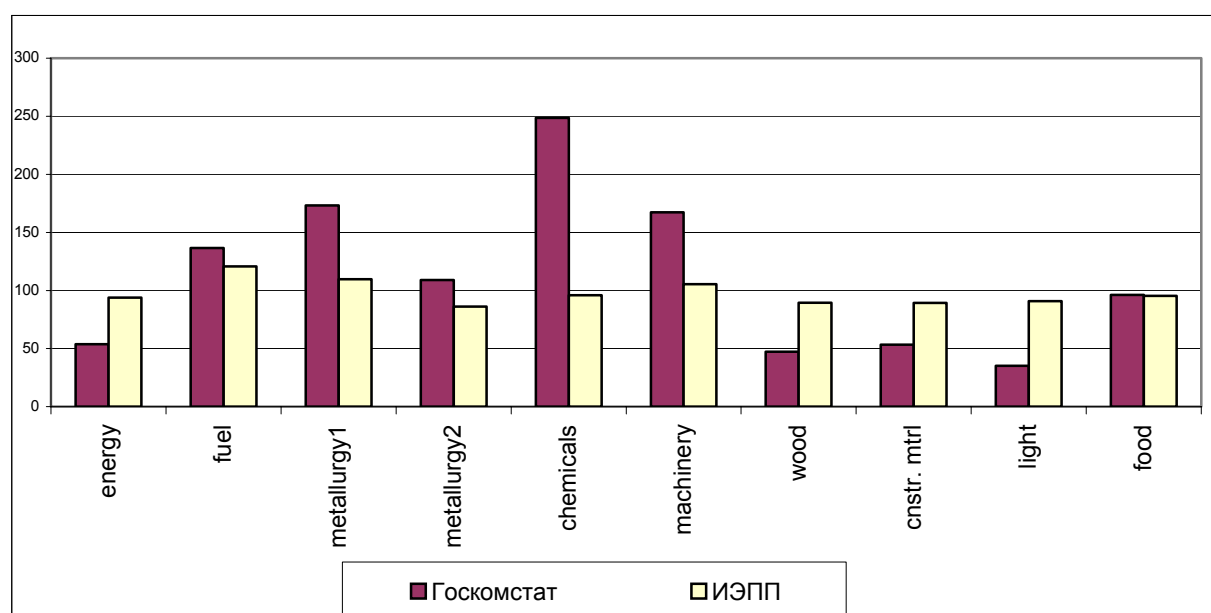
The percentage of firms, involved into innovative activities in this dataset is 8.5% in 2000 and 8.7% in 2001. Since these numbers correspond to innovation activities during one year, they are not highly inconsistent with the findings of the IET survey. Assuming that each enterprise introduce innovation once every three years, Goskomstat data suggests that about 25-30% of firms innovated in the period 1991-2001. This number is below than the number, obtained in the IET questionnaire. However, the IET questionnaire refers to a slightly later period (the questionnaire was sent out in September 2003). The time period, considered in the IET dataset, is characterized by higher and more stable growth rate, than the period, considered in the Goskomstat survey. Such better economic situation can explain why IET innovation rate is higher than the Goskomstat one. We also can not exclude the hypothesis that Goskomstat's number is biased downward because of underreporting. While in the case of the first dataset, firms, which have no innovations, had little incentives to respond to the questionnaire, in the case of the Goskomstat dataset, firms, which had innovations, but did not fill in the form can be mixed with the firms, which did not have innovations. This type of underreporting is very common in the Russian statistics.⁶ Goskomstat's questionnaire is much larger than the IET questionnaire, and includes not only qualitative questions about presence of innovations, types of innovations, problems with innovations, and so on, but also rather detailed questions about the percentage of funds spent on innovation activities. Russian firms can be more reluctant to answer the questions about finance than to qualitative questions. As a result, the percentage of positive answers to the Goskomstat questionnaire can be smaller than for to the IET one. In addition, Goskomstat seems to first ask whether enterprises innovate, and then asks to choose proper innovation activity from the list. IET questionnaire go directly to the list of innovations. It is possible that due to this difference in methodology, some minor innovations are not taken care of in the Goskomstat survey, but appear in the IET survey.

Graph 3 presents the ratios of the share of firms, which innovate in each industry over the average share of innovative firms in overall sample. So, this graph compares innovation rates across industries. The variables were constructed in such a way, which allowed comparison between the two datasets. Surprisingly, in the IET dataset innovations are relatively equally distributed across

⁶ Jefferson et al (2002a) report similar problem in the Chinese data.

industries. In the Goskomstat innovation sample, firms in chemicals, machinery and metallurgy innovate more often than enterprisers from other industries.

Graph 3



Types of innovation activities

As far as forms of innovative activities are concerned, there are important similarities in both datasets (see Table 1). Both datasets report that among innovative activities, major role belongs to purchases of new machines and equipment: 62% of all firms, which do innovations, in the Goskomstat survey, and 64% of corresponding firms in the IET sample are involved in this type of activities. In the IET questioner, we also asked for the introduction of new products, and 61% of firms, which do innovations, reported that they have done it in the last three years. In-house R&D are doing 33% of innovating firms from the IET sample, and additional 16% of enterprisers outsource R&D. Goskomstat divides research and development into two separate activities, and reports that about 33% of innovative firms are involved in research, while 37% develop new products or technologies. Almost twice as many firms, which do R&D, are doing it in house. The median spending on R&D (among firms, which do R&D) is 2% of total sales in the IET dataset, and less than 1% in the Goskomstat dataset. Education of personnel was done on 24% of innovating firms in

the Goskomstat study, and 31% of innovating firms in the IET study. About 8% of innovative firms in the Goskomstat sample, and 7% in the IET sample purchase licenses. Introduction of new technologies varies a lot: if in Goskomstat data 16% of firms are buying new technologies, in the other sample this number goes up to 36%.

Both surveys ask whether firms do marketing studies. About 19% of Goskomstat firms, and 31% of IET firms do it. Goskomstat asks about purchases of new computer programs, and 27% of innovating firms did it. The question about education of personnel is formulated differently in two datasets. Goskomstat specifically asks about innovation-related education of personnel, while IET treats all education activities as innovations. This difference in formulations may explain difference in responses: only 24% of the GKS sample in comparison to 45% of the IET sample reported that they educated their personnel.

Table 1 Percent of firms, involved in innovative activities, in breakdown by activity.

Goskomstat		IET	
marketing studies	19%	marketing studies	31%
Innovation related education of personnel	24%	education of personnel	45%
Purchasing of new technologies	16%	introduction of new technology	36%
Of which: patents, licenses, prototypes	8%	purchases of licenses or patents	7%
Innovation-related purchasing of machines and equipment	62%	purchase of new machines and equipment	64%
Research and development of new products and technologies	33%	in-house R&D	33%
		outsourced R&D	16%
Purchasing of IT products	27%		
Development of new products, and preparation for production of new goods and services	37%		
		introduction of new products	61%

The IET questioner tries to separate development of absolutely new products and copying of already existing ones (see **Table 2**). Surprisingly high percentage of firms claim that they introduced absolutely new product or technology (27% and 13% respectively). About one third of all firms report that the new product they introduced is a small improvement to the one, which existed before.

Table 2: Characterization of new products/technologies.

	new products	New technologies
this is an absolutely new product/technology developed on our firm	27%	13%
this is an absolutely new product/technology developed by Russian specialists	12%	8%
This is a small improvement of the technology/product, which we already have on our firm	34%	29%
this is a technology/product, widely used abroad, on which we bought a license	5%	5%
This is a widely used technology/product for which we bought an equipment	23%	22%
this a copy of a foreign technology/product, which was developed at our firm (or by other Russian specialists)	15%	8%

Note: the numbers do not sum up to 100%, because firms were allowed to mark more than one answer.

Notice, that in Table 2 percentages do not sum up to 100%. This is related to the fact that firms were given the opportunity to give several answers to this question. It is possible that firms introduced several innovations during the period in question, and these innovations were of different types. Among 727 firms, which replied to the questioner, 226 firms either do not make innovations, or did not specify their type, 196 firms only conducted imitating innovations (raw 3 to 6 in Table 2), 148 firms introduced only absolutely new products or technologies (raw 1 and 2 in Table 2), and the remaining 157 firms have innovations of both types (marked more than one answer in Table 2).

Table 3 provides cross tabulation of answers to the questions about activity types and characteristics of activities. In this Table and other tables, which use the same classification of firms, we call positive answers to questions 1 and 2 in Table 2 “innovations”, and answers to questions 3-6 “imitations”. This table allows checking whether firms give reasonable and consistent answers to similar questions. Interestingly, those firms, which introduced both absolutely new innovations and imitations, are involved in innovations of all types more often. Quite reasonably, these firms, and firms, which introduce absolutely new products and technologies, are doing R&D themselves or outsource R&D more often than firms, which are involved into imitations. In contrast, the latter firms purchase machinery and equipment more often. They also educate their personnel slightly more often than the firms, which introduce absolutely new innovations. Conducting innovations may be self-educatory, so those firms, which do innovations themselves, do not need to spend time and resources on educating their personnel to use equipment, developed by other firms. However, education of new personnel is even more popular in the case of firms, which do both absolutely new innovations and imitations. Interestingly, imitating firms conduct marketing studies less often than

innovating ones. The highest rate of doing marketing studies is among those enterprisers, which do both innovations and imitations.

Table 3. Per cent of firms doing specific types of innovations.

	Firms with imitations	Firms with innovations	Firms with both
in-house R&D	23%	41%	53%
outsourced R&D	8%	22%	31%
introduction of new products	63%	63%	79%
introduction of new technology	34%	32%	55%
purchase of new machines and equipment	77%	39%	75%
education of personnel	44%	38%	64%
marketing studies	26%	32%	48%
purchases of licenses or patents	6%	7%	11%

Note: Firms, which did not answer to the questions regarding innovative or imitative types of activities, are omitted.

Reasons for innovation activities:

The IET survey asks firms why they like to be involved in innovative activities. About 73% of firms, which replied to this question, do it in order to improve financial situation. It appears that they often achieve this goal through decrease of the costs of production (64%). Increase (or preservation) of the market share (66%) or accessing new markets (59%) are also among the major reasons of doing innovations. The percentage of firms, which consider getting access to the international market as an important goal of innovation activities, is fairly large – 31%, but most of the firms still consider domestic market as the major market for their output. At the same time, only 7% of firms would like to become suppliers for the foreign firms working in Russia. Only 14% consider innovations as a way to improve capitalization of the company. This last number is consistent with the finding of Guriev et al (2003), who used similar dataset to study corporate governance of Russian firms. Guriev et al (2003) argue that most of the firms in the IET sample do not care about market capitalization, because are not traded openly on the market. Finally, about 11% of firms answered that they consider innovations as a way of decreasing dependence on suppliers, meaning that these firms would like to replace foreign-produced or outsourced inputs with inputs, outsourced to domestic suppliers or produced in-house. Such behavior can be a part of cost-decreasing strategy.

In Table 3 we compare motivation for innovation activities for firms, which conduct innovations, imitations, or both. There seem to be not that many differences in motivations across different groups of firms. The group, which conducts both innovations and imitations, is slightly different from the other two groups. Firms, which belong to this group, mention each goal more often than other firms. The difference is particularly large when they answer the question about increase in market share and product diversification. In addition, these firms more often than others care about market capitalization – this result is very interesting in light with the results about corporate governance, which we will show later. Finally, this firms care the most about becoming suppliers for foreign firms. Naturally, those firms, which conduct innovations, are the ones, which consider the possibility to become suppliers for foreign firms as the least important.

Table 3. Per cent of firms from each category, which mentioned the corresponding reason for innovation activities

Reason mentioned	Firms with innovations	Firms with imitations	Firms with both
better serve demand	53%	52%	66%
increase market share	71%	69%	83%
access new markets	68%	65%	75%
access new international markets	36%	34%	42%
decrease costs	66%	68%	73%
diversify products	23%	24%	38%
increase capitalization	16%	11%	26%
improve financial situation	72%	73%	76%
become supplier for foreigners	4%	7%	11%
decrease dependance from suppliers	11%	12%	17%
else	1%	2%	1%

Note: Firms, which did not answer to the questions regarding innovative or imitative types of activities, are omitted.

Financing innovations

Both data sources contain information about sources of funding for innovations, but they report it differently. In the IET dataset, firms report percentage of funds, used to finance innovations, which was raised from a particular source. Therefore, summary statistics, which we report in this paper, correspond to the average number across firms. In the case of Goskomstat data, we do not have firm level information on financing sources, and report the break down of sources of finance, summed up across all firms.

Not surprisingly, both datasets show that retained earnings compose the largest share of innovation finance. In the Goskomstat data, the retained earnings share is equal to 87%. The corresponding number in the IET sample is 71%. Only 5% of all firms did not use retained earnings in the period of consideration. The share of government subsidies is almost negligible in both datasets: 3.6% in the Goskomstat data, of which the shares of federal and local governments are almost equal, and 2.4% in the IET data. About 91% of firms in the IET data did not have any government finance at all, although there are firms, which completely financed their innovations with the government funds. On a median firm, which received government funding, the share of such finance amounted to 15%. The share of foreign funding differs across datasets, and across years in the Goskomstat dataset. If in the 2000 Goskomstat book this share amounts to 6.5%, in 2001 it drops to 1.5%. In comparison, the average firm in the IET dataset finance only 0.5% of its spending on innovations with foreign investments. The maximum share of foreign finance reaches 63%, though, and the median firm, which receives foreign finance, covers 24% of its innovation spending from foreign investments. The IET dataset also provides information on banking credits: the share of banking finance in total funds, used for innovations, is 12% on average, but 43% among firms, which use banking finance. There are firms, which finance 100% of their innovation spending with banking finance. A small percentage of firms actively use credit from consumers of their products, or shareholders, to finance innovations. There are firms, which finance 100% of their innovation spending from these sources. The median firm, which receives credit from shareholders to finance innovations, gets 50% of its innovation spending financed from this source, and the median firm, which have access to credit from its consumers, covers 18% of its innovation expenditure from this source. Only two percent of firms in the sample ever used bond finance or issued new equity. Those, who did it, financed on average 24% of innovation expenditure from this source.

Obstacles to innovations

Both questioners have a section, which asks respondents to evaluate the problems, which they face in conducting innovation activities. The list of suggested problems includes financial problems, problems with finding managers, workers and other personnel with required qualifications, and

problems with access to information and infrastructure. Most of firms in both datasets consider financial problems, particularly lack of retained earnings followed by insufficient state support, as the highest barrier to innovations (see Table 3). In the IET questioners respondents ranked problems with finding experienced management and/or other personnel as secondary order problems, while infrastructure problems, lack of information, and problems with hiring foreign specialists are viewed as even less important than problems with personnel. Interestingly, firms, which conduct absolutely new innovations, appear to be slightly more liquidity constraint than imitating enterprises, and enterprises, which introduce both types of innovations. While complains about lack of retained earnings are similarly frequent across all three types of enterprises, more of those enterprises, which are involved into absolutely new innovations, rank lack of external finance as a significant barrier.

Goscomstat questioner pays a lot of attention to such factors as economic risks. Enterprises were asked about economic risk directly, and about those characteristics of innovations, which may become a problem in the presence of high economic risk. The list of such factors consists of the length of the period, which is needed to return the money, invested in innovations, and the costs of innovation activities. The latter factor can be related not only to the risk of innovation process, but also to the problem that firms are credit constraint. Respondents ranked such problems quite high, i.e. higher than the problems with personnel and infrastructure. Interestingly, when enterprisers are asked about lack of personnel, they rank this problem quite low, but rank quite high the problem “enterprise has a low innovation potential”. Infrastructure problems are ranked higher than problems with personnel. This result may have some relation to the credit constraints problem, though, because Goscomstat ask general question about infrastructure, and not the specific question about infrastructure directly needed to perform innovative activities. Respondents to Goskomstat questioner also rank quite high the question about lack of legislation, regulating innovation activities.

Table 4 Barriers to innovation activities.

Numbers correspond to the percentages of those enterprises, which answered to this question. In both sample both firms, which conduct innovations, and which do not do innovations are included. In the IET case numbers do not sum up to 100% in those cases, where some respondents chose “difficult to answer” option.

Goskomstat				IET				
	unimportant barrier	important barrier	main barrier		not a problem	small barrier	barrier	significant barrier
Lack of retained earnings	9	35	56	Lack of retained earnings	1.5	2	10	85
High costs of innovations	23	50	27	No access to external finance	11	9	19	42
				You find conditions, at which external finance is available, non acceptable	12	11	16	19
				Too high interest rates on loans	5	8	21	59
Lack of state support	26	39	35	Lack of state support of innovation activities (subsidies, tax credits, etc.)	5	6	15	60
low innovation potential	61	28	11	Lack of skilled technical personnel at the firm	12	20	31	24
lack of skilled personnel	65	30	6	Lack of managers, experienced in managing innovative activities	12	23	29	23
				Lack of skilled labor	17	23	26	21
Lack of infrastructure	58	34	8	Lack of technological infrastructure (research institutes or firms, whom you can contract out development of an innovation for your firm)	15	24	23	16
Underdeveloped market for technologies	55	37	8					
Lack of information about new technologies	73	27	0	Lack of information about new projects and technologies	16	29	23	13
<i>Low demand for new goods</i>	46	40	14	<i>Bureaucratic problems with hiring foreign skilled personnel</i>	38	10	7	4
<i>High economic risk</i>	50	40	10					
<i>Long period of return of investments in innovations</i>	45	43	12					
<i>Lack of information about the market demand</i>	68	27	5					
<i>The enterprise is poorly suited to introduce innovations</i>	85	13	2					
<i>Lack of opportunities to cooperate with other enterprisers and research institutes</i>	73	24	4					
<i>Low consumer demand for new products</i>	60	30	10					
<i>Lack of legal infrastructure for innovation activities</i>	48	39	13					
<i>Uncertainty about the length of innovation process</i>	70	27	3					

Factors, which influence innovations: theory and evidence from other studies

The description of the innovation data, provided in the previous section, allows to make several conclusions. In the last three years about 40% of Russian firms introduced absolutely new or imitated products and/or technologies. The percentage of imitations or incremental changes was slightly higher than the percentage of innovations. Most of innovations are financed by retained earnings, and enterprisers consider lack of retained earnings as major obstacle to innovations. Only small number of firms uses banking finance, although those, who use it, finance almost half of their innovation expenditure out of this source. Often, firms do not use banking credits not because it is not available, but because of habit, or because they are reluctant to do so. As a result, the percentage of firms, complaining that external finance is unavailable is smaller than the percentage of firms, complaining about lack of retained earnings. Soviet-times nostalgia explains the fact that a large percentage of firms in both samples complains that government do not participate in financing their innovations. Problems with quality of infrastructure, personnel or general uncertainty are considered as much less important than financial problems, and ranking of these problems can differ from one source of data to another.

The problem with such self-evaluation of barriers to innovations by enterprises is that it misses the effect of some factors, which stimulate innovations, but maybe perceived by managers as obstacle to innovations. Among such factors, competition has, probably, attracted most of attention in the literature. Clearly, by reducing profits competition can have negative effect of innovation. The growth literature until recently was dominated by such Shumpeterian ideas (Dasgupta-Stiglitz (1980), Aghion-Howitt (1992), Caballero-Jaffe (1993)). This theory was not supported by empirical findings, which demonstrated positive correlation between product market competition and innovative output (Geroski (1995), Nickel (1996), Blundell, Griffith and Van Reenen (1999)). Positive relation between competition and innovations can be generated in the model, where competition increases incentives to innovate for satisfying managers, who minimize their effort

subject to staying in business (Aghion-Dewatripont-Rey, 1999). Recently, various theoretical justifications of an inverse U-shape relationship were proposed (Aghion, Harris and Vickers (1997), Aghion, Harris, Howitt and Vickers (2001), Aghion and Howitt (2002), Aghion, Bloom, Blundell, Griffith, Howitt (2002)). In these models firms innovate in order to increase the post-innovation rent in comparison to the pre-innovation rent in the neck-to neck competition environment. The difference of this model from the traditional Shumpeterian models is that incumbent firms are also allowed to innovate.

Empirical literature from the developed countries supports the hypothesis of an inverted U-shape relationship between product market competition and innovations. (Aghion, Bloom, Blundell, Griffith, Howitt (2002)). Blundell, Griffith, and Van Reenen (1995, 1999)) find positive association between the number of innovations and patents, and increase in domestic competition and trade openness. Evidence from Central and Eastern European (CEES) transition countries is mixed. Grosfeld-Tressel (2001) reports positive association between competition and TFP growth, Carlin, Fries, Schaffer, and Seabright (2001) report negative relation between domestic competition and new product innovation, and positive relation between foreign competition and innovation, and, finally, Aghion, Carlin and Schaffer (2002) find an inverse U-shape relationship between competition and new product innovation. The latter result is supported in the Jefferson et al. (2002b) study of the R&D performance of Chinese firms.

Aghion, Carlin and Schaffer (2002) study interaction between competition and firm leverage or corporate governance, hard budget constraints or credit rationing. The theoretical part of the paper shows that in the Aghion-Dewatripont-Rey (1999) model (ADR), where managers do not maximize profit, but care about their own survival, the effect of competition on innovation decreases with increase in managerial claims on monetary profit or higher debt pressure, because these factors work as substitutes to competition in their effect on managerial incentives. In step-by step innovation model of the type of Aghion, Harris, Howitt and Vickers (2001) model (AHHV), competition and managerial claims on profit or hard budget constraints are complements. The interaction between competition and credit rationing in AHHV model is nonlinear. When competition is not too strong, and, therefore, financial constraints are not binding, increase in competition enhances innovation.

However, when competition increases, Shumpeterian-type effects start to work, i.e. competition starts to exert negative influence on innovations through the negative effect on profit. The empirical part of the paper demonstrates dramatic differences between the effect of competition on new and old firms. While new firms innovate more than the old ones, competitive pressure boosts innovations on both types of firms. Foreign competition is particularly important for the old firms. Soft budget constraints are detrimental to innovations. Similar finding, although using the same dataset, was obtained in Carlin et al (2001). New firms are significantly less likely to innovate when they face more than one competitor. Since new firms are usually considered as more budget-constrained, this finding is consistent with the hypothesis that ADR model is more relevant for the old firms, while AHHV model is more relevant for the new firms.

Several papers study the effects of ownership structure on firms restructuring and innovation performance in more details. Carlin et al (2001) show that state-owned firms innovate less than the privatized and new firms, although fails to find differences in introduction of new products by privatized and new firms. Jefferson et al (2002a) show that introduction of new product on Chinese firms is more or less the same for all ownership categories, with the exception of overseas and foreign firms. Among these two groups of firms, the proportion of firms, which is involved into introduction of new products, is rather small. In fact, such firms also spend less on R&D, which may suggest that they rely on headquarters in their innovative activities. Importantly, those overseas and foreign firms, which introduce new products, do it with significantly higher intensity, than average Chinese firms. It is also interesting to report the results of Grossfeld and Tressel (2001) paper, although they are not directly related to innovative activities. This paper finds non-linearity in performance of Polish listed firms with ownership concentration: firms with dispersed ownership and with the concentrated one are more productive than the firms with intermediate concentration of ownership. In the Russian context it would also be interesting to look on the effect of ownership by “oligarchs” on innovation activities of firms. According to the literature on financial-industrial groups, firms, controlled by oligarchs, can have weaker credit constraints, because they have access to funds, owned by the group. The direct evidence from IET questioner does not confirm this hypothesis: only small number of firms received funds aimed at innovation finance from their

shareholders. However, it is conceivable that firms, controlled by oligarchs, receive money from other sources than their shareholders, i.e. from banks, suppliers, consumers, and so on. Empirical evidence of the effect of oligarchs control on industry is mixed. Early paper by Volchkova (1998) argues that financial industrial groups improve corporate governance of firms, which they own. Guriev, Rachinsky (2004) show that firms, controlled by oligarchs, increase their productivity by 10% faster than other firms. Following findings from these two papers, we can expect that oligarchs-controlled firms innovate more than other firms.

Two other factors, effect of which on innovations is interesting to study in a transition economy, are corporate governance and quality of management. Throughout 1990s Russian companies were famous for bad quality of corporate governance. The major goal of managers and some groups of outside owners was to get control over companies, and they used all possible means to fulfill this goal. At the beginning of the 2000s, this process of ownership consolidation was finished, and owners started to pay more attention to capitalization of their companies. As a way of influencing capitalization, the companies started to pay more attention to improving relationship with minority shareholders. Many companies adopted new codes of corporate governance, started to produce accounting reports prepared using international rules, introduced independent directors into their board, and so on. This process started on some of the large companies, but it quickly spread into a number of smaller companies (Guriev et al, 2003). There are at least two reasons why owners of Russian companies started to behave in this way. The first one is that they decided to cash in the results of privatization, and attempted to increase capitalization of their companies in order to increase the price of these companies in their future sales. The second reason is that they needed to raise funds for investments, and they had to improve corporate governance in order to decrease the costs of such funds. These two different hypothesis map themselves into two different strategies regarding innovations. Clearly, in the second case, when good corporate governance is a way to attract investments, corporate governance should be positively correlated with innovations. Owners of firms, which follow such strategy, care about current and future profitability of their firms, and make investments to increase profitability. Most likely, such increase in investments results in innovations or at least in imitations. In the first case scenario, the sign of the correlation coefficient

between the quality of corporate governance and innovation activities is not so easy to predict. If innovations are expensive, and owners would like to sell of their firms quickly, firms are unlikely to conduct innovations. On the other hand, some cheap incremental innovations can still be undertaken, because they can also lead to improvement of capitalization of the firm and increase in its current profit.

Apart from other factors, quality of management can have substantial influence on incidence and form of innovation activities of enterprisers. Soviet managers were not used to changing production profile in order to suite the interests of consumers and to maximize profit. Instead, their major goal was fulfilling production plans. There is a substantial literature on economics of planned economies, which argue that this goal was inconsistent with renovation of enterprisers and introduction of new technologies and products on old firms. Renovations and other changes took time, thus not allowing firms to produce more goods to fulfill plans. This lead to problems in commercialization of R&D results, which were widespread in the Soviet Union. Most of innovations were installed on absolutely new plants, while the old ones continue to produce outdated output. Because of resource constraint, rate of innovations in such economy was quite low. In addition to this improper alignment of incentives, Soviet managers had no marketing skills. Soviet firms did not have to care whether consumers like their products or not. The wholesale and retail trade sectors were separated from production, and producers did not get enough signals from consumers. Producers did not care whether the good is sold to the final consumers; they only cared about fulfilling production plan.

Although transition from plan to the market economy has clearly changed the incentives of producers; managers' skills have not automatically changed. Therefore, one can imagine that firms innovate too little because their managers do not know how to find or design the product, which will be popular among consumers, and how to advertise it and more generally how to sell it to consumers in the most efficient way. Innovations may appear to be too expensive, and too risky process for such managers, and they will under-innovate as a result. In addition to decrease in the overall innovation rate, poor quality of management can result in bias toward imitations, which may look as a safer bet for under-qualified managers.

Data and Methodology of Regression Analysis

To analyze, whether factors, discussed in the previous section, have any effect on innovation activities of Russian firms, we use probit regressions techniques. We estimate whether probability of a firm to be involved into innovation activities depends on competition with domestic and foreign firms, credit constraints, ownership structure, state interventions in the regional economic activities, quality of corporate governance, and quality of managers. In the case of Goskomstat data, the dependent variable takes the value of 1 if the enterprise belongs to the list of firms, which conducted innovative activities in the last three years according to the 2001 publication. The remaining firms are the rest of the firms, included in the Registry of Russian Firms. We should note that this approach can suffer from mis-classification basis. It can happen in those cases, when a firm, which is included in the registry, and is being involved into innovating activities, did not participate in the Goskomstat innovation survey. However, since the survey is quite large, we don't think that the number of firms misclassified in this way is large. A similar specification can be estimated using IET survey data.

IET questioner allows us to estimate several other specifications. We can use the answer to the question about change in the rate of innovative activities since 1980s as a dependent variable. Additionally, we can test whether there are any differences in factors, which influence firms with imitating and innovating development strategies.

Methodology of constructing dependent variables also differs slightly in the case of Goskomstat and IET data. In the case of Goskomstat data we have to rely on other sources, usually also produced by Goskomstat, to construct most of the variables. In the case of IET some of the variables can be obtained from other IET surveys, conducted using the same original sample of firms.

In addition to survey data and data from various Goskomstat publications, we use the so called Russian firms registry. This dataset contains firm level balance sheet statistics, and other statistical information, which Russian firms have to submit to statistical agencies. This dataset was constructed using information from GNOZIS, ALBA, Registry, and other datasets. These datasets

are a traditional source of information on Russian firm, which was used in a number of other studies, among which are Yudaeva et al. (2003), Guriev and Rachinsky (2004), Brown and Earle (2001), etc.

Variables construction in the case of Goskomstat survey.

There are two competition measures, which are included in the regression separately. Foreign competition is measured as a log of the ratio of import to total output of the firm's 5-digit OKONH industry. Domestic competition is proxied by Herfindahl-Hirschmann concentration index in the 5-digit industry. Theory predicts that competition should have an inverted U-shape effect on innovations. To capture non-linearity of the effect, we also included in the regression the mean-subtracted square of the log of the import-output ratio. To measure domestic competition, we computed Herfindahl-Hirschman index for 5-digit OKONH industries and its square (also mean-subtracted). The index was constructed using data on firms' production from the Registry of Russian firms. To escape reversed-causality interpretation, both measures of domestic and foreign competition were constructed for 1999.

Several firms' characteristics are used as explanatory variables – availability of own funds to finance innovations (sum of four dummies that equal one if the firm has positive profit in 1995-1998), size of the firm (log of average employment in 1996-1998), dummies for firms with foreign-ownership of more than 10% and firms with federal government ownership. All these variables are constructed using registry of Russian firms.

Regional factors include the share of consolidated regional budget in gross regional product in 1999 and log of the number of financial agencies and their branches divided by the region's population in 1998. These variables were computed using Goskomstat regional statistics.

Dummies for the firms, controlled by oligarchs, are obtained from the authors of Guriev, Rachinsky (2004). These dummies are based on the 2003 survey of ownership and control over Russian firms. This survey was sponsored by the World Bank. The corporate governance index, which we use, was constructed by Guriev et al (2003) on the basis of the survey, which was also conducted by S. Tsukhlo. The survey included questions on relationships with minority shareholders,

presence of external directors, producing reports using international accounting standards and so on. The corporate governance index is the first principle component of all these measures.

Variables construction in the case of the IET survey.

Instead of using Herfindahl-Hirschman index or import share as a measure of competition, in this model we are able to include as a right-hand side variable firms' own assessment of the degree of competition it faces. Information on competition is a part of the regular IET surveys. The firms are asked to evaluate the level of competition using the four-score scale ranging from *very strong* (1 point) to *none* (4 points) for three groups of producers: domestic producers, producers from CIS countries, and producers from abroad. The index of competition intensity is constructed as the standardized inverted first principal component of firms' assessment of competition with all three groups of competitors. That is, the higher is the size of the variable, the tougher is competition.

Other regional and firms' characteristics are the same as in the regressions, which use Goskomstat data. In some specifications we also use indicator of those firms, whose managers studied abroad. This indicator is obtained from another survey, which we conducted together with the IET. That survey contained the question about firm having managers with foreign MBA, and the question about presence of managers, who took short management courses and/or internships abroad. Positive answer to one of these questions was coded as presence of managers, which studied abroad. Of course, we can not control for the quality of education, which such managers received, so this variable gives only an imprecise measure of the quality of managers. Nonetheless it turns out that inclusion of this variable in the regression equation provides interesting information about behavior of firms.

Appendix 2 provides further details about construction of each variable, and some summary statistics.

Results

Tables 4 and 5 report the results of regression estimation in Goscomstat and IET datasets respectively. As can be seen from the regression tables, major results are in line with the theory.

Profitability is highly significant in all specifications, estimated using Goskomstat sample. In the case of IET sample, this variable is also always positive, but it gets less significant or even insignificant in the specifications, where we control for oligarchs's ownership, quality of corporate governance, and quality of managers. Profitability here is a predetermined variable, and we interpret profitability as a measure of credit constraints. Our results suggest that credit constraints is an important obstacles to innovations. Similar conclusion can be made after estimating the specification with the number of banks in the region. The coefficient at this variable is always positive and significant suggesting that development of the financial system positively affects firms innovation activity. Ownership by oligarchs and better corporate governance can relax credit control via access to credit resources of the financial-industrial group, controlled by the same oligarchs, or by increased opportunity to raise money on the stock market. Therefore, controlling to these factors may make profitability less important as a factor, influencing innovations. Ability of a firm to attract managers, educated abroad, or send managers abroad, can be a signal of firm profitability, so, again, it is not surprising that inclusion of this variable in the regression decreases significance of profitability itself. We should notice also that the size of the sample is smaller in all these tree cases, which can be an alternative explanation for insignificance of profitability.

In both datasets, when we compare firms, which innovate, with those, which do not innovate, size of the enterprise enters equations positively and significantly. This finding can have several explanations. Size of the firm can be another proxy for its credit constraints. Usually larger firms have better relationships with banks, which allows them to get credit. Large firms can also economize on scale, while doing R&D. Since we count not only large, but also small innovations, a technical explanation is also possible. Large enterprisers usually produce goods, which go through more stages of production, than the goods produced at smaller firms. Even if innovation rate in each stage of production is the same, the innovation rate on the large enterprise will be higher than on a small one.

Interestingly, size of the enterprise does not matter when we look at the changes in innovation rate since 1980s. In a sense this regression controls for size fixed effect, which becomes unimportant. Imagine, however, that firms, which innovate more often, grow faster. Than the positive relationship

between the firm size and change in innovation rate should be positive. Since we do not find such relationships, our results tend to suggest that innovation activities of Russian firms affect size distribution of firms very little, i.e. that it is not necessarily true that firms with high innovation rate tend to increase their size, and slow innovators decrease their size. Absence of this effect can be explained either by the small size of most of innovations, or by ineffectiveness of most of innovations. It is also possible, that during most of the 1990s firms rarely innovated at all, and they only started to innovate recently. If this is the case, the size distribution of firms should change according to the intensiveness of innovation activities in the near future.

The regressions on the IET dataset show that competition has an inverted U-shape effect on innovations. This means that if competition is not severe, it actually forces firms to innovate. This effect is observed both in the comparison between different firms, and in the regressions, which looks on changes in innovation rate since 1980s. When we compare innovation rate across firms, the effect of competition gets insignificant in the specifications, where we control for the ownership by oligarchs, and for the corporate governance quality. The sample, on which we can estimate the effect of oligarchs ownership, is extremely small, it has only 57 observations. By construction, this sample is biased toward large firms, which can be insensitive to the domestic competition. Interestingly, the effect of competition is insignificant both in the cross-section comparison of innovation rate, and in the specification, where the dependent rate is changes in innovation activities since 1980s. Another variable, inclusion of which in the specification makes competition insignificant in the specification with changes in innovation rate as dependent variable, is the dummy variable for presence of managers, which received some training of education abroad. In both cases, when we include the quality of corporate governance, and education of managers, sample size is smaller than in the original specification. We estimated basic specifications on these smaller samples. Competition was insignificant already in this basic specification, so sample size explains most of the differences in the results.

Goscomstat sample is much larger than the IET one, so we can control separately for the effect of domestic and foreign competition on innovations. Foreign competition we measure as competition with imports. The effects of both of them have a U-shape form. It means that there is a

threshold in the intensity of competition, after which innovative activities become less intense. Since linear coefficient is positive and significant, and all measures of competition, which we use, are standardized variables, we can say that maximum of the parabola is to the right from the median firm, and majority of firms are on the upward-sloping part of parabola. In the smaller samples, where we control for oligarchs ownership or quality of corporate governance, domestic competition, measures by Herfindahl index, becomes insignificant. As we mentioned before, the sample, on which we can control for oligarchs' ownership, is biased toward larger firms, which may care less about domestic competition. A similar situation seems to be true in the case of sample, on which we can measure corporate governance index.

Interestingly, the share of budget expenditure in GDP, which we use as a measure of soft budget constraints, produces different results in different datasets. In the Gosomstat dataset the effect of this variable is positive and significant. In the IET dataset the effect of this variable is negative, but insignificant in all specifications, but the absolutely new products and technologies ones. Why the results are so different in two datasets is difficult to explain.

On the Goscomstat dataset we can compare innovation rates of firms in different ownership. In the case of IET dataset this is impossible, because it contains almost no firms with high ownership stake, which belong either to the government or to the foreign firms. Most of firms in this dataset are privately owned, and not traded on the stock exchange. In the Goskomstat, both enterprisers in foreign ownership and in federal government ownership turned out to innovate with higher probability than other enterprisers. The former result differs from finding of Jefferson et al (2002a,b) regarding Chinese firms. That paper showed that foreign firms usually innovate less than the domestic ones. If they do innovate, though, they do it much more actively than the domestic firms. The Chinese paper concentrated more on R&D than on imitations. It interprets the finding regarding the foreign firms as if they rely more on innovations, made by the foreign investor.

Oligarchs-controlled firms innovate less in the Goskomstat dataset. Our innovation data in this dataset refer to the end of 1999-2001, while the ownership data refer to the summer of 2003. Therefore, in principle, the negative coefficient at the oligarchs variable can be explained by reversed causality. In the early 2000s Oligarchs could have bought those firms, which were the least efficient,

including not being involved in innovative activities. Guriev, Rachinsky (2004) came to a similar result: they show that in 2000-2001 firms, controlled by oligarchs, were less productive than other firms, but the results are reversed in 2002, when oligarchs-controlled firms showed the highest productivity growth. The regressions with the IET sample, though, also show that oligarchs-controlled firms innovate less. The coefficient at this variable is negative in all regressions, but significant only in imitations specification. The sample of IET enterprisers, on which we have ownership data, is very small: only 57 enterprisers. Hence, we can not claim that this result will hold in the larger sample. However, it does not look so non-intuitive. In principle, it is possible that firms, controlled by oligarchs, introduced major innovations in the very early 2000s, while by 2003 other firms started to imitate their behavior. Technically speaking, the period, to which question about innovations refers to in the IET questioner, includes early 2000s, because it asks about innovations during the last 3 years. To the extent that people tend to forget and underreport changes, which happen some time ago, innovations, made in the beginning of 2003, are better represented in the answers to the questioner, than the innovations, conducted in 2001. Therefore, negative sign at the oligarchs variable in the Goskomstat can correctly demonstrate the situation, which took place before oligarchs restructures enterprisers, which they bought, while the IET regression refers to the period, when non-oligarchs controlled firms make an attempt to catch up with the oligarch controlled ones. This interpretation is highly speculative, though, and we can not reject the hypothesis that enterprises, controlled by oligarchs, simply innovated less than other enterprisers through out the whole period of end 1990s – early 2000s.

Controlling for the quality of corporate governance and foreign education of managers produced positive, but insignificant results in all specifications in the IET samples. We did not run the regression with managers education on the Goskomstat sample, because this variable describes situation in 2003, while the information in the sample is relevant for 2001.

As we will see, though, these variables have different effects on different types of innovation activities. Therefore, it is not surprising that their effect becomes insignificant, if we treat all innovation activities equally.

Difference between innovations and imitations

Table 6 reports probit estimates of determinants of innovations and imitations. In this specification, the dependent variable is equal to 1 if the firm is involved in corresponding innovation activities, and equal to zero if it does not do innovations, or if it does innovations of another type. In Table 7 we report the results of multinomial logit estimation, where we divide all firms in three groups: those, which only innovate, those, which both innovate and imitate, and those, which only imitate. The qualitative results of both estimation techniques are quite similar. They demonstrate substantial differences in behavior of firms, involved in innovations and imitations. Both groups of firms innovate or imitate more often if they are larger. Other characteristics are correlated with imitations and innovations in a different way.

Introduction of absolutely new products or technologies (innovations) is insensitive to profitability of the enterprise. The stimulating positive effect of competition is positive in this case, unless we control for oligarchs' ownership, corporate governance or foreign education of managers. Interestingly, the share of government budget in regional GDP is strongly negatively correlated with this type of innovation activities. Another variable, which is correlated with innovations is good corporate governance, while managerial education is insignificant. Oligarchs' ownership is negative but insignificant.

The factors, which determine imitations, are slightly different. Imitations strongly positively and significantly depend on profitability of firms. Stimulating effect of competition on imitations is very strong in all specifications, while negative effect of very high competition gets insignificant in some specifications. Imitations are insensitive to both the share of government in regional GDP, and quality of corporate governance. At the same time, the probability to imitate is strongly and positively correlated with the probability to have managers, educated abroad. Ownership by oligarchs is negative, and significant, which may suggest that such firms are copying from those firms, which are owned by oligarchs.⁷

Probability to do both innovations and imitations is less dependent on profitability than probability to only imitate, and depends on competition stronger than both probabilities to only

⁷ Sample, where we can control for ownership by oligarchs is so small, that we were not able to run multinomial logit specification.

innovate or only imitate. This probability is strongly correlated with both education of managers and good corporate governance.

Columns 6 and 7 of Table XXXXX report results of the estimations, which relate probabilities to innovate, imitate, or to do both with probability to train personnel or conduct market studies. All three groups of firms rely on these two other activities significantly more often, than firms, which do not do product or technological innovations, or did not mark the answer about the type of innovation. The size of the coefficients at both variables is somewhat larger in the case of firms, which do both innovation and imitations. This latter finding can simply reflect the fact that such firms do more innovations. Imitating firms seem to conduct marketing studies slightly less often. Since many of them simply copy projects, which face high demand on the market, such studies may be unnecessary.

The finding that profitability is much stronger correlated with imitations than with innovations is a bit at odds with the theory. Usually, firms, which introduce absolutely new products are considered as more liquidity constraint than firms, which implement existing technologies. There are two possible explanations why the situation is different in the Russian case. The group of firms, which innovate, may include two types of firms. The first type is “surviving” firms, which are not profitable. Such firms try to use their own resources to implement changes in technology and product range. Firms view these changes as introduction of absolutely new products or technologies, but the major goal of these innovations is simply to allow the firm to survive. These firms can’t afford sending their managers for training abroad or attract foreign educated managers, so this variable is insignificant in corresponding regressions. The second type is the enterprisers, which do innovations in the theoretical sense of the word. Since innovations require domestic human capital, which is cheaper than foreign human capital, this activity requires less investment than buying foreign technologies. Additionally, these are usually the firms with good corporate governance, which allows them to make credit constraint less strong, and to depend less on profitability. Interestingly, in Section 2, when we described firms’ answers to the question of obstacles to innovations, we noticed that firms, which introduced absolutely new products or technologies, complain about lack of external finance more often. In light of the regression results, this finding can be interpreted slightly

differently. Firms, which introduce absolutely new products and technologies, pay more attention to relaxing credit constraints, and as a result care a lot about improvements in corporate governance. We suspect that a number of such firms conduct both innovations and imitations. This later group of firms also pays special attention to education of their managers and personnel. Presence of “surviving” firms in the group of firms, which only conduct innovations, makes coefficient at the managerial education variable less significant.

The group of firms, which are involved only in imitations, follows “westernization strategy”. They upgrade their technological level and introduce product range, which is common to other firms and other countries. At the same time they attempt to improve their management, and with higher managers with western education, or, more often, educate their managers abroad on various training programs. Such strategy requires more resources than upgrading of production using domestic human capital, and innovation activities of such firms depend heavily on profitability. Competition seems to be the major driving force behind this process, although the effect of competition seems to be even stronger in the case of firms, which do both innovations and imitations.

Conclusions

This paper reveals that Russian enterprisers follow two development strategies. “Westernization” strategy involves using retained earnings to implement products and technologies, which are actively used by other firms. Usually firms, which follow this strategy, pay special attention to educating their managers, or attracting managers, educated abroad. The second strategy involves relying on innovations, either developed by personnel of the firm, or outsourced to other organization. Such firms pay less attention to educating managers abroad. Instead they try to relax their budget constraints, and improve corporate governance. These two strategies are not mutually exclusive: there is a group of firms, which do both innovations and imitations.

Which of these two strategies produces better results in terms of increasing firms’ productivity, and reaching other goals, which firms try to achieve by getting involved in innovative activities is an open question. We will try to answer it in further research.

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Appendix 1

Table 4. PROBIT regressions for Goskomstat sample

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Profit	1.81*** [13]	1.83*** [13]	1.78*** [13]	1.79*** [13]	1.79*** [13]	0.88** [2.07]	0.80* [1.85]	1.89*** [3.72]	1.89*** [3.70]
Employment	0.38*** [26]	0.38*** [26]	0.38*** [26]	0.37*** [25]	0.38*** [26]	0.45*** [8.33]	0.46*** [8.37]	0.52*** [7.71]	0.50*** [7.01]
Import share	0.67*** [9.7]	0.68*** [9.8]	0.67*** [9.7]	0.68*** [9.8]	0.66*** [9.6]	1.38*** [5.22]	1.38*** [5.16]	0.89*** [3.38]	0.90*** [3.41]
Import share squared	-0.85*** [6.2]	-0.85*** [6.2]	-0.85*** [6.2]	-0.85*** [6.2]	-0.84*** [6.1]	-2.03** [2.02]	-1.99* [1.95]	-0.87* [1.71]	-0.87* [1.71]
Herfindahl index	0.45*** [2.66]	0.45*** [2.62]	0.44*** [2.61]	0.43** [2.52]	0.44*** [2.58]	-0.02 [0.03]	0.09 [0.13]	0.21 [0.34]	0.25 [0.41]
Herfindahl index squared	-1.74*** [2.80]	-1.72*** [2.76]	-1.74*** [2.80]	-1.70*** [2.74]	-1.78*** [2.86]	-4.77 [1.60]	-5.66* [1.77]	-2.75 [1.28]	-2.57 [1.22]
Share of regional budget in GDP		1.13** [2.15]							
Number of banks in the region			0.05** [2.02]						
Foreign ownership				0.26** [2.55]					
State ownership					0.10** [2.08]				
Oligarch-controlled							-0.31** [2.51]		
Corporate governance index									0.05 [0.85]
Observations	10816	10816	10816	10816	10816	662	662	505	505

Absolute value of z statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5. PROBIT regressions for IET sample

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
	All innovations						Changes in innovations					
Profit	1.19	1.11	1.17	0.91	6.23	0.88	0.80	0.79	0.78	0.51	0.96	0.73
	[2.8]***	[2.6]**	[2.77]***	[1.70]*	[1.81]*	[1.6]	[2.1]**	[2.1]**	[2.05]**	[1.06]	[0.82]	[1.6]
Employment	0.28	0.29	0.28	0.26	0.37	0.43	0	0	-0.00	0.01	-0.26	0
	[4.1]***	[4.2]***	[4.11]***	[2.97]***	[1.09]	[4.6]***	[0.1]	[0.0]	[0.03]	[0.13]	[1.50]	[0.3]
Competition	0.17	0.17	0.17	0.19	0.03	0.18	0.13	0.13	0.13	0.19	0.14	0.09
	[2.4]***	[2.4]***	[2.42]**	[1.96]*	[0.05]	[2.2]**	[2.0]**	[2.0]***	[1.96]**	[2.24]**	[0.60]	[1.2]
Competition^2	-0.18	-0.19	-0.19	-0.13	-0.3	-0.20	-0.18	-0.12	-0.13	-0.22	-0.05	-0.11
	[3.1]***	[3.1]***	[3.11]***	[1.45]	[0.65]	[2.8]***	[2.2]**	[2.2]**	[2.22]**	[2.70]***	[0.25]	[1.8]*
Share of regional budget in GDP		-4.43						-0.35				
		[1.5]						[0.1]				
Number of banks in the region			0.06						0.03			
			[0.51]						[0.34]			
Oligarch-controlled				-1.39						-0.37		
				[1.67]*						[1.03]		
Corporate governance index					0.11						0.05	
					[1.48]						[0.82]	
Managers studied abroad						0.08						0.22
						[0.4]						[1.4]
Obs	456	456	456	57	299	346	456	456	456	57	299	346

Absolute value of z statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Differences between innovations and imitations in the IET sample. Simple PROBIT.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
	Absolutely new innovations						Imitations					
Profit	-0.33	-0.45	-0.42	-0.39	0.27	-0.91	1.27	1.29	1.29	0.7	2.5	1.63
	[0.9]	[1.2]	[1.12]	[0.83]	[0.24]	[2.0]*	[3.2]***	[3.2]***	[3.20]***	[1.47]	[1.85]*	[3.1]***
Employment	0.22	0.24	0.23	0.18	0.34	0.24	0.10	0.10	0.10	0.14	0.32	0.17
	[3.9]***	[4.2]***	[4.0]***	[2.41]**	[1.98]**	[3.5]***	[1.8]**	[1.8]**	[1.79]*	[1.90]*	[1.71]*	[2.5]**
Competition	0.17	0.17	0.17	0.1	0.34	0.12	0.22	0.22	0.22	0.26	0.05	0.19
	[2.7]***	[2.7]***	[2.69]***	[1.13]	[1.40]	[1.7]	[3.4]***	[3.4]***	[3.44]***	[3.17]***	[0.20]	[2.5]**
Competition^2	-0.06	-0.07	-0.06	-0.11	0.13	-0.05	-0.10	-0.10	-0.10	-0.09	-0.34	-0.07
	[1.1]	[1.2]	[1.17]	[1.35]	[0.61]	[0.7]	[1.8]**	[1.8]**	[1.81]*	[1.23]	[1.61]	[1.1]
Share of regional budget in GRP		-6.28						0.79				
		[2.3]**						[0.3]				
Number of banks in the region			0.14						-0.03			
			[1.49]						[0.32]			
Oligarch-controlled				-0.54						-0.92		
				[1.46]						[2.25]**		
Corporate governance index					0.2						0.02	
					[3.18]***						[0.39]	
Managers studied abroad ⁺						0.14						0.35
						[0.9]						[2.1]**
Obs	456	456	456	57	299	346	456	456	456	57	299	346

Absolute value of z statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7. Differences between innovations and imitations in the IET sample. Multinomial LOGIT regressions.

No new or copied innovations as base category.

	[1]			[2]			[3]		
	Inno- vations	both	Imita- tions	Inno- vations	Both	Imita- tions	Inno- vations	both	Imita- tions
Profit	-0.75 [0.95]	1.65 [1.69]*	1.93 [2.33]**	-1.01 [1.26]	1.48 [1.50]	1.90 [2.27]**	-0.86 [1.08]	1.35 [1.35]	1.90 [2.27]**
Employment	0.43 [3.32]***	0.52 [3.90]***	0.22 [1.91]*	0.47 [3.56]***	0.54 [4.03]***	0.23 [1.94]*	0.40 [3.12]***	0.50 [3.60]***	0.20 [1.76]*
Competition	0.31 [2.17]**	0.62 [3.89]***	0.37 [2.88]***	0.32 [2.20]**	0.62 [3.90]***	0.37 [2.89]***	0.27 [1.87]*	0.54 [3.30]***	0.35 [2.71]***
Competition^2	-0.13 [1.07]	-0.24 [1.80]*	-0.19 [1.66]*	-0.15 [1.19]	-0.25 [1.85]*	-0.19 [1.67]*	-0.10 [0.80]	-0.17 [1.23]	-0.17 [1.51]
Share of budget in GRP				-14.50 [2.31]**	-8.01 [1.31]	-1.91 [0.37]			
Number of banks in the region, per capita							0.19 [0.87]	0.19 [0.87]	-0.08 [0.43]
Observations	456	456	456	456	456	456	456	456	456

Absolute value of z statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7 continued

	[4]			[5]			[6]			[7]		
	Inno- vations	both	Imita- tions	Inno- vations	both	Imita- tions	Inno- vations	both	Imita- tions	Inno- vations	both	Imita- tions
Profit	-1.90 [1.92]*	1.30 [1.02]	2.26 [1.99]**	-1.08 [0.99]	0.99 [0.81]	0.86 [0.88]	-0.86 [1.06]	1.17 [1.20]	1.73 [2.02]**	-0.86 [1.08]	1.35 [1.35]	1.90 [2.27]**
Employment	0.52 [3.12]***	0.69 [4.08]***	0.39 [2.58]***	0.35 [1.85]*	0.49 [2.63]***	0.16 [1.03]	0.36 [2.72]***	0.39 [2.80]***	0.15 [1.31]	0.40 [3.12]***	0.50 [3.60]***	0.20 [1.76]*
Competition	0.24 [1.47]	0.50 [2.70]***	0.33 [2.21]**	0.32 [1.57]	0.46 [2.20]**	0.45 [2.65]***	0.25 [1.75]*	0.52 [3.16]***	0.33 [2.48]**	0.27 [1.87]*	0.54 [3.30]***	0.35 [2.71]***
Competition^2	-0.07 [0.50]	-0.20 [1.26]	-0.11 [0.84]	-0.08 [0.43]	-0.28 [1.45]	-0.09 [0.57]	-0.14 [1.15]	-0.26 [1.87]*	-0.20 [1.76]*	-0.10 [0.80]	-0.17 [1.23]	-0.17 [1.51]
Managers educated abroad	0.56 [1.40]	0.85 [2.20]**	0.83 [2.36]**									
Corporate governance index				0.46 [2.85]***	0.37 [2.35]**	0.13 [1.04]						
Personnel training dummy							1.26 [3.83]***	2.08 [6.21]***	1.19 [3.92]***			
Marketing studies dummy										1.11 [3.14]***	1.82 [5.28]***	0.69 [2.05]**
Observations	346	346	346	275	275	275	456	456	456	456	456	456

Absolute value of z statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix 2

Variable construction:

IET dataset, dependent variables:

- *Innovations* – indicator of a firm answering positively on any question of types of innovations
- *Change in innovations* – indicator of a firm answering positively on question of whether innovation activity on the enterprise is higher than in Soviet times (pre 1980)
- *New innovations* - indicator of a firm answering positively on whether innovations are absolutely new
- *Imitations* - indicator of a firm answering positively on whether innovations are copies of existing technologies
- *Type of innovations (multinomial)* – 4 categories: no innovations, only new, only imitations, both kinds

IET dataset, independent variables:

- *Competition* – principal component of average of firms estimate of intensity of competition they are facing across three categories: competition with home producers, competition with CIS producers, and competition with foreign producers.
- *Profitability* – % of profit in sales, averaged through 1998-2001
- *Employment* – log employment in 2001

Goskomstat dataset, dependent variable:

- *Innovation* - indicator of a firm being in the list of innovators, with the name of innovation given

Goskomstat dataset, independent variables:

- *Concentration* – Herfindahl-Hirschmann index for 5-digit OKONH industries
- *Import penetration* – share of imported commodities on the market for firm's output. Constructed from GNOZIS data about real commodity output of Russian enterprises, and database on Russian international trade.
- *Profitability* – % of profit in sales, averaged through 1996-1999.
- *Employment* – log employment in 1999

Common independent variables:

- *Share of budget in regional GRP* – Size of regional budget in GRP, 2000
- *Number of banks in the region* – log of per capita number of bank offices in the region, Goskomstat, 2000
- *Corporate governance index* – constructed in Guriev, Rachinsky(2004) as an average of several indicators of good corporate governance practices
- *Oligarch-controlled* – constucted in CEFIR
- *Managers studied abroad* – indicator of positive answer to questions about whether some of enterprise managers got an MBA or had training abroad

Table 8. Sample summary statistics

Dependant variable	IET sample								Goskomstat sample	
	All innovations		Change in innovations		Absolutely new		Buy or copy		All innovations	
	0	1	0	1	0	1	0	1	0	1
Firms	91	395	305	181	297	189	250	236	9748	1062
Mean avg. profit/sales	-0.1%	7.1%	4.4%	7.9%	5.8%	5.6%	2.9%	8.7%	2.6%	10.1%
Median avg. profit/sales	2.3%	7.2%	5.4%	8.5%	6.4%	6.5%	4.7%	8.4%	5.1%	10.5%
Mean employment	734	1471	1357	1292	1031	1808	1149	1528	431	1806
Median employment	349	704	559	702	521	757	503	688	170	635

Table 9. Description of the samples of firms, where there is information on oligarchs ownership.

	Innovators (IET)		Innovators (Goskomstat)	
	No	Yes	No	Yes
Oligarch-controlled	47	35	260	118
No oligarch	34	23	227	75