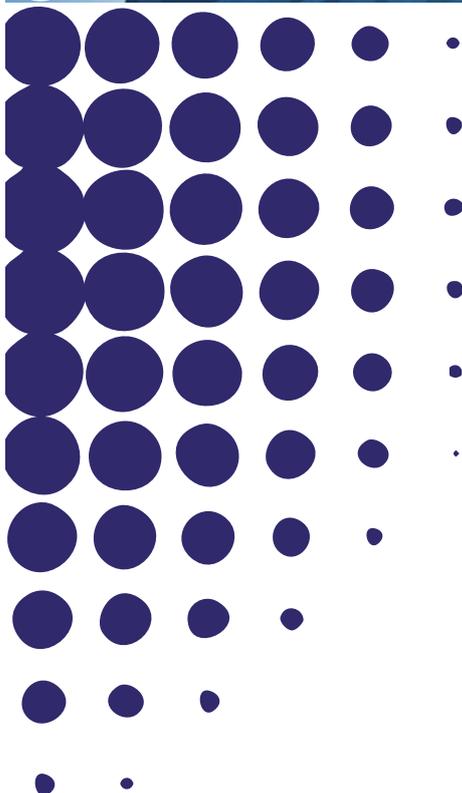


WP4/29 SEARCH WORKING PAPER

Participation in domestic and foreign networks as a factor driving innovations: an empirical analysis of Russian manufacturing firms

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Participation in domestic and foreign networks as a factor driving innovations: an empirical analysis of Russian manufacturing firms¹

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Abstract

Russia's increased participation in the global economy since its accession to the WTO not only provides new opportunities but also creates new challenges for Russian firms. To compete internationally, many firms must significantly modernize their technologies and introduce new products. Various channels exist to acquire new knowledge, including investment in a firm's own R&D and innovation, acquisition of new equipment, attraction of FDI, etc. Competition and formal contracts may be important but are not the only mechanisms that facilitate innovations. Foreign and domestic networks may also serve as additional sources of information flows and promote the direct and indirect acquisition of relevant valuable information about foreign markets. In this paper, we present a preliminary empirical analysis of the impact of network participation on the technological upgrading and innovation activities of Russian manufacturing firms. We analyze both the prerequisites for establishing an international/domestic partnership and the impact of such participation on the behaviors and innovation strategies of a firm. We utilize data from two waves of a survey of medium and large Russian manufacturing firms conducted in 2005 and 2009 to evaluate the effects of network participation on the innovation behavior of firms. We find evidence of a positive relationship between participating in both domestic and foreign networks and innovations, but the impact of domestic networking is stronger than that of foreign networking.

Keywords: networks, innovations, Russian manufacturing firms

JEL: L14, O33, P23

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I. Introduction

Networking is considered an important factor of firm competitiveness in modern market economies, and both theoretical explanations for and empirical evidence of this effect have been documented for different countries (see section 2 for a brief literature review). For the purposes of this paper, we concentrate on one aspect of firm networks – the establishment of formal or informal partnership relations. Institutions based on formal rules such as contracts are not the only rules that govern firms' relationships in a market economy. Trust as the basis for these relationships has long been acknowledged in economic theory (Polanyi, 1992). The creation of partnerships between firms and the role these partnerships play in shaping behavioral patterns, including innovation activities and strategies, in Russia are of particular interest due to the specific institutional environment created during the economic transition of the 90s. Many researchers note that the evolution of the Russian economy during the transition led to a system characterized by both weak enforcement of formal rules (including contracts) and a relatively low level of trust between economic agents (see, for example, Radaev, 2003). The system of strictly regulated non-market transactions of the planned economy collapsed at the beginning of the 90s and was not immediately replaced by a modern system of market institutions. This change produced a long period of transitional havoc during which formal rules were not properly enforced and previous informal relationships based on trust between managers of enterprises were eroded by privatization, i.e., by changes in ownership, by highly unstable economic and institutional environments, by global changes in the supply chains, etc. Long-term relationships that were based on personal ties between Soviet managers (the so-called "Red directors") were destroyed. Many firms became closed and unfriendly towards outsiders, especially foreigners, to avoid transparency and to protect themselves from hostile acquisition. Partnerships became quite rare. For example, in 1997, only 15% of surveyed firms reported established links with foreign partners, and only 28% of firms were seeking such opportunities (Wright et al, 2002). Additional distrust towards foreigners stemmed from the existence of diametrically opposed objectives for local and foreign partners (Fey, 1995). Local managers expected an alliance or partnership with a foreign firm to provide an entry into global markets and an inflow of capital and technical knowledge, while foreign companies sought access to the large Russian market and cheap labor. Researchers identified two types of business networks during that period: survival networks and entrepreneurial networks (Huber&Worgotter, 1998). The former predominated, and the latter were relatively few in number.

At the beginning of the 2000s, the economy began to stabilize and grow as market institutions were established. During this period of economic growth, Russian industrial firms began to actively reconfigure path-dependent networks and create a new system of long-term

cooperation and partnership. According to survey data for the period 1999-2002, 84.2% of medium and large industrial firms in Russia reported acquiring new Russian partners, while 51.3% reported new foreign partners (Gurkov, 2004). We presume that this high level of partnership formation reflects the initial recovery of inter-firm relationships after the chaos of the 90s and the improved economic situation. In 1999, import substitution produced growth in industrial production for the first time in a decade after the devaluation of Russian ruble in 1998. The period from the mid-2000s to the economic crisis of 2009 is particularly relevant the investigation of the role that networking and partnerships play in performance and behavior of firms because this period was no longer significantly affected by the devaluation. The enhancement of networks was more deliberate, purposeful and driven by the strategic goals of enterprise restructuring and improvement of firms' capabilities to strengthen their position in the market. However, even in the first decade of the 2000s, especially after the financial crisis of 2008-2009, the Russian formal institutions and business environment were far from benevolent. Lax contractual discipline and enforcement encouraged industrial enterprises to maintain extensive in-shop production of auxiliary goods and services, which led to higher costs and lower competitiveness. Distrust over intellectual property rights protection prevents tighter market relationships between R&D institutions and producers. These obstacles may be factors leading to non-market (or at least not completely market-based) links between economic agents to overcome the deficiencies in formal institutions. Additionally, the search for strategic partners is often spurred by relatively high barriers to entry into new markets (other regions or countries), which may be offset by a relationship with a strategic partner. We have previously analyzed the impact of extending partnership networks on the foreign trade of Russian manufacturing firms (Golikova, Gonchar&Kuznetsov, 2012).

This paper investigates the impact of partnerships on firm innovation activities utilizing data from two waves of a survey of Russian industrial enterprises conducted in 2005 and in 2009. One-thousand medium and large firms in eight manufacturing industries were surveyed in each wave, and 500 firms included in both wave. We use these panel data to investigate the effect of domestic and foreign partnerships on innovation performance and to determine whether the impact of these two types of partnerships is different.

This paper is organized as follows. Section II provides a brief description of the relevant theoretical and empirical literature on the subject of networks and innovation. In Section III, we formulate the main research hypothesis and describe the data. Section IV consists of descriptive analysis, and Section V discusses the model and estimation methodology and provides the econometric results. Section VI concludes with a discussion of our findings.

II. Literature review

Network definition and types of networks

Research on networks over the last two decades has produced many theoretical and empirical contributions in many disciplines, including evolutionary economics, strategic management, geography, sociology and entrepreneurship. Current research in this area includes different fields of scientific knowledge, which enriches the understanding of knowledge flows between actors and their effects on a firm's performance. In our paper, we explore partnership relations at the firm level and ignore personal ties and connections.

The literature includes a variety of definitions of networks, including cooperative inter-organizational relationships (Oliver, 1990; Ring and Van de Ven, 1994), inter-firm networks (Grandori and Soda, 1995), strategic networks (Jarillo, 1988) and many others. Jarillo (1988) defines a strategic network as a long-term agreement between different but linked organizations and stresses the existence of an opportunity for the members of the network to gain a competitive advantage over competitors outside of the network.

Fortunately, a majority of scholars possess a common understanding of the subject (Ozman, 2009) and define a network as “a select, persistent and structured set of autonomous firms engaged in creating products or services based on implicit and open-ended contracts to adapt to environmental contingencies and to coordinate and safeguard exchanges” (Jones, Hesterly and Borgatti, 1997).

Theoretical network research is based on transaction costs economics. These scholars treat networks as a special institutional arrangement - a hybrid organization of firms and markets (Thorelli, 1986; Williamson, 1991). This governance structure, or mechanism of cooperation, is effective in coping with the problems of asset specificity, bounded rationality and opportunism. Williamson (Williamson, 1991) argued that networks are better forms of coordination than hierarchies or markets in situations of medium-level asset specificity and high flexibility requirements. Thorelli (Thorelli, 1986) stressed that actors within networks could compete efficiently and reduce transactions costs that are typical in market organization without the large investment typical of hierarchical organizations.

However, the basic assumptions of this theory about economic behavior and economic agents with bounded rationality and exhibiting opportunism led to criticism of transaction costs analysis in the analysis of networks. An agent's opportunistic behavior cannot explain the production of mutual trust in long-lasting networking relationships that reduce transaction costs. With few exceptions, this point divided scholars into two camps – those who concentrate on opportunism and those who focus on trust (Nooteboom, Berger and Noorderhaven, 1997). Other

scholars note that the static approach of transaction costs theory is not applicable to the dynamic character of networks development.

Four major components are being analyzed within the framework of a network (Conway et al., 2001): actors (firms, in our case), links or ties that connect actors, flows (information, advice, money, goods, etc.) and mechanisms (modes and rules of interaction).

Researchers distinguish between vertical and horizontal networks (Ghauri et al., 2003). Vertical networks are defined as cooperation between suppliers, producers and buyers; horizontal networks reflect cooperative relationships among competitors. An alternative classification of networks characterizes them as heterogeneous (cooperation among different types of partners) or homogeneous (cooperation among partners of one type).

Networks and innovation performance

A large body of literature considers the effects of networks on various aspects of performance (for a detailed review, see Ozman, 2009). Because we focus on innovation performance, we briefly review the main findings of this research.

- The position of the firm in the network affects its innovative output. Both direct and indirect ties have a positive effect on innovative output, while structural holes have a negative effect (Ahuja, 2000);
- Improving firm capabilities by combining their own knowledge with outside expertise has a positive effect on innovation (Tomlinson, 2010; Becker and Dietz, 2004; Faems et al, 2005). Evidence of a positive effect of target-oriented R&D collaboration with a number of partners is less convincing (Kang and Kang, 2010).
- Vertical and horizontal collaboration have different effects. Vertical collaboration with clients and suppliers is of great value. Partnering with clients is significant for firms that intend to produce products with a high degree of novelty or to develop more complex innovations (Amara and Landry, 2005). Collaboration with suppliers reduces the risks and cycle of product development, increases the producer's flexibility, enhances product quality and increases adaptability to market requirements (Chung and Kim, 2003). There is evidence that interaction with suppliers promotes greater levels of both incremental and radical product and process innovation (Fitjar & Rodriguez-Rose, 2013). Horizontal collaboration with competitors, which is concentrated in basic research and establishing standards, appears to be less important for innovation. The empirical evidence even suggests a significant negative effect of network relations with competitors on product innovation (Nieto & Santamaria, 2007).
- The diversity of partners plays a significant positive role in innovation outcomes because each partner makes unique, specific contributions to organizational learning (Becman and Haunchild, 2002; Hoang and Rotharmael, 2005; Wuyts et al, 2004; Chesbrough, 2003;

Laursen and Salter, 2006; Nieto and Santamaria, 2007). The relationship between alliance complexity and innovative performance exhibits an inverted U-shape, which signals that increasing complexity becomes inefficient (Duysters and Lokshin, 2011).

Local, domestic or foreign network collaboration - which is more important for innovation?

The globalization of the economy and the rapid development of communication technologies have provided more opportunities to search for strategic partners domestically and abroad. Collaboration through local networks is an important source of technological dynamism. However, there is evidence that technological ventures may be biased towards local partnerships because of the ease of a local search or insufficient resources to coordinate and support interactions with foreign partners (a point especially relevant to small firms) (Rosenkoph and Almeida, 2003; Patel et al, 2013). In their study of 1600 firms in Norway, Fitjar and Rodriguez-Rose (Fitjar and Rodriguez-Rose, 2013a, 2013b) find that collaboration with extra-regional agents is much more efficient for innovation than exclusive collaboration with local partners, but the key driver of firm level innovation is collaboration with international partners reinforced by open-minded managers. Firms that managed to balance foreign and local network relations were more successful in introducing their new products to the global market (Patel et al, 2013). A survey of 600 companies in the Chinese ICT sector found a positive effect of export/import and domestic firm innovation, while supplier-client relationships with foreign invested enterprises did not produce positive effects (Sun and Du, 2011).

An important contribution to the understanding of network effects was the introduction of different proximity dimensions to the formation of networks and more nuanced analysis of their effects (Boschma, 2005; Boschma and Frenken, 2010). Five dimensions of proximity – cognitive, organizational, social, institutional and geographical – should be taken into consideration. For Russia, a large, transition economy with a heavy legacy of weak and inefficient institutions and characterized by a lack of trust, local and foreign partners represent more than the spatial setting.

III. Hypotheses and Data

The relationship between partnership networks and firm-level innovations is not straightforward. On the one hand, new partners may be sources of new knowledge and experience and thus may facilitate innovation. For example, partners who promote the sale of a product in new markets may help formulate new requirements for the product and encourage the firm to innovate to improve product quality or its technology. On the other hand, in some partnerships, knowledge acquired through this channel may be a substitute for firm innovation

and function as a form of outsourcing. Still, consistent with existing research, we expect that active networking leads to higher innovation activity and elaborate the following hypothesis:

Hypothesis 1. Enhancement of the partnership network facilitates the innovation activities of a firm.

Furthermore, we presume that the goals and opportunities of domestic and foreign networks are different. This effect may be stronger when a firm creates partnerships with stronger and more competitive partners. However, the crowding-out effect of a strong partner on innovation may also be higher. Although we do not include data on the features of partners of firms in our sample, we expect that, on average, foreign partners perform better and possess more knowledge and competencies to share. Thus, our second hypothesis is formulated as follows:

Hypothesis 2. Foreign and domestic partnerships pursue different goals and have different impacts on innovation.

We utilize panel data from two waves of surveys of manufacturing firms conducted by the Higher School of Economics. The first wave, implemented in 2005, was a joint project with the World Bank Investment Climate Assessment Survey (ICA). The second wave, implemented in 2009, was a project of the Russian Ministry for Economic Development. The first wave included 1002 enterprises, and the second included 957 firms in eight two-digit manufacturing industries in Russia. The second wave targeted the same companies as the first wave. This task proved possible only for approximately half of the firms, but the sample characteristics of the previous wave were preserved (by types of activities and enterprise size). The entire sample represents 8 percent of manufacturing industry output and 5 percent of employment. The sampling frame was identical for both waves. The sample includes medium and large enterprises, which report employment in the range 100-10,000 people and are located in 48 Russian regions. The panel data consist of 499 observations. The distributions of firms across industries and size categories for both waves, including the characteristics of the panel firms, are presented in Table A1 of the Appendix. The panel subsample is representative of the entire sample and the total population of manufacturing industries. Firm characteristics include: the 2-digit industry code, the number of employees, the age of the firm, the ownership structure, participation in integrated business groups and location. Both surveys include many questions on both the qualitative and the quantitative indicators of firms' performance, strategy and innovation.

IV. Descriptive analysis

Only the second wave includes the question on networking activity. Firm representatives were asked if they had recently acquired strategic partners (foreign and/or domestic). Therefore,

the data on partnerships reflect the appearance of partner(s) between survey waves. According to the survey data, approximately 41% of respondents reported new domestic strategic partners and approximately 20% of firms acquired new foreign strategic partners (15% acquired both types of partners). Nevertheless, more than half of the firms reported no new partnerships (Fig. 1).

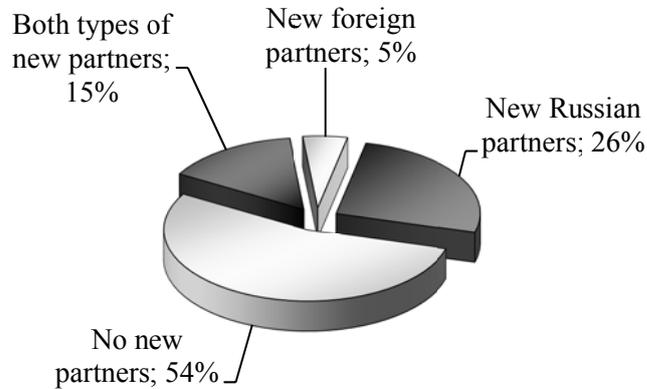


Fig. 1. The distribution of firms by new strategic partnership during 2005-2009, % of firms.

Fig. 2 displays the distribution of firms by their acquisition of partners by manufacturing industry, including the group of firms that obtained both types of partners. Predictably, industries differ in terms of partnership creation with the export-oriented metal and chemical industries leading in finding new foreign strategic partners. However, all industries include some firms with new partners.

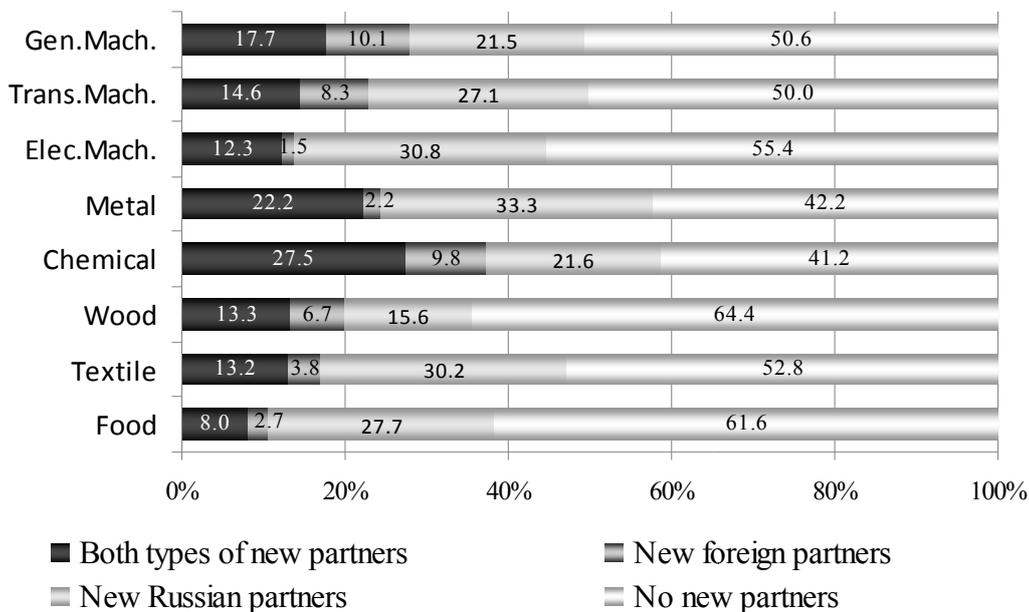


Fig. 2. The distribution of firms by new strategic partnerships in different industries, % of firms.

The group of firms that acquired foreign partners exclusively is quite small (5% of the sample). For the purposes of this paper, we provide further analysis for three groups of firms: a

group that acquired Russian firms as new strategic partners (NSP_rus), a group that acquired new strategic partners among foreign companies (NSP_for) and a group that did not acquire strategic partners. The group pursuing a strategy of mixed partnership is omitted and represents an avenue for future research.

Table 1 provides summary statistics for selected performance and behavior indicators for each group. The main characteristics of these groups indicate that larger firms find partners, and this effect is more pronounced for foreign partners. Firms that acquired foreign partners operated at higher productivity prior to the partnership; this pattern supports a hypothesis of self-selection. However, this is not true for domestic partnerships. Firms with foreign shareholders are more likely to acquire new partners, especially foreign partners.

Participation in foreign trade also indicates that both exporters and importers are more likely to enhance partnership networks, though this effect is less evident for importers. We also observe significant differences in the share of intra-regional sales among groups; a larger share of out of region sales both motivates the search for new partners and likely creates additional opportunities to find them.

Table 1. Summary statistics by groups

	New foreign strategic partner(s)	New domestic strategic partner(s)	No new partner(s)
Labor productivity in 2005, mean, thou rubles	244.0(281.5)	201.6 (250.7)	202.7 (309.3)
Size (number of employees) 2005, mean	994.0 (1417.3)	756.4 (1144.7)	491.1 (661.5)
Annual average sales growth (2004-2008, in nominal prices)	18.2% (0.235)	17.5% (0.231)	16.2% (0.305)
Share of sales inside the region in 2005	19.4 (23.4)	23.5 (28.8)	32.3(4.6)
Share of firms with Foreign shareholder in 2005 (%)	13.7	6.8	4.1
Share of firms with State shareholder in 2005 (%)	9.8	8.3	12.0
Share of exporting firms in 2005 (%)	77.5%	56.6%	43.6%
Share of importing firms in 2005 (%)	67.6%	67.3%	60.2%
Share of firms with non-zero R&D Expenditures in 2009	40.2%	32.2%	21.1%
Share of firms introducing new product in 2009	55.9%	55.6%	44.7%
Share of firms introducing new technology in 2009	45.1%	43.9%	29.3%
N of observations	102	205	266

Note: standard error in brackets. Groups are overlapping: groups “New foreign partners” and “New Russian partners” includes firms which acquired both types of new partners.

Partnerships and innovations are not determined exclusively by objective firm characteristics but may depend on consciously selected strategies. In 2005, firms were asked to select among three types of strategy they pursue: (1) to become a leader in development and production of original products (“Leadership”_strategy); (2) to produce goods imitating the leading foreign firms by employing their technologies (“Imitation”_ strategy); (3) to maintain a

position in traditional markets by optimizing price/quality ratio (“Defensive” strategy). Fig. 3 displays the distribution of firms by partnership and strategy. The acquisition of foreign partners is more often associated with a leadership strategy and less often with a defensive strategy. To a lesser extent, the same relationship holds for firms that enhanced domestic partnerships. Of course, the selection of a strategy is not a free choice. To pursue a more active strategy, a firm should possess competitive advantages: greater market power, better technologies, etc.

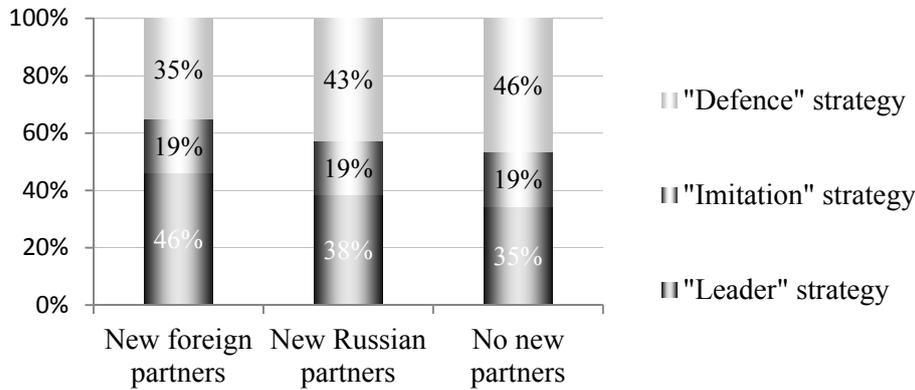


Fig. 3. The distribution of firms by strategy and groups of network activity, % of firms

We observe some differences among groups of firms depending on their involvement in partnership, i.e., in building those networks because we actually possess no information about the level of firms’ involvement in those networks. Nevertheless, this picture is not comprehensive; many differences may be the result of basic structural differences, e.g., industry, size, location, etc. Econometric analysis is needed to assess a network effect.

V. Model

We estimate a model that presumes that there are different groups of factors influencing the innovation of a firm: (1) individual, firm-related characteristics such as size, possession of specific features and export activity; (2) indicators reflecting behaviors and strategies, including network activity; (3) location of a firm.

Our general model is defined as follows:

$$P(\text{Innov}_i^T) = F(\text{Innov}_i^{T-1}, \text{Network_for}_i^T, \text{Network_rus}_i^T, \text{Firms_indicators}_i^{T-1}, \text{Strategy}_i^{T-1}, \text{Location}_i, \text{Industry}_i)$$

where $P(\text{Innov}_i^T)$ – probability that a firm is active in an innovation activity; we utilize three commonly used indicators for technological innovation:

RD – the existence of non-zero R&D spending;

NewProd – the production of a new or radically improved good;

NewTech – the introduction of a new or radically improved technology.

We control for a firm's past innovation performance in period T-1 and use dummy variables to indicate new strategic partners between periods T-1 and T:

NSP_for equals 1 if a firm found a strategic partner among foreign firms and zero otherwise,

NSP_rus equals 1 if a firm found a strategic partner among Russian firms and zero otherwise.

Other variables used in the model are the following:

Size05 – the lagged size of the firm, measured as the logarithm of annual average number of employees;

F05 – a dummy for the presence of foreign investors among owners in 2005;

S05 - dummy variable (1 if the firm was an exporter in 2005, 0 otherwise);

Exp_World05 – a dummy for firms with non-zero exports to world markets (outside of the CIS countries) during T-1;

Exp_CIS05 – a dummy for firms with non-zero export exclusively to CIS countries during T-1;

Imp05 – the share of imported intermediates and materials in the production costs during T-1;

Strat_leader05 – a dummy equals 1 if a firm declared a leadership strategy, zero otherwise;

Strat_imit05 - dummy equals 1 if a firm declared an imitation strategy, zero otherwise;

GRPpc05 – Gross Regional Product per capita – reflecting the level of regional development,

City1 – a dummy for Russian capital- firm located in Moscow;

City2 – dummy for a firm located in regional (oblast) capitals

All models control for industry by including **ind_i** dummies (i from 1 to 8).

At the first stage, we estimate simple probit models utilizing the described factors for our three indicators of technological innovations. The results are provided in Table 2 as Models 1-3.

Table 2. Probit model estimates of partnerships' impact on innovations here

	Model 1	Model 2	Model 3
Dependent variable	RD09	NewProd09	NewTech09
NSP_for	0.171	0.060	-0.030
NSP_rus	0.261*	0.237*	0.301**
Size05	0.194**	0.149**	0.205***
F05	0.045	-0.154	0.202
S05	0.426**	0.163	-0.160
Exp_World05	0.339*	-0.036	0.157
Exp_SIS05	0.054	0.243	0.174
Imp05	0.001	0.006**	0.002
Strat_leader05	0.560***	0.035	0.141
Strat_imit05	0.137	-0.361**	0.065
GRPpc05	0.000	0.000	0.002
City1	0.664*	0.377	0.266
City2	0.054	0.260**	0.152
Innov05	0.347	0.416***	0.167
Const	-2.58***	-1.41***	-2.128***
Num. of obs.	457	499	499
PseudoR2	0.21	0.10	0.90
lroc	0.80	0.70	0.69

Note: Industry dummies are included but not reported.

While the model demonstrates a weak, positive impact of domestic partnership network extension on the three indicators of technological innovations there are no visible effects of foreign partnerships. However, this basic model ignores the endogeneity of innovations and partnership enhancement, and because they occur during the same period of time, we cannot be sure about the direction of causality. Innovations may have occurred because of new partners, but innovations may also have facilitated new partnerships. Our estimations may not be unbiased.

One of the most frequently used methods for evading this problem is the use of instrumental variables. The limitation of this approach is the requirement for the dependent variable to be continuous. Because our dependent variable is binary, this method is not appropriate in our case. Another option has been suggested (Arendt and Holm, 2006) and employed in similar models (Demidova, Yakovlev, 2011).

To estimate a model with binary dependent variable Y_1 and endogenous binary variables Y_2 and Y_3 to produce unbiased estimations we solve the system of bivariate probit models:

$$\begin{cases} Y_1^* = X_1\beta_1 + \alpha Y_2 + \delta Y_3 + \varepsilon_1 \\ Y_2^* = X_2\beta_2 + \varepsilon_2 \\ Y_3^* = X_3\beta_3 + \varepsilon_3 \end{cases}$$

where Y_1^*, Y_2^*, Y_3^* are latent variables, $\alpha, \beta_1, \beta_2, \beta_3, \delta$ are the estimated parameters, β_1, β_2 are the coefficients, $\varepsilon_1, \varepsilon_2, \varepsilon_3 \sim N(0,0,1,1,\rho)$ (ρ – coefficient of correlation of errors in the first and the second equation) and X_1, X_2, X_3 are the vectors of independent factors for two models (with at least one variable in the second equation not be present in the first one). Y_1 is an innovation indicator for period T (2009). Y_2 represents NSP_for and Y_3 represents NSP_rus.

For the second and third equations (for modeling the NSP variables) we employ different indicators that may facilitate the acquisition of a foreign partner but are assumed not to be endogenous to NSP. The list of factors that affect the acquisition of a new partner is different for foreign and for domestic partners. Those variables are:

Forfirmsup05 – a dummy variable that equals 1 if a firm was a supplier of a foreign-owned firms producing in Russia in 2004;

Org_help – a dummy variable set to 1 if the firm obtains organizational help from state authorities on federal, regional or local level (to establish contacts with partners, to promote contact with other state authorities, to attract investors, etc.) and 0 otherwise;

Imp_eq05 – a variable equals 1 if a firm imported equipment and 0 otherwise;

Reg_share05 – the percentage of sales in the same region the firm is located.

As we presume that firms should have sufficient competitiveness to be of any interest for potential partners, we include indicators of competitiveness prior to innovation changes and the enhancement of partnership network.

Compet05_1 – is a dummy that equals 1 if the firm reports itself to be leading in the industry among domestic producers, 0 otherwise. **Compet05_2** – equals 1 if a firm declares that it is lagging behind the leaders in competitiveness but is closing the gap, 0 otherwise; **Compet05_3** – equals one if a firm state that it lags but at a constant level, 0 otherwise; **Compet05_4** – is a dummy that equals 1 for firms with increasingly lagging competitiveness, 0 otherwise; **Compet05_5** – is a dummy that equals 1 for firms that could not answer the question, 0 otherwise (which includes 10% of firms in our sample).

The results of the estimation of the system are provided in Table 3.

Table 3. Estimations of the system of equations

	Model 4	Model 5	Model 6
Dependent variable	RD09	NewProd	NewTech
Equation 1: Innov09.			
NSP_for	0.758***	0.468*	0.581*
NSP_rus	1.118***	1.111***	1.284***
Size05	0.172**	0.158**	0.047
f05	-0.140	-0.009	-0.351
s05	0.521***	-0.077	0.290*
GRPpc	0.020**	0.021**	0.002
Innov05	0.435***	0.157	0.337***
_cons	-2.55***	-1.985***	-1.190***
Equation 2: NSP_for			
ffsupplier04	0.231	0.240	0.237
Size05	0.101	0.093	0.111
Imp_eq05	-0.164	-0.125	-0.115
org_help	0.170	0.275*	0.174
reg_share05	-0.003	-0.003	-0.005**
f05	0.690***	0.665***	0.656***
s05	-0.036	0.001	-0.076
City1	0.459*	0.380	0.479*
City2	0.265	0.256*	0.293**
Exp_CIS_05	0.441**	0.479***	0.455***
Exp_World_05	0.676***	0.639***	0.541***
_cons	-1.933	-1.912***	-1.936***
Equation 3: NSP_rus			
Size05	0.078	0.085	0.074
org_help	0.183	0.308**	0.191*
reg_share05	-0.004**	-0.004**	-0.006***
f05	0.086	0.032	0.073

Table 3. Estimations of the system of equations (continued)

	Model 4	Model 5	Model 6
Dependent variable	RD09	NewProd	NewTech
s05	-0.253	-0.215	-0.330*
Holding05	-0.198*	-0.220*	-0.191*
City1	-0.284	-0.345	-0.152
City2	0.263**	0.281**	0.332***
Compet05_1	0.242	0.207	0.060
Compet05_2	0.541***	0.465***	0.308*
Compet05_4	-0.291	-0.403	-0.415
Compet05_5	0.298	0.340*	0.116
_cons	-1.086**	-1.066**	-0.842**
/atrho21	-0.626***	-0.501***	-0.723***
/atrho31	-0.874***	-0.766**	-1.281***
/atrho32	0.653***	0.643***	0.711***
rho21	-0.555***	-0.463***	-0.619***
rho31	-0.703***	-0.645***	-0.857***
rho32	0.573***	0.567***	0.611***

Note: Industry dummies are included but not reported

VI. Discussion and Conclusion

Table 3 demonstrates that the quality of the model is adequate, and both foreign and domestic partnerships positively influence innovation activities in terms of R&D, new products and new technologies. This result supports hypothesis 1. We found that innovations in manufacturing in Russia during the survey period were more strongly associated with domestic partnerships than with foreign partnership (the coefficients are significant at a higher level). This result may seem counterintuitive, but it supports previous research cited in section II (Rosenkoph and Almeida, 2003; Patel et al, 2013). The results may indicate that first, new foreign and domestic partners play different roles. Foreign partnerships may be more often used for entry into new markets than for new technology or the development of new products. Second, foreign partnerships are more demanding in terms of skills and competences and thus may be available only for firms that are closer to the technological frontier. Note that the impact of new foreign partners is strongest for R&D spending compared to the impact of new technology and new products. Firms just seeking to upgrade products and technologies may not be of any interest to foreign firms and may seek domestic partners to improve their product lines.

Foreign co-owners, somewhat contrary to expectations, seem to not influence innovations directly. However, the presence of foreign owner among the stockholders strongly increased a chance of acquiring new foreign partner(s), which, in turn, is a positive factor for innovations. However, the presence of state owners directly, positively influences R&D expenditures and the implementation of new technologies (though not new products), but has virtually no impact on

formation of partnerships. One possible explanation is the fact that many state-owned firms or firms in which the state has a significant stake specialize in producing goods for public procurement, which (at least in Russia) does not stimulate product innovations. These firms compete by price and new technologies are needed to reduce costs of production. However, firms with state owners may have better opportunities to obtain state support for R&D through participation in different state-financed programs.

If we examine the results of the equations for new foreign partners, we observe that the significant factors are foreign ownership, i.e., FDI and export activity. This is easily explained as both FDI and exports are evident channels for searching for new partners. Export to both to and outside of the CIS countries are both positively related to new foreign partners. Other factors that increase the chance of acquiring new foreign partner in most specifications are associated with the location of a firm – location in Moscow or in the regional capital is positively related to the appearance of new foreign partners. Very likely this pattern is due to better infrastructure and lower costs of communication with partners.

The probability of acquiring new domestic partners is also positively related to location in the regional centers (but not in Moscow). We may presume that for firms located in Moscow domestic partnerships were formed earlier because the level of business activity in Moscow is much higher than in the rest of the country, and their activity in this field became less intensive during the survey period. According to our results, firms located in Moscow were much more successful in building partnerships with foreign firms. Being a global city Moscow provides a variety of opportunities for new business contacts and international trade is only one such option.

The high level of concentration of sales of a firm in the region in which the firm is located is strongly and negatively associated with the probability of acquiring new partners (both foreign and domestic). Regionally oriented enterprises may have fewer opportunities (due to limited choice) and fewer incentives to form new partnerships (low level of trust of outsiders).

The likelihood of new domestic partners is related to the initial competitiveness level (measured by self-estimation of the top managers). Contrary to expectations, the likelihood is not highest for the most competitive firms but for the group that was “catching up” to leaders. This is evidence that leaders formed their partnership networks prior to the period surveyed, while catching up firms actively searched for partners inside Russia to increase competitiveness. The last result worth mentioning is the significant and negative coefficient before the holding dummies in all the specifications, i.e., firms belonging to a group is less likely to form partnerships most likely because that type of decisions in industrial group are made at the level of the parent company.

The results reported in this paper are very preliminary and should, of course, be treated with caution. First, we stress that the explanatory power of our models for partnerships is rather weak. We cannot predict the formation of new partnership very well and may have missed some important factors. The system of equations is not very stable and is sensitive to changes in specification and changes in the number of observations; additional efforts are needed to produce robust results. However, our results support the hypothesis that new partnership networks (both foreign and domestic) positively influence the technological innovation activities. If this is true, state policies (both at federal and regional levels) that facilitate firms' searches for new partners may be a quite efficient way to increase innovation activity and, eventually, the competitiveness of firms. We find that in 2005-2009, foreign partnerships were not widespread among Russian manufacturing firms, and their contribution to innovations was less visible in comparison with the collaboration with local firms. More time and additional efforts of companies' owners and managers are needed to overcome cognitive, institutional and geographical proximity in their search of new partners.

As networks and partnerships seem to have a positive effect on innovation activity of Russian manufacturing firms it is important to make trade and innovation policy interrelated and consistent with the broader economic objectives. The state agencies and local governments should create opportunities for face-to-face dialogs and collaboration between both foreign and domestic companies. To facilitate the international networking of firms the state should, first of all, create legal prerequisites for long-term cooperation schemes that create trust between actors. The lack of trust between private firms is one of the main obstacles for establishing such links and the state can do a lot to overcome it. The possible policy measures should include improvements in Russian juridical system for better property rights protection, in particular in the field of intellectual property rights, contract enforcement, etc. Also the state should be less prejudiced against strategic partnerships between Russian firms and foreign partners and balance the antitrust policy.

It should be stressed that inside Russia the regions differ a lot in their policies towards FDI and collaboration of local and foreign firms. It would be useful if the best practices in this field are disseminated among other regions. Interregional horizontal networking between authorities, regional business-associations, chambers of commerce, etc. should become a priority task for all the participants. More active interregional communications will also contribute to networking between Russian domestic firms. As our analysis indicates, this type of partnerships before the financial crisis of 2008-2010 and Russia's accession to WTO had even more significant impact on innovations than cross-border cooperation.

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