

R&D, Innovation and Interfirm cooperation of Russian manufacturing firms

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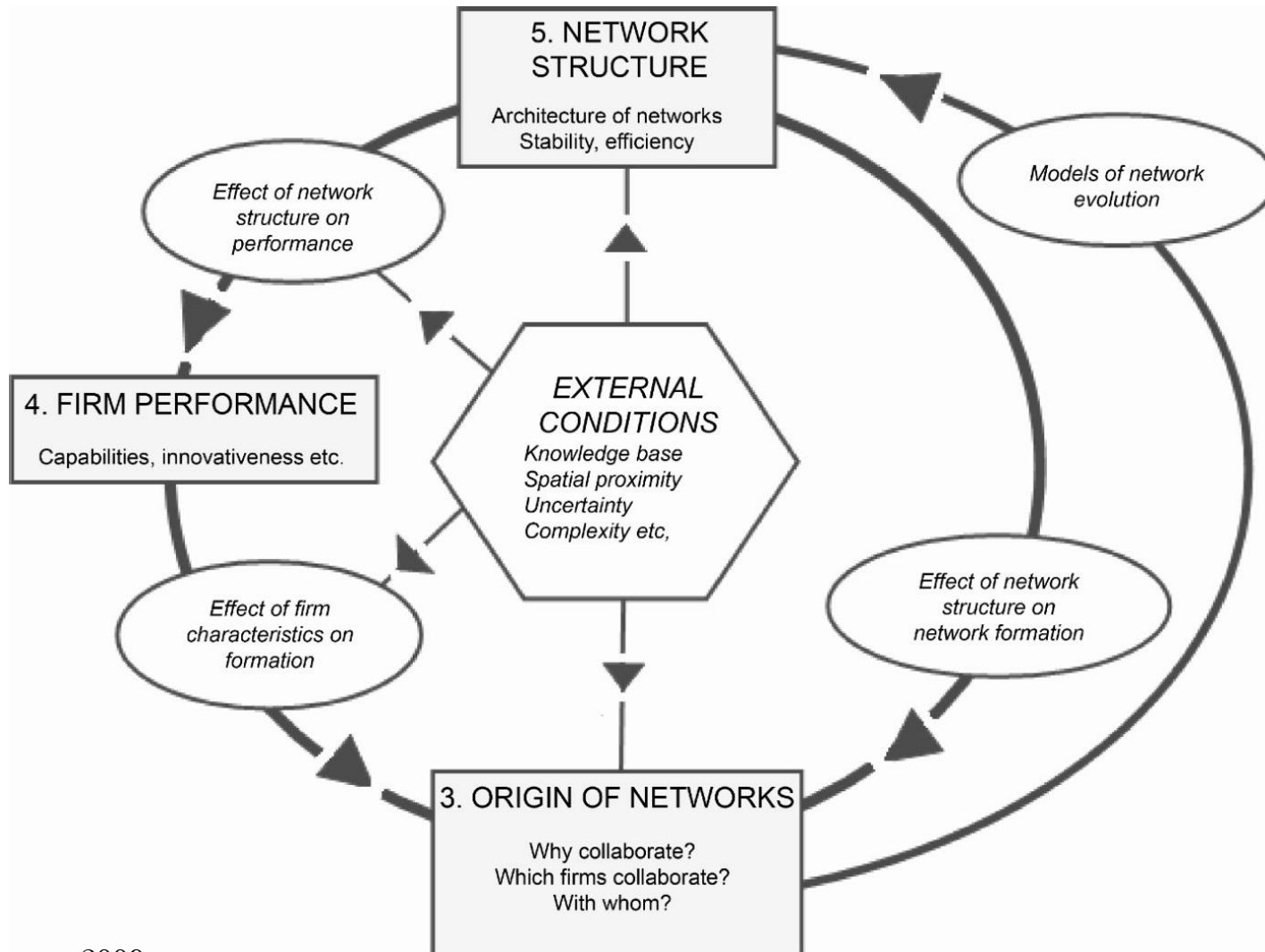
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Research idea

- technological innovations are less and less the outcome of isolated efforts of the individual firms;
- innovations are created and brought to the market through complex interfirm relationships and linkages;
- Russian firms are less involved into interfirm cooperation: "old" firms struggle from Soviet heritage with its centrally planned economy (and centrally planned links), "young" firms demonstrate individualistic behavior and don't involve into long-term relationships;
- two questions arise:
 - What is the intensity of interfirm cooperation that Russian manufacturing firms create for different purposes? Does "Soviet heritage" take place?
 - What are the differences in the characteristics of firms involved in different types of interfirm cooperation?

Background and previous results (1)



Source: Ozman, 2009

Background and previous results (2)

- During the last three decades many researchers has considered enterprise networks as the “locus of innovation” (*Powell et al., 1996; Ahuja, 2000*).
- Several reviews confirmed that innovation flourishes within inter-firm networks (*Rogers, 2004; Powell and Grodahl, 2005; Ozman, 2009*).
- *Two explanations:*
 - *Resource interdependence.* Firm motives to collaborate are explained by uncertainty and access to resources (*Pfeffer and Salancik 1978*) especially in technologically intensive industries (*Hagedoorn 1993*); by reduction of the innovation period (*Eisenhardt and Schoonhoven, 1996*), complementarity of resources (*Miotti and Sachwald, 2003*), technological capabilities (*Arora and Gambardella, 1994*); link formation is influenced by the social, commercial and technological capital of the firm (*Ahuja, 2000*).
 - *Organisational learning.* Firm would like to explore and exploit knowledge bases, not only resources, collaboration between firms not only enhances learning about new developments, but also strengthens internal competencies (*Powell, Koput, and Smith-Doerr, 1996*); **external collaboration is complementary to internal capabilities** (*Mowery 1989*);

State of Interfirm cooperation of Russian firms

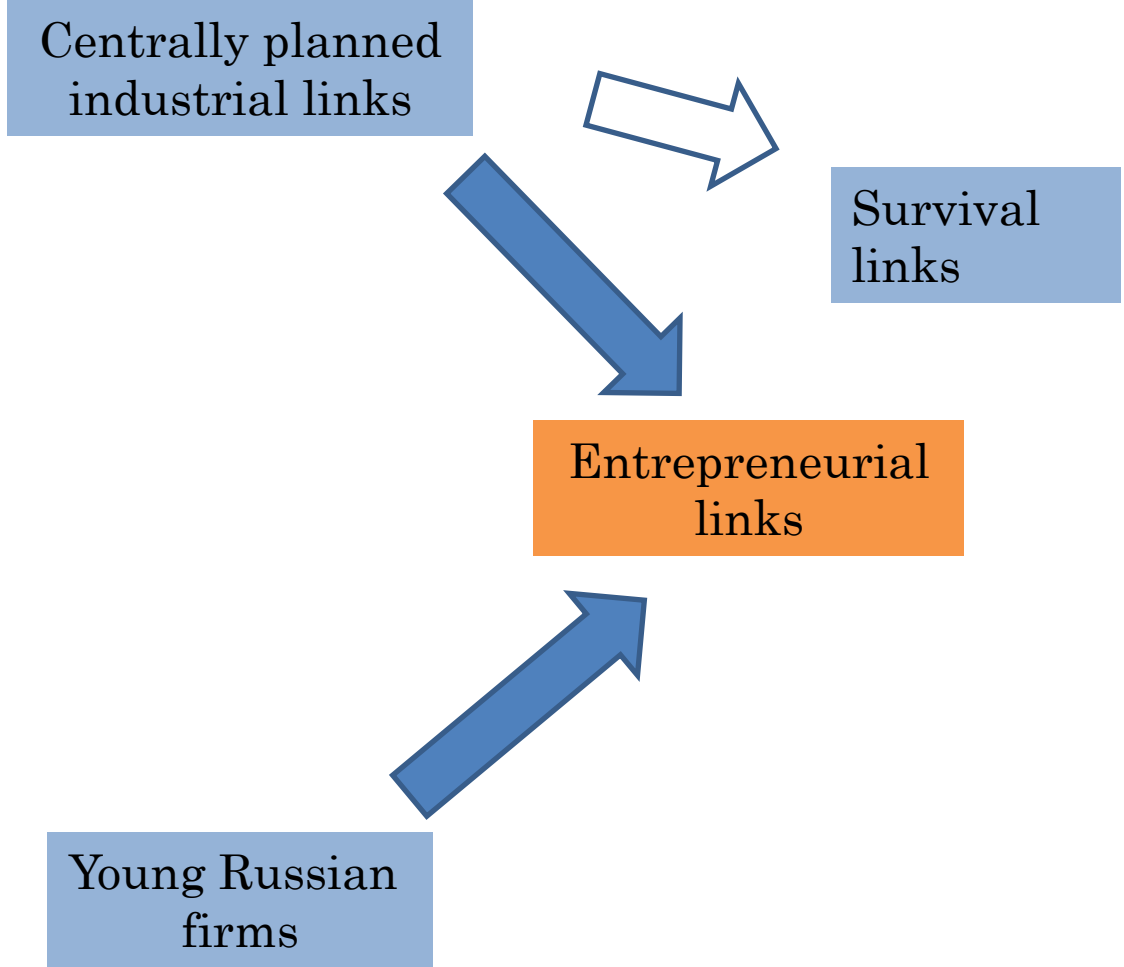
Russian Interfirm cooperation is significantly different from that of developed countries (*Afanasiev, Kusch, 2004; Kusch, Rafinedzhad, Afanasiev, 2002; Katkalo, 1999; Sivakov, 1999; Sautin, 1999; Okulov, 1999; Radaev, 2000*):

1. Before 1990th , interfirm cooperation had been developing under centrally planned mechanism - so called **centrally planned industrial links**.
2. After 1990th two types of interfirm cooperation co-exist: ”**survival links**” and “**entrepreneurial links**”
3. Suppliers in resource industries have market power over producers in resource-intensive industries. Thus, producers are forced to build long-term links with suppliers

Soviet
Industrial
links

Strategic
partners

Post-Soviet
Individual links



Data (2)

- Survey of Russian manufacturing firms RUFIGE (HSE, 2018)
- Data is representative across manufacturing industries, but not regions
- 5 types of partnership:
 - **Backward linkages** of manufacturing firms - **Supplier networks** measured as a % of long-term partners (dummy equals 1 if >50%)
 - **Forward linkages** of manufacturing firms - **Customer networks** measured as a % of long-term partners (dummy equals 1 if >50%)
 - **Strategic linkages** – **Strategic partnerships** that have significant impact on a respondent firm currently or in the future (dummy equals 1 if local/national/international)
 - **R&D linkages** - **University networks** (dummy if university/research institutes)
 - **R&D linkages** - **Producer networks** (dummy if Russian/Foreign firm)

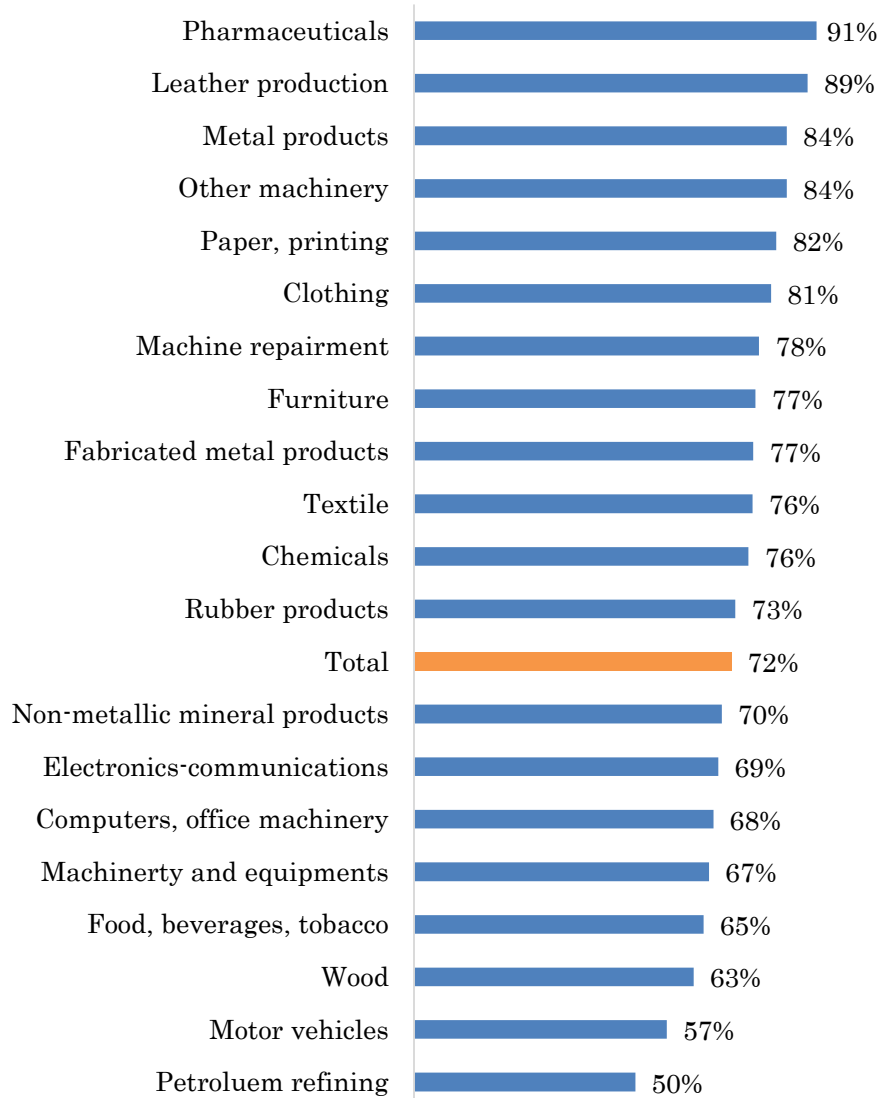
Networks Data description

Share of long-term relations	Suppliers		Customers	
	firms	% of total	firms	% of total
0-20%	74	10%	82	11%
21-40%	69	10%	76	11%
41-60%	185	26%	205	28%
61-80%	245	34%	211	29%
81-100%	150	21%	149	21%

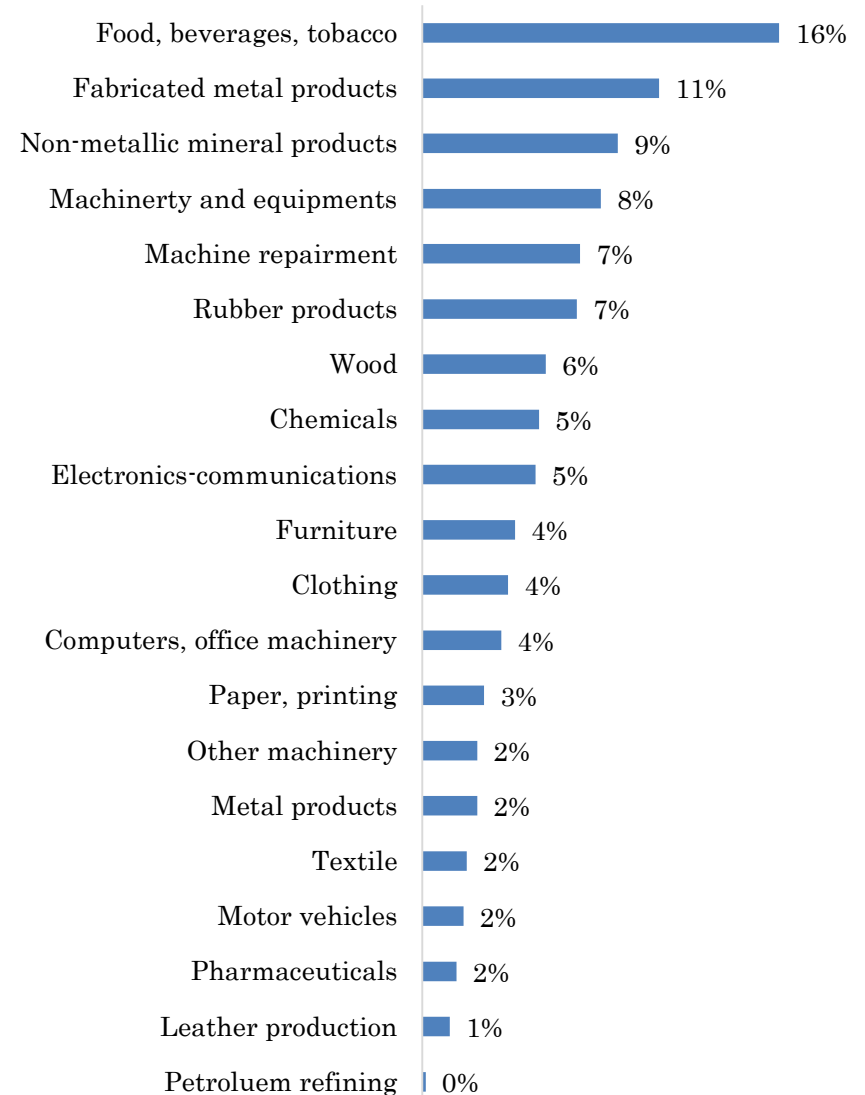
	Strategic partners		University linkages		Producer networks	
	firms	% of total	firms	% of total	firms	% of total
No	356	40%	863	96%	880	98%
Yes	544	60%	37	4%	20	2%

Supplier networks

% of long-term networks by industry

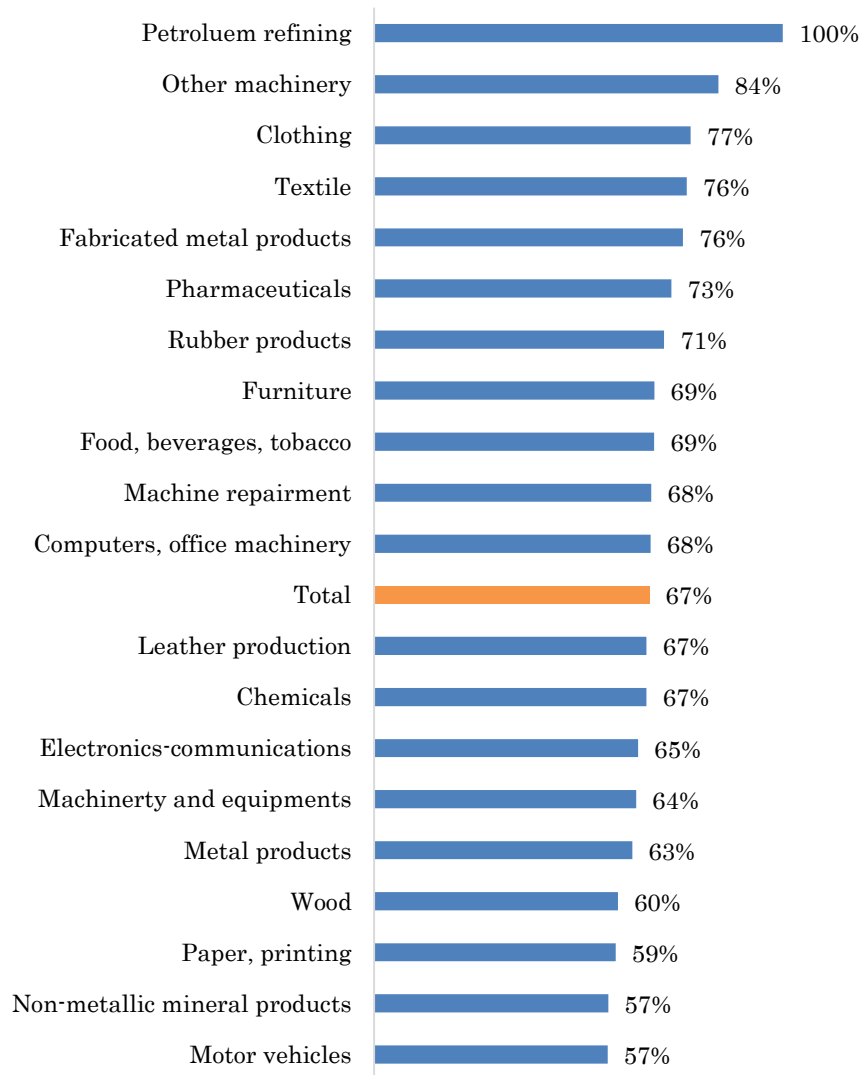


% of long-term networks out of total

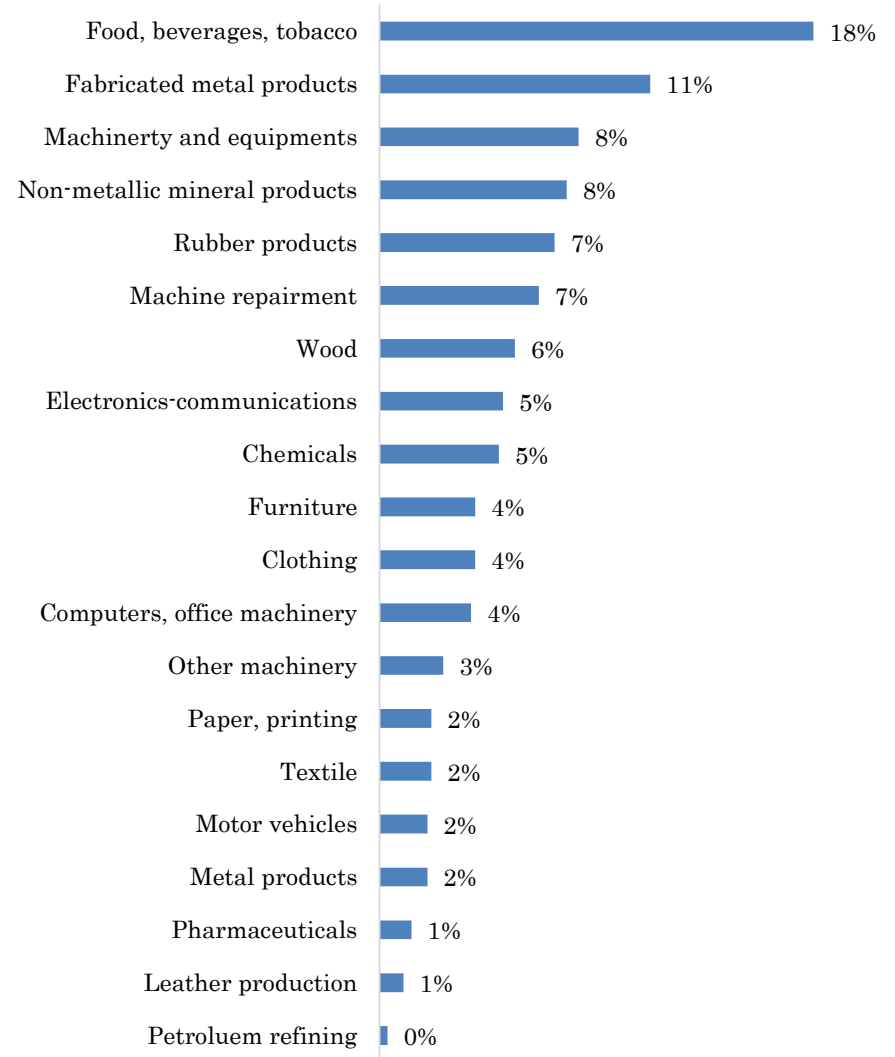


Customer networks

% of long-term networks by industry

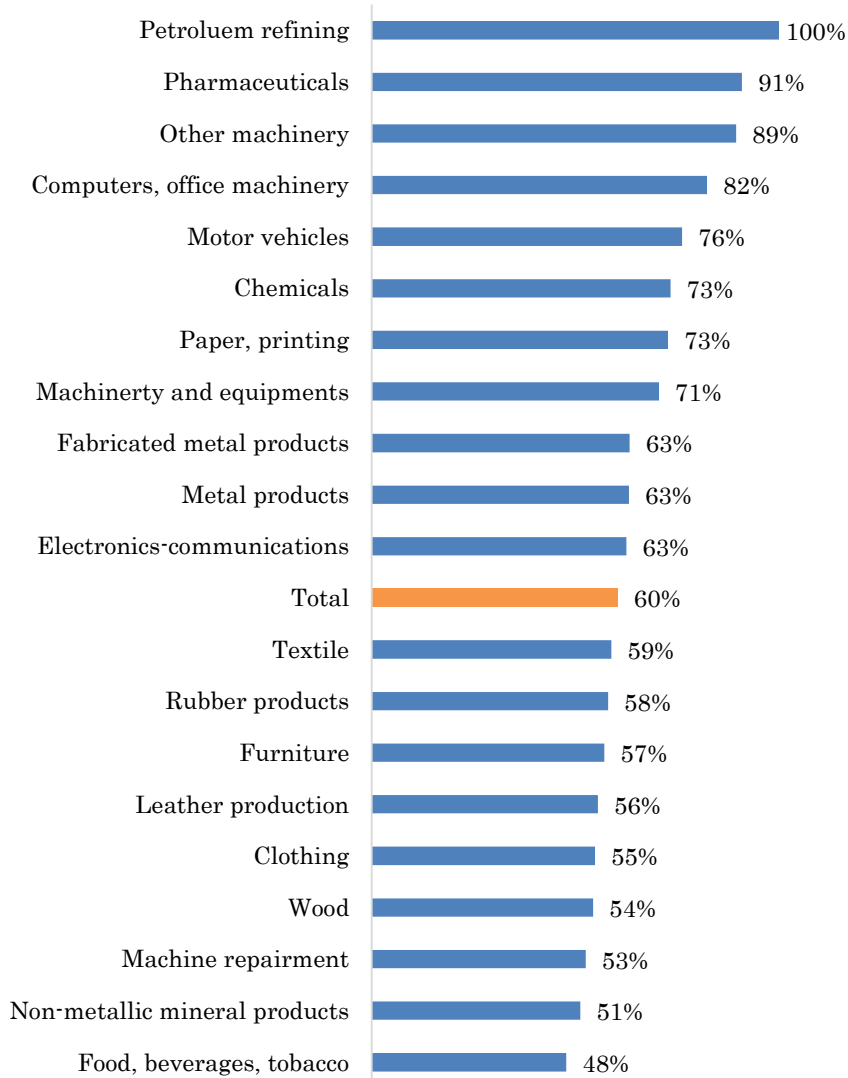


% of long-term networks out of total

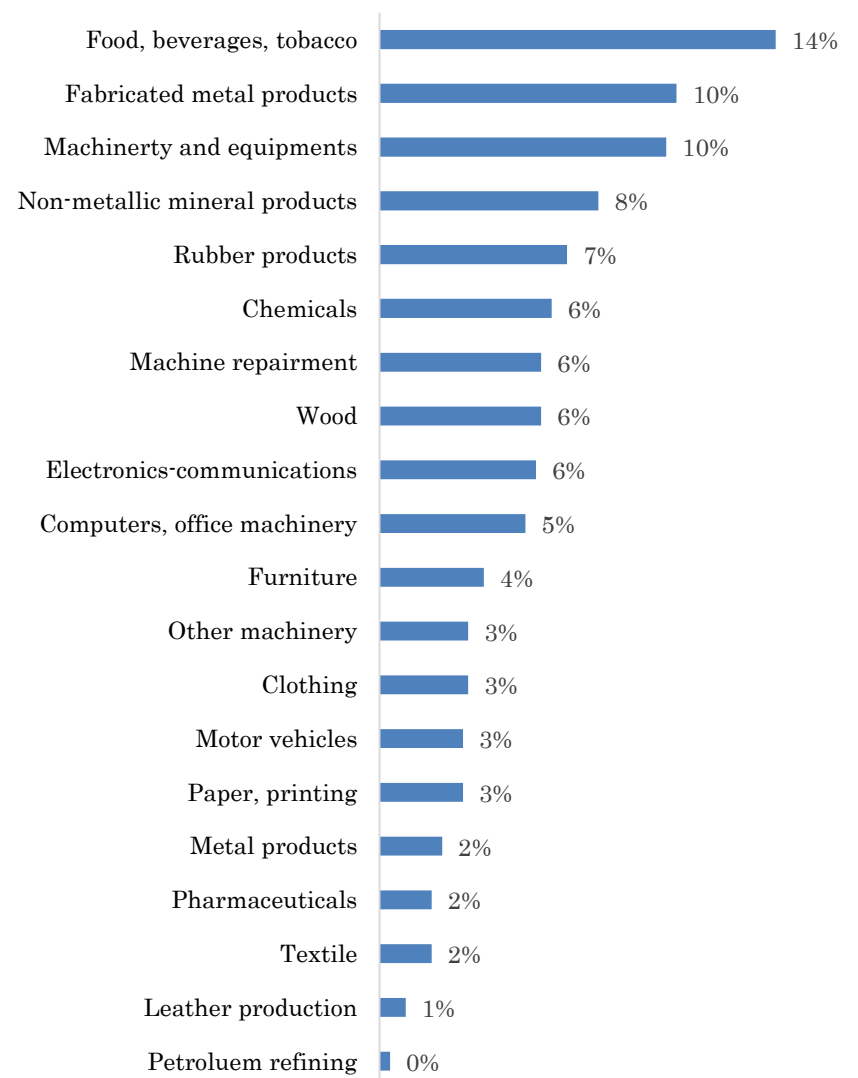


Strategic partnerships

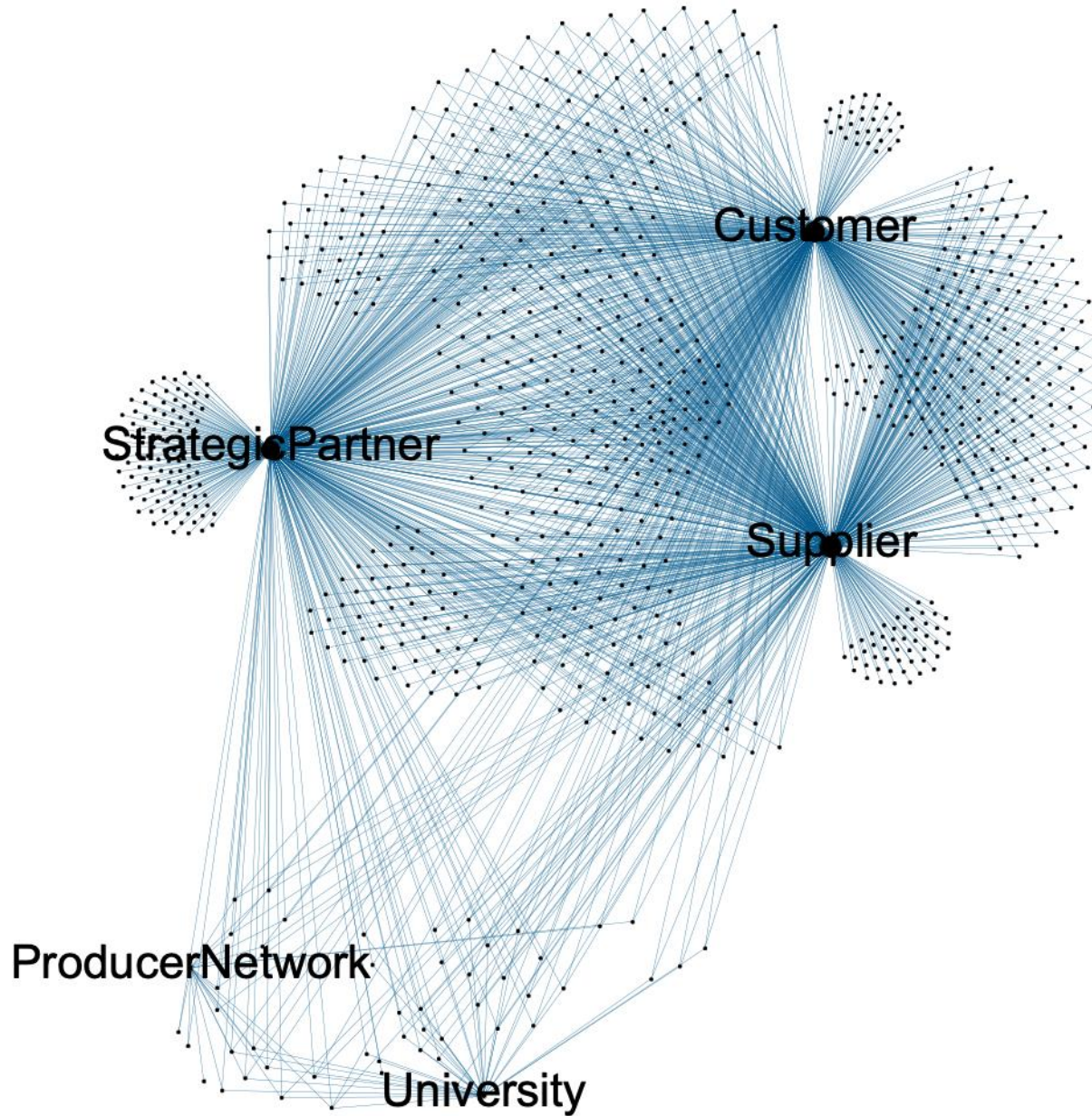
% of long-term networks by industry



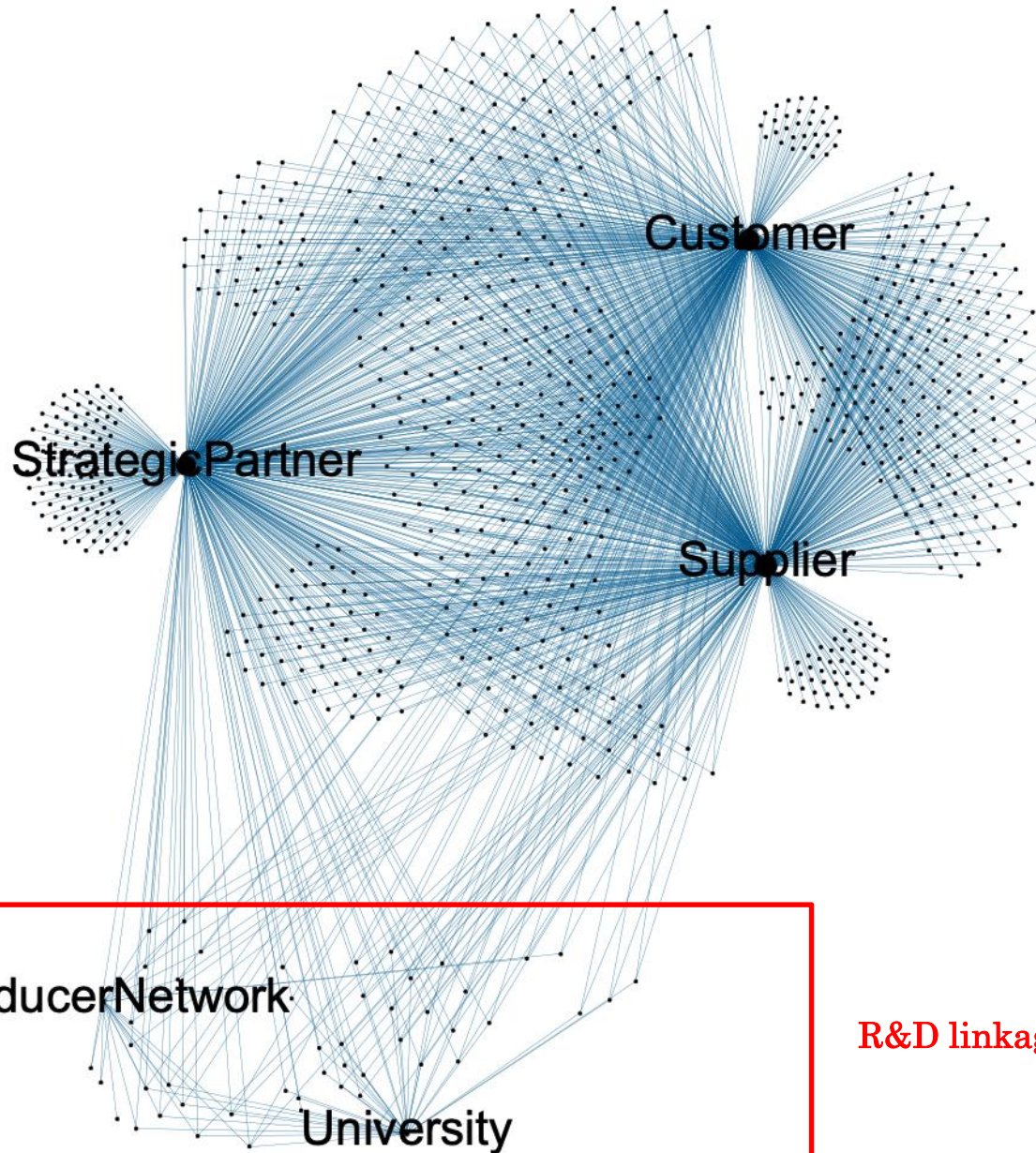
% of long-term networks out of total



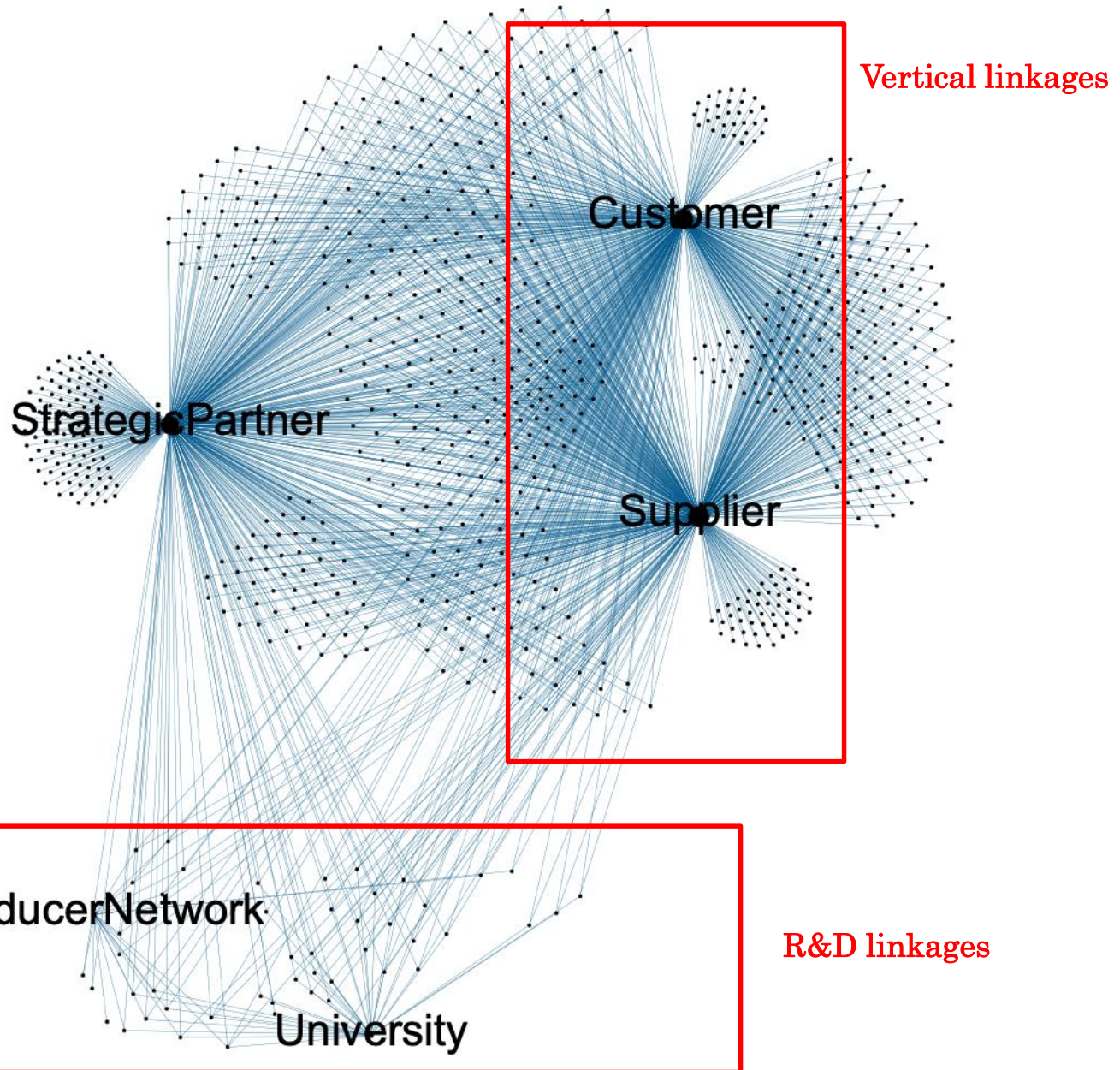
Network graphs



Network graphs



Network graphs



Descriptive statistics

	N. of observations	Mean	Std. dev.	Min	Max
Share of long-term suppliers	900	0,63	0,26	0	1
Share of long-term customers	900	0,61	0,26	0	1
More than 50% long-term suppliers (dummy)	900	0,72	0,45	0	1
More than 50% long-term customers (dummy)	900	0,67	0,47	0	1
Strategic partners	900	0,60	0,49	0	1
University linkages	900	0,04	0,20	0	1
Producer networks	900	0,02	0,15	0	1
Part of holding	900	0,18	0,38	0	1
Share of employees in R&D	900	0,225	0,06	0	0,63
Foreign owners	885	0,05	0,22	0	1
Export intensity	900	0,23	0,42	0	1
New-to-world	900	0,03	0,18	0	1
New products for Russian market	900	0,25	0,43	0	1
Share of new products in revenue	900	0,14	0,22	0	1
Age					

Correlation matrix

	Suppliers	Customers	Share of new products in revenue	Holding group part	Share of employees in R&D	Foreign owners	Export intensity	New products for world	New products for Russia
Suppliers	1,00								
Customers	0,55	1,00							
Share of new products in revenue	-0,11	-0,05	1,00						
Holding group part	0,04	0,07	0,06	1,00					
Share of employees in R&D	-0,06	0,01	0,27	0,09	1,00				
Foreign owners	0,03	0,00	0,04	0,32	0,04	1,00			
Export intensity	0,00	0,03	0,19	0,23	0,24	0,16	1,00		
New products for the world	0,00	0,01	0,22	0,07	0,26	0,03	0,20	1,00	
New products for Russia	0,00	0,06	0,31	0,13	0,25	0,12	0,22	0,11	1,00

Results for Supplier and Customer links

	OLS Suppliers	OLS Customers	Probit Suppliers	Probit Customers
Share of employees in RD	-0.278 (0.220)	0.0226 (0.214)	-0.0038 (0.0105)	-0.0020 (0.00965)
Export intensity	-1.118 (2.791)	-1.205 (2.837)	0.0193 (0.144)	0.0049 (0.138)
New-to-world products	4.281 (6.206)	0.647 (6.780)	0.0768 (0.343)	0.0617 (0.321)
% of new products in revenue	-0.132** (0.0558)	-0.0888 (0.0632)	-0.0033*** (0.00272)	-0.0018* (0.00281)
Constant	-0.00813 (6.452)	0.404 (7.160)	0.490 (0.735)	-0.370 (0.552)
Industry dummies	+	+	+	+
Region dummies	+	+	+	+
Observations	710	710	766	773
R-squared	0.15	0.17	0.13	0.11

+Control variables include: age, size, part of holding, foreign ownership, new-to-Russia products

++Marginal effects are reported for probit model

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Firms with higher % of new products in revenue are less included into vertical relationships (supplier/customer links)

- Firms at Global/Russian tech frontier are not different in building supplier/customer links
- Larger firms (with 250+ employees) more likely have customer links
- Recently established firms (during 2009-2014) more often have vertical relationships

Results for Strategic, University and Producer links

	Probit Strategic partners	Probit University linkages	Probit Producer networks
Share of employees in RD	0.0082** (0.0123)	0.0028*** (0.0131)	0.0031*** (0.0148)
Export intensity	0.1176*** (0.142)	0.0253 (0.268)	-0.0210 (0.383)
New-to-world products	0.1750 (0.471)	0.0271 (0.450)	0.0334 (0.597)
% of new products in revenue	0.0010 (0.00263)	0,0000 (0.00501)	0.0003 (0.00578)
Constant	-1.319** (0.596)	-4.659*** (0.839)	-9.063*** (1.197)
Industry dummies	+	+	+
Region dummies	+	+	+
Observations	864	522	372
Pseudo-R2	0.22	0.43	0.37
Correctly classified	73.84%	93.87%	95.16%

+Control variables include: age, size, part of holding, foreign ownership

++Marginal effects are reported for probit model

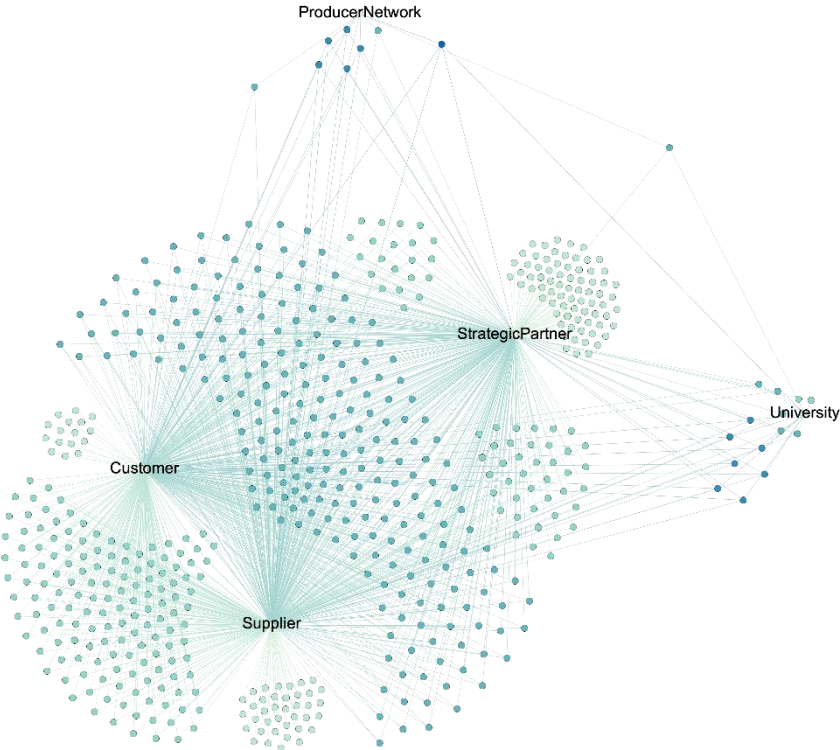
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

- Firms with higher % of employees in R&D more likely have horizontal relationships (Strategic, University, Producer links)
- Exporters more likely build strategic partnerships
- Recently established firms (during 2009-2014) more often have strategic partnerships
- Larger firms (with 50+ employees) more often have horizontal (customer/supplier) relationships

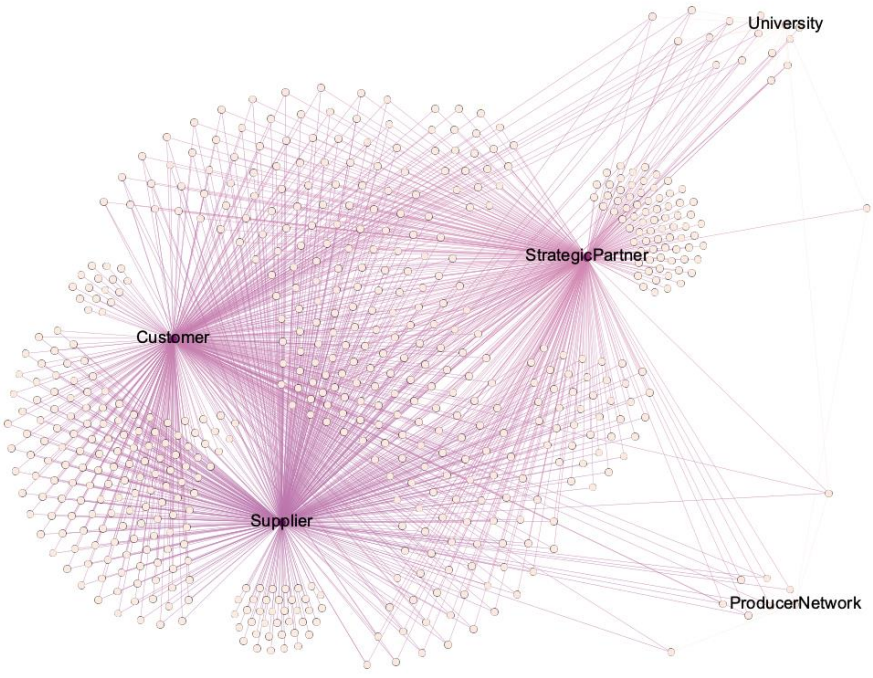
Networks Data description (2)

	Suppliers			Customers			Strategic partners		
	Soviet (N=689)	Post- Soviet (N=211)	All (N=900)	Soviet (N=689)	Post- Soviet (N=211)	All (N=900)	Soviet (N=689)	Post- Soviet (N=211)	All (N=900)
No	26%	36%	28%	33%	32%	33%	40%	37%	40%
Yes	74%	64%	72%	67%	68%	67%	60%	63%	60%

Network for firms founded in Soviet period



Network for firms founded in Post-Soviet period



Results for firms from Soviet/Post-Soviet periods

	Suppliers			Customers			Strategic partners		
	All	Soviet	Post-Soviet	All	Soviet	Post-Soviet	All	Soviet	Post-Soviet
Share of employees in R&D	-0.278	0.322	-0.415*	0.0226	0.589	-0.0176	0.0278**	0.000707	0.0440***
Export intensity	-1.118	0.0641	-2.022	-1.205	-1.319	-2.685	0.397***	0.526	0.242
New-to world products	4.281	-7.916	13.66	0.647	-19.08*	20.97***	0.591	1.194	0.600
Share of new products in revenue	-0.132**	0.0285	-0.175**	-0.0888	-0.119	-0.0529	0.00338	-0.0176**	0.00710**
Industry dummies	+	+	+	+	+	+	+	+	+
Region dummies	+	+	+	+	+	+	+	+	+
Observations	710	209	501	710	209	501	864	146	667
R-squared	0.153	0.373	0.218	0.173	0.422	0.220	0.22	0.17	0.24

+Control variables include: age, size, part of holding, foreign ownership, new-to-Russia products

++Marginal effects are reported for probit model

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

- Post-soviet firms with higher innovative inputs (% of employees in R&D) and innovative outputs (% of new products in revenue) more likely have strategic partners and less likely have supplier links
- Post-soviet firms at global tech frontier more likely have customer links
- Firms within holdings or firms with FDI are not different from other in customer/supplier and strategic links

Outcomes

- Networking doesn't seem to be popular among Russian manufacturing firms and is primarily based on vertical relationships (72% firms have supplier links, 67% - customer links) and partially on horizontal (60% - strategic partner links, 4% university links, 2% - producer links).
- “Soviet heritage” does take place in networking activities of Russian manufacturing firms:
 - Although the distribution of Soviet and Post-Soviet firms by types of links is similar, the nature of the links is different
 - Among Post-Soviet firms, those that have higher innovation capabilities and innovation outputs are included into horizontal links (strategic partnerships) and forward vertical links (customer networks); simultaneously, Post-Soviet innovative firms less likely have supplier networks
 - It seems that links of Soviet firms should be indeed explained only by centrally planned system as most of the explanatory variables do not work for them

Further work

- Do robustness check for different types of industries
- Split innovations in process innovation and product innovation
- Run regression models on two samples: SMEs and Large companies for the purpose of robustness check and difference for categories