



HIGHER SCHOOL OF ECONOMICS  
NATIONAL RESEARCH UNIVERSITY

# Productivity, learning, product innovations and competitive pressure in Russian manufacturing firms

within a project “Factor affecting productivity in Russian firms in basic non-resource industries”  
together with Yu. Simachev, M. Kuzyk, S. Schuvalov, N. Zudin, M. Yurevich

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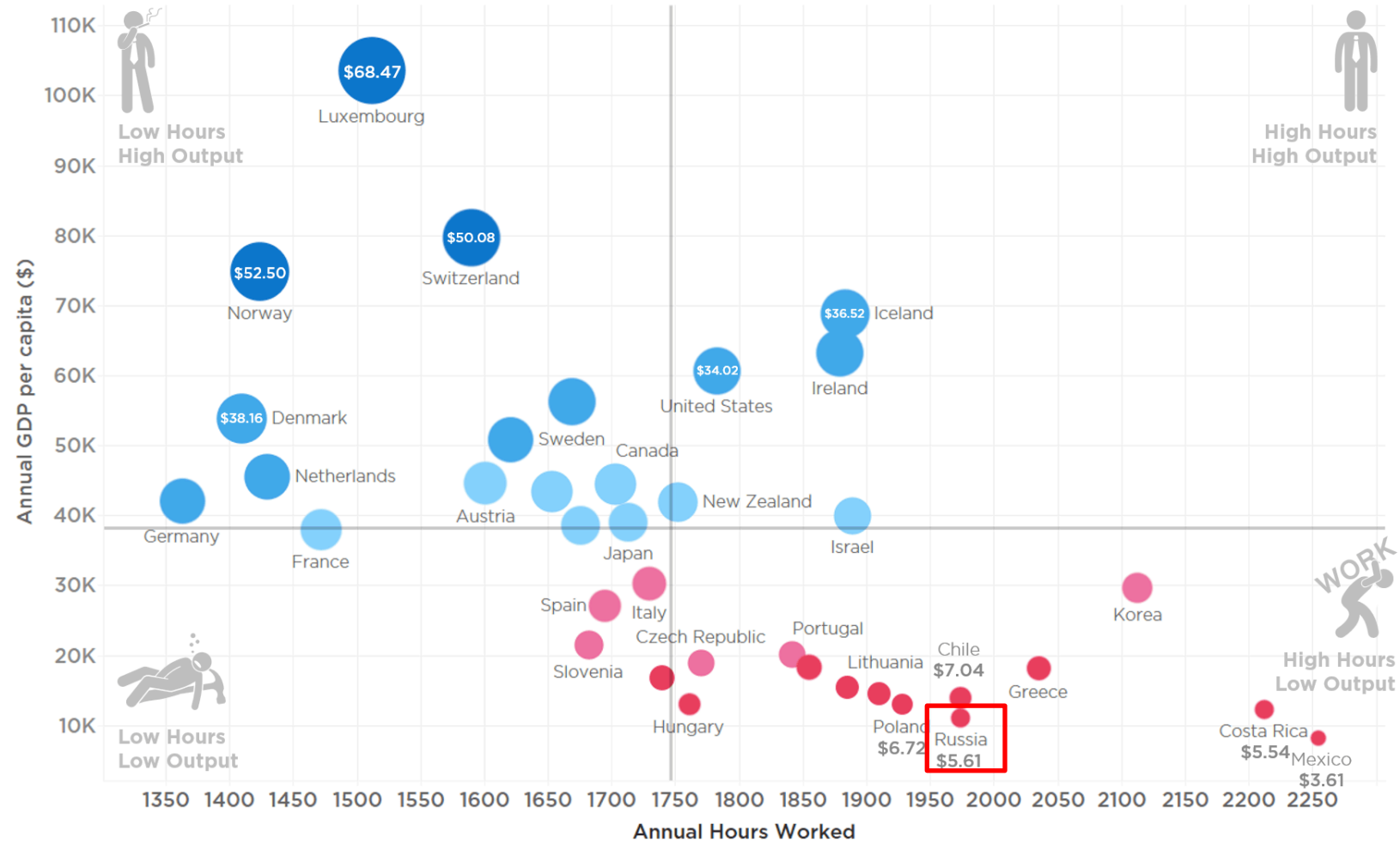
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ASEEES

San Francisco, 2019

# The World's Productivity 2017

## Productivity Per Person Per Hour



Productivity Per Person Per Hour (Selected 35 Countries)

### Article and Sources

<https://howmuch.net/articles/worlds-most-productive-countries>  
 International Monetary Fund; Organisation for Economic Co-operation and Development

# What are main features of foreign programs targeting higher productivity?

Based on: Kazakhstan 2011, Brazil 2016, India 2011, UK 2015, Finland 2016, Malaysia 1962, Korea 1978, USA 1980:

- long-term planning (without short-term expectations)
- wide coverage of participating firms (no exclusion)
- targeting not only particular sectors, but the economy as a whole
- combination of technological and organizational innovation
- usage of existing infrastructure, development institutions
- not only government organizations are included
- combination of different forms of support
- emphasis on the spread of advanced competencies, development of human capital

# What's about Russian program aimed at higher productivity?

*Nacional'nyj proekt «Proizvoditel'nost' truda i podderzhka zanyatosti»*

- Approved in December 2018 according to Presidential Executive Order On National Goals and Strategic Objectives issued May 7, 2018
- Currently is under review and amendments
- Main features of the program:
  - targets mainly large and medium-sized enterprises in basic non-resource sectors of the economy (agriculture, manufacturing, retail, construction, transportation)
  - chooses organizational innovations as a main instrument (among technological, product and organizational innovations)
  - has no connections with programs aimed at export potential and human capital development
  - doesn't assume joint measures together with innovative infrastructure – techno parks, engineering centres and so on

What does empirical literature say about factors affecting productivity?

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- **Export affects productivity through “learning by doing” and “learning by exporting” effects**
  - Learning by doing and Self-selection into exporting: Bernard and Jensen 1995, 1999, Melitz, 2003, Bernard and Jensen 2004; Secchi et.al. 2016; [for Russia: Golikova et.al., 2012; Kadochnikov, Fedyunina, 2013;](#)
  - Learning by exporting: Clerides, Lach, and Tybout 1998; de Loecker 2007; Harrison and Rodriguez-Clare 2010, Alvarez and Lopez, 2005, Van Biesebroeck 2005, Greenaway and Keller 2007, Aw et al. 2011, Atkin et.al. 2017;

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- **Innovations affect productivity**
  - Endogenous growth models: Grossman and Helpman, 1990b; Romer 1986;
  - R&D-Innovation-Productivity model proposed by Crepon et.al. 1998 and a large number of the followers; [for Russia: Roud 2007, Trachuk, Linder 2017; Fedyunina, Radosevic, 2019](#)
  - Self-selection into innovation: Bustos 2011;

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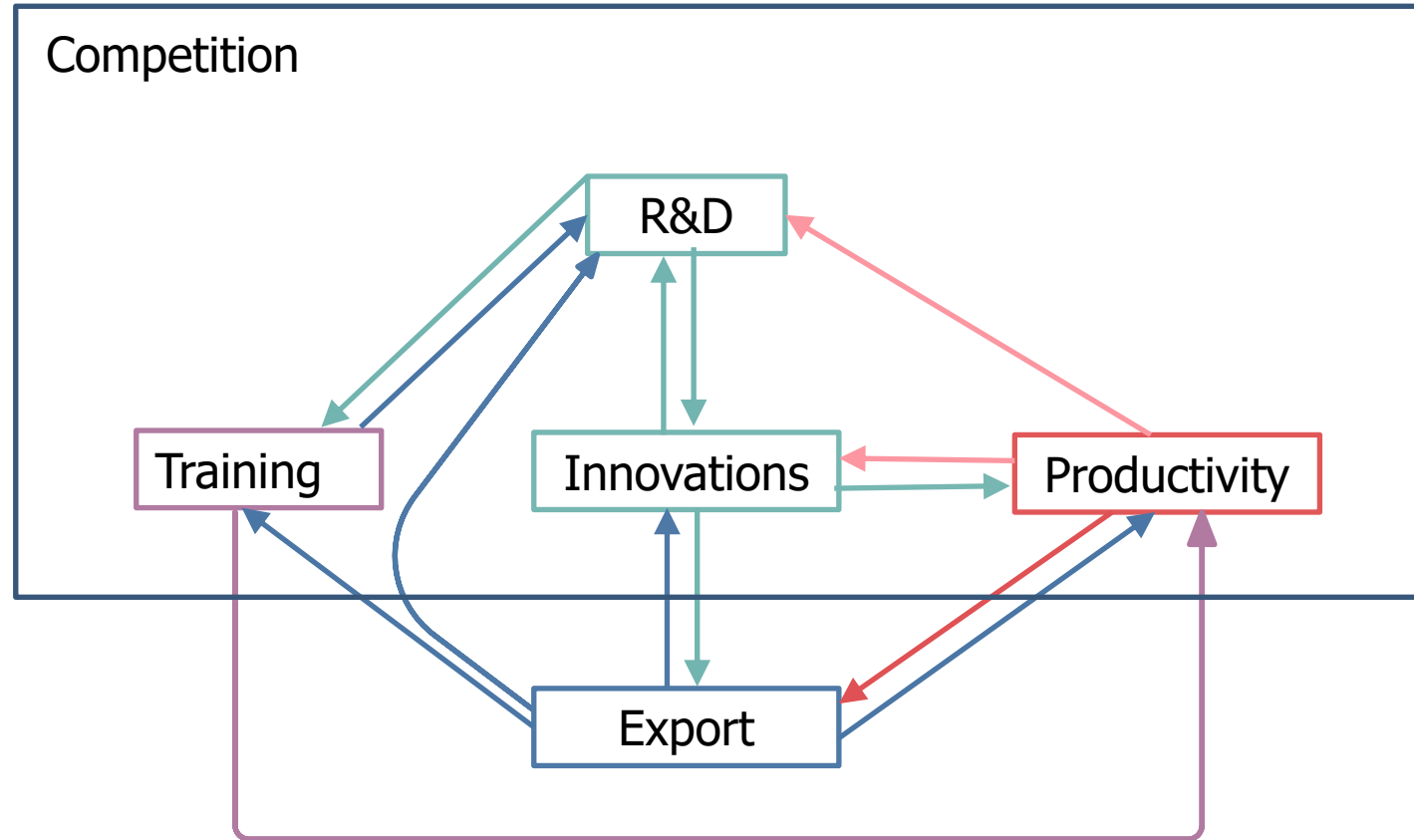
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- **Human capital and learning affects productivity**
  - Endogenous growth models: Romer 1986; Lucas 1988
  - Resource based view of the firm: Barney 1991; (Barney and Wright 1998; Ployhart et al. 2009; Ployhart et al. 2011; Chang et.al 2016; **for Russia: Fedyunina, Gerina, Averyanova, 2019**



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- (!) There is also a relationship between export, innovations and human capital and there is competition affecting all these factors

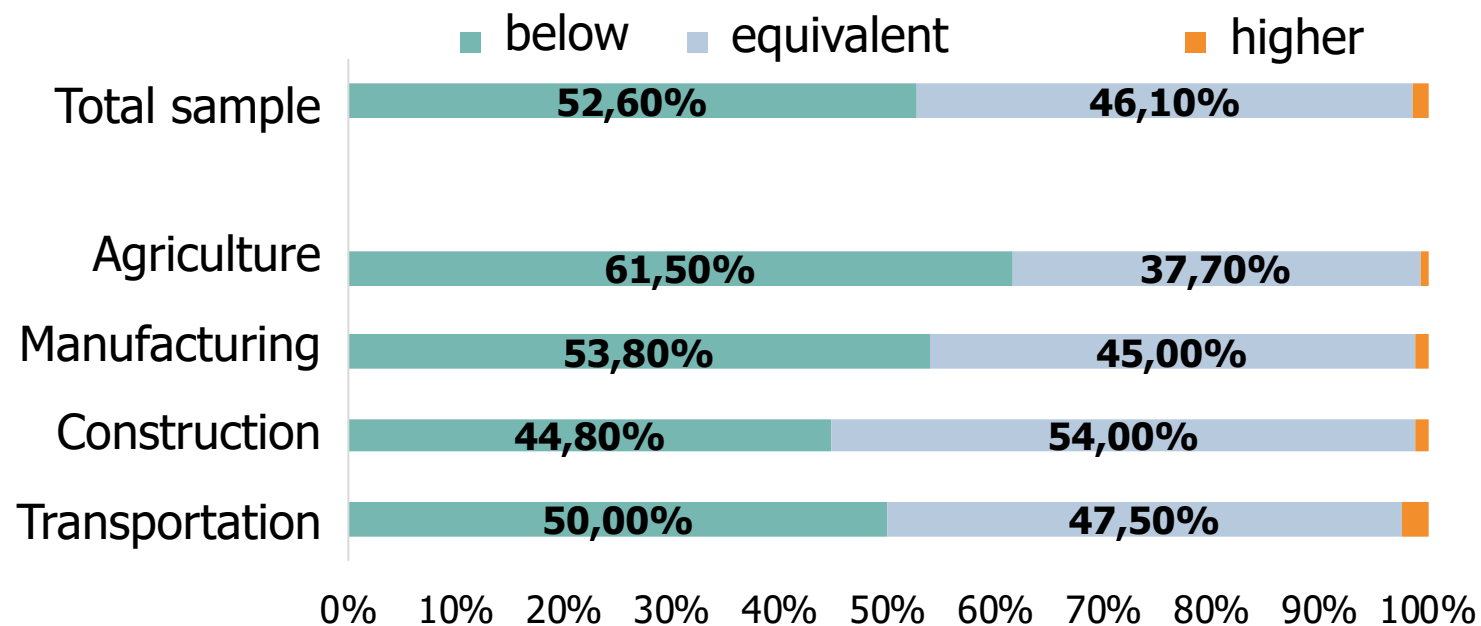
# Theoretical model based on literature survey



# Data

- Survey “Factors affecting productivity in Russian manufacturing industries” conducted by HSE in 2019
  - 4 basic non-resource industries: Agriculture, Manufacturing, Construction and Transport
  - 713 firms representative across sectors (but not across regions)
  - 4 sections in questionnaire:
    - (i) basic characteristics
    - (ii) employees and labor productivity
    - (iii) R&D, innovations and learning
    - (iv) government support

## Self-estimated productivity and foreign competitors



- On average, only 46% of Russian firms have equivalent productivity according to their own estimation
- Lag in productivity is lower for young firms, investment active firms, firms introducing digital techs, and firm working on foreign markets

# Change in productivity across sectors and basic indicators at the firm level 2013-2018

Descriptive stats for the firms that reported growth of productivity in 2013-2018:

	Agriculture	Manufacturing	Transport	Construction
Productivity per employee				
< 200K RUR				
200-400R RUR				
400-700K RUR				
700-1500K RUR				
>1500K RUR				
Revenue				
Number of employees				
Salary of employees				
R&D spending				
Export				
Investment				

>40% firms report growth  
 >30% firms report growth

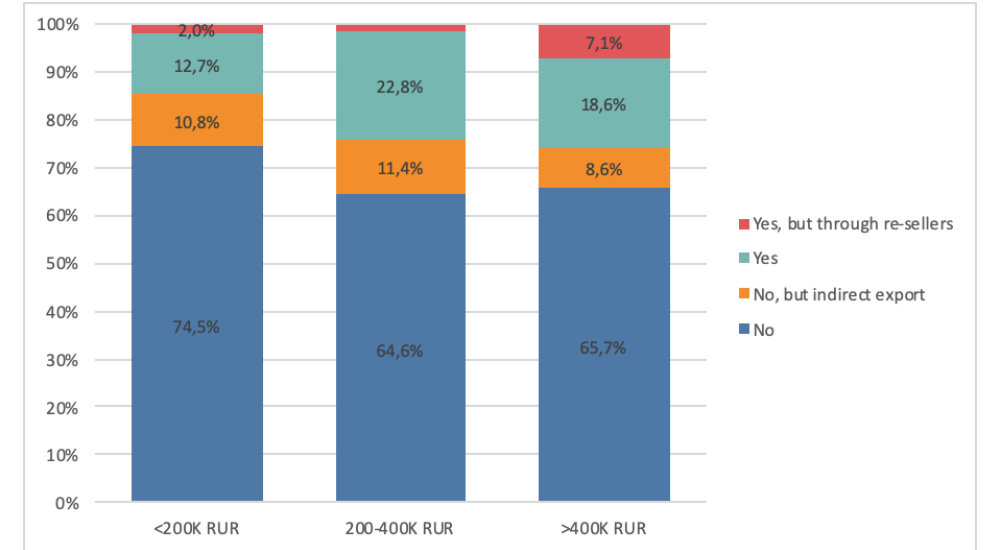
R&D-led model doesn't work  
 Export-led growth in manufacturing  
 Investment-led model in agriculture, manufacturing and transport

# Export, productivity and competitiveness

## Export and productivity in agriculture and manufacturing

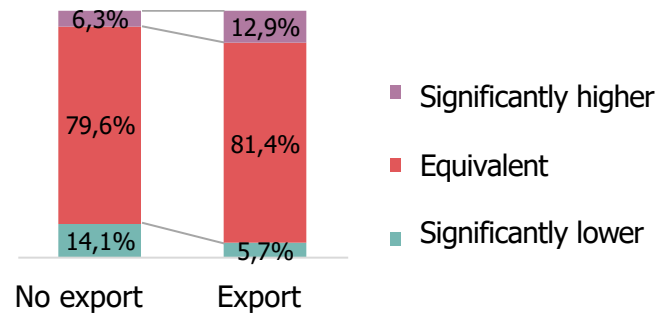


## Export and productivity in construction and transportation

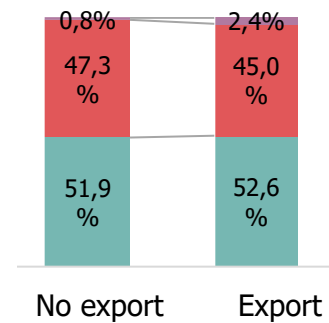


## Technological level and distance to leaders

### In comparison with Russian firms

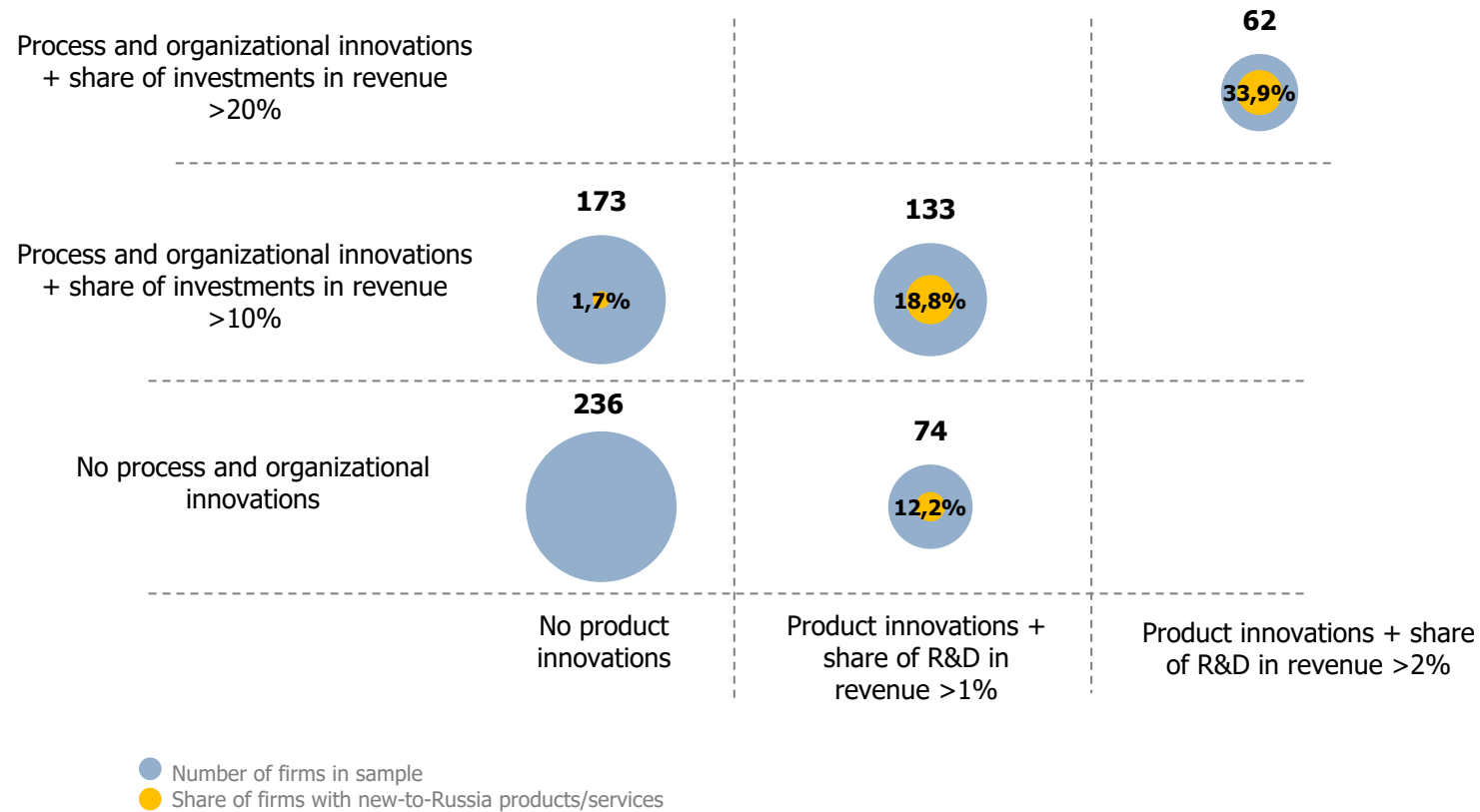


### In comparison with foreign firms



- Self-selection into exporting in manufacturing and agriculture
- Exporters report higher tech level in comparison with Russian firms, but not in comparison to foreign ones

# Catch up and new-to-market products

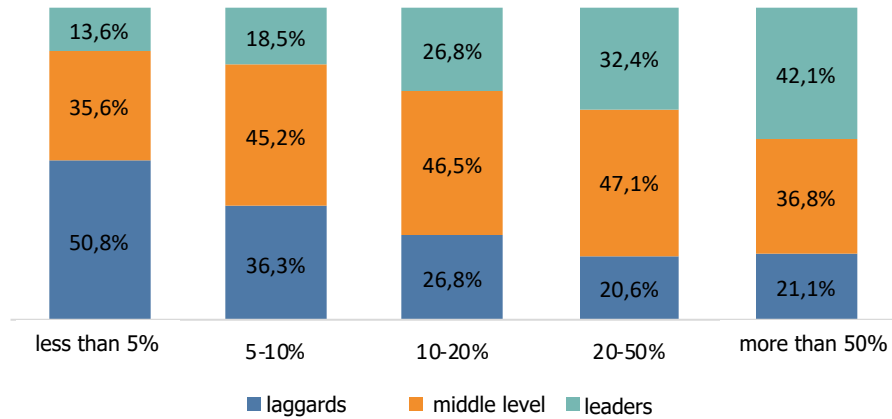


- Product, process and organizational innovations have complementary effect on the introduction of new-to-market products
- Process and organizational innovations and investments in fixed assets almost do not affect the introduction of new-to-market products

Source: Author' calculations based on survey "Factor affecting productivity in Russian firms in basic non-resource industries"

# Employee training and competitiveness

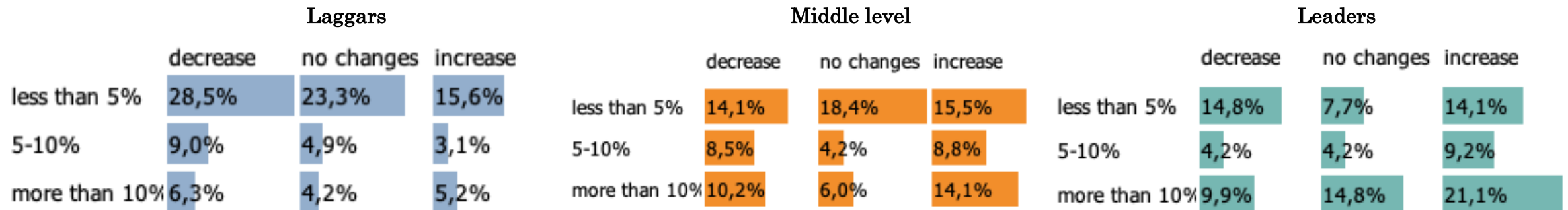
Share of employees who received training during last 5 years and firms by productivity status



There are some evidence of increasing differences in the skills level among firms:

- Laggards in productivity do not hire new employees
- Leaders in productivity hire new employees and train existing staff

Share of employees who received training during last 5 years and change in the number of employees 2013-2018





# Empirical equations

$$Productivity\ leader_i = a_1 + b_{1,1}Training_i + b_{1,2}Innovation\ Intensity_i + b_{1,3}Export\ Intensity_i + \delta_1 Competition_i + \gamma_1 X_i + g_1 Salary\ fund_i + g_2 Investments_i + g_3 Taxes_i + w_{1,1}Region_i + w_{2,1}Industry_i + \varepsilon$$

$$Training_i = a_2 + b_{2,1}R\&D_i + b_{2,2}Innovation\ Intensity_i + b_{2,3}Export\ Intensity_i + b_{2,4}Productivity\ leader_i + \delta_2 Competition_i + \gamma_2 X_i + g_4 Availability\ of\ labor_i + w_{2,1}Region_i + w_{2,2}Industry_i + \varepsilon$$

$$Innovation_i = a_3 + b_{3,1}R\&D_i + b_{3,2}Training_i + b_{3,3}Export\ Intensity_i + b_{3,4}Productivity\ leader_i + \delta_3 Competition_i + \gamma_3 X_i + g_5 Innovation\ barriers_i + w_{3,1}Region_i + w_{3,2}Industry_i + \varepsilon$$

$$R\&D_i = a_4 + b_{4,1}Innovation_i + b_{4,2}Training_i + b_{4,3}Export\ Intensity_i + b_{4,4}Productivity\ leader_i + \delta_4 Competition_i + \gamma_4 X_i + g_6 Access\ to\ technologies_i + w_{4,1}Region_i + w_{4,2}Industry_i + \varepsilon$$

$$Export_i = a_5 + b_{5,1}Innovation_i + b_{5,2}Training_i + b_{5,3}Export\ Intensity_i + b_{5,4}Productivity\ leader_i + \delta_5 Competition_i + \gamma_5 X_i + g_7 Export\ barriers_i + w_{5,1}Region_i + w_{5,2}Industry_i + \varepsilon$$

Instruments

Control variables

Competition

# Dependent variables

Productivity leader – a firm which is within top-20% of firms in industry according to productivity level

Export intensity – share of export in revenue >10%

R&D – share of R&D in revenue >1%

Innovation intensity – number of innovations introduced during the last 5 years / introduction of technological innovations / introduction of non-technological innovations

Training – more than 10% of employees in a firm received training during the last 5 years

# Methods

## We employ 3SLS procedure

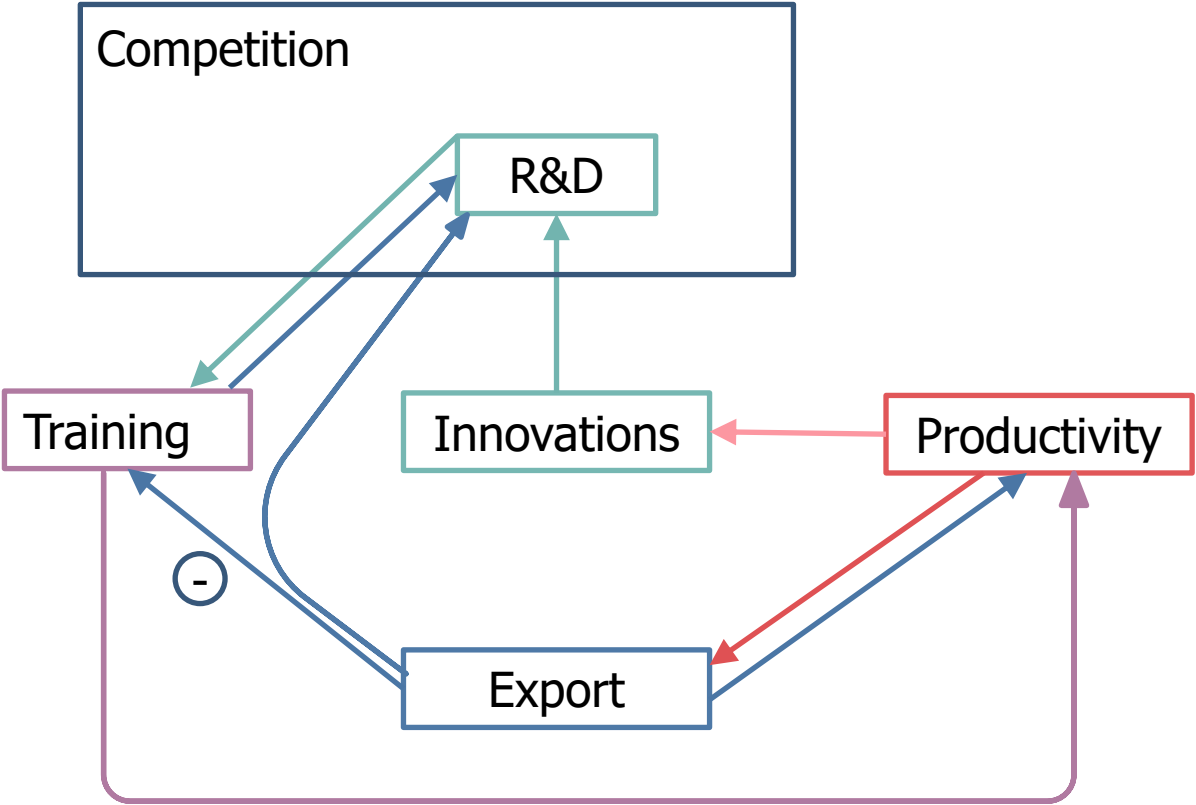
- System of equations is obviously endogenous
- Estimation technique should correct simultaneity bias
- Should be at least 2-step procedure with instrumental (strongly exogenous) variables for each equation
- dependent variables are explicitly taken to be endogenous to the system and are treated as correlated with the disturbances in the system's equations.
- Exogenous variables serve as instruments

# Empirical results (1)

	Productivity leader	Export	R&D	Innovation	Training
Productivity leader	x	***	n.s.	+	n.s.
Export (>5% in revenue)	***	x	***	n.s.	**
R&D (>10% employees)			x	n.s.	***
Innovation	n.s.	n.s.	**	x	n.s.
Training (>5% in revenue)	+		***	n.s.	x
Owner - State	+	*	n.s.	*	n.s.
Owner - Foreign	**	***	**	n.s.	+
Size (5 categories)	*	**	+	n.s.	n.s.
Age (5 categories)	n.s.	n.s.	n.s.	n.s.	***
Medium competition with Russian firms	n.s.		n.s.	n.s.	n.s.
Medium competition with foreign firms	n.s.		***	n.s.	*
Strong competition with Russian firms	n.s.		+	n.s.	n.s.
Strong competition with foreign firms	n.s.		+	n.s.	n.s.
Industry FE (4 sectors)	Yes	Yes	Yes	Yes	Yes
Region FE (23 regions)	Yes	Yes	Yes	Yes	Yes

n.s. – not significant, \* - significant at 10% level, \*\* - 5% level, \*\*\* - 1% level

# Empirical results (2)



## Empirical results (3)

- Productivity:
  - Training and exports increase productivity
- Training equation:
  - Doing R&D pushes firm to train its workers (sources for R&D?)
  - Smaller exporters are more involved into employee training (train to export more)
  - Productivity and innovations aren't significant for employee training
- R&D equation:
  - Training determines higher R&D intensity
- Innovation equation:
  - Higher productivity increases innovations (self-selection into innovations)
- Export equation:
  - Higher productivity increases export (self-selection into exports)
- Competition:
  - Competition increases R&D intensity
  - Competition decreases training (fear to lose highly educated staff?)
  - No effects on productivity and innovations

# Outcomes and Policy recommendations

- There is a divergence in productivity levels not only between, but also within industries and regions
- Within-industry divergence is driven by lack of innovations and human capital shortage in less-developed locations
- Government support is oriented towards relatively large firms, which are, in a nature, more productive themselves
- Organizational innovations and investments into fixed assets do not provide introduction of new products

⇒ Approved policy measures will further increase the divergence

- Government support should be extended to small enterprises and other sectors
- Additional measures towards productivity convergence within industries should be introduced
- Instruments should include measures promoting export activity and training programs
- Additional measures should be provided to generate positive linkages between innovation activity and productivity at the firm level