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Effects of Market Selection in the Ural Federal District: Did Sanctions Bring Any Changes?

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***Abstract*—In this research we assess the market selection effects on productivity and firm growth. Using data on more than 22 000 manufacturing firms in the Urals Federal District over the period from 2006 to 2017, we conduct aggregated labor productivity decomposition at the industry level and then proceed to estimate the expiatory power of the productivity components on revenue growth. Obtained estimates are compared between two periods – before the international sanctions on Russia and after that. Results of both approaches suggest overall weak role of market selection in the UFD for the whole observation period. We also fail to find statistically significant differences between two considered periods. We conclude that the sanctions have had mixed impact on the effectiveness of the market selection processes. While in some industries, the estimates on the strength of market selection have considerably risen; in other industries, we observe the opposite situation.**

Keywords—productivity, market selection, labor productivity, sanctions.

I. Introduction

In this research, we look at the effects on market selection on firm growth in the Urals Federal District and how they change over time. Namely, we consider two periods – before the international sanctions on Russia (2006-2013) and after that (2014-2017). Our main aim is to determine which role market selection plays with regards to aggregated productivity growth and revenue growth of separate companies.

For this, we utilize two main methods that are described in the literature on the topic: productivity decomposition and the econometric estimation of the connection between revenue growth and different productivity components.

This paper is structured in a following order. In the nest section, we provide a brief overview of existing research on the topic of market selection. In Section 3, empirical estimation is conducted and main results are discussed. Section 4 concludes the paper.

II. Literature review

Existing research on the topic of market selection forces is rather limited and has been previously mostly devoted to the developed countries. We present the analysis for the Russian regions.

For example, Bottazzi et al. have estimated effects of the productivity on the revenue growth [1]. Dosi et al., who looked at market selection forces in the USA, Germany, France, and the UK, conducted similar research [2]. In both works, authors find a weak role of market selection forces across all considered countries.

Similar research for Russia has been conducted in two recent papers: for the UFD and its regions [3] and for Russia as a whole [4]. Again, weak role of the market selection both on aggregate productivity dynamics and revenue growth is confirmed in these works.

To our knowledge, as of today, there is no extensive empirical research dedicated to the effects of economic sanctions on market selection forces.

III. Data and methods

A. Methodology

In our empirical estimations, we fully adapt methodology described in [3]. It has been previously applied to the UFD firm level data and has produced robust results. Nonetheless, previously a different dataset has been used. As in aforementioned work, we use two main methods. First, decomposition of the aggregate productivity growth is used. Namely, we are estimating two components: «within»-effect - the own productivity growth of firms; and «between»-effect – reallocation of market shares on the market. The latter component represents market selection forces. Research on these two factors is rather heterogeneous, showing that competition can exist in some industries and may be completely irrelevant to other. (see [5-8])

Second, econometric modelling is used. For each industry we construct three models: with a static productivity component as an explanatory variable; with a dynamic productivity component as an explanatory variable; and a model with both of them. That way we estimate a share of the revenue growth variance on the firm level that each component explains. For more detailed explanation of the used methods, see [3].

Next section provides an empirical estimations of the market selection forces and their effects on productivity and revenue growth.

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TABLE I. MAIN STATISTICS

	Revenue growth			Labor productivity (USD)			Size		
	Obs.	*Avg.*	*Med.*	*Obs.*	*Avg.*	*Med.*	*Obs.*	*Avg.*	*Med.*
Overall	20160	3.1%	8.8%	27270	22329.5	4292.2	27270	240	47
2006-2013	10776	1.2%	5.6%	14926	18538.9	3675.1	14926	291	58
2014-2017	9384	5.3%	15.2%	12344	26912.9	5654.5	12344	180	39

B. Data

For the empirical analysis, we use data on manufacturing firms from the Urals Federal District over the period from 2006 to 2017. Data is obtained from the database Ruslana, produced by Bureau van Dijk (BvD). We look at all industries except for the tobacco production, as it is not present in the UFD. From the data we take labor productivity measured as value added (sales minus cost of input except wages) per employee and firm sales. The labor costs were calculated following the Brynjolfsson and Hitt methodology [9]. Namely, we use industry average yearly wage, multiplied by the number of workers.

We impose several limitations on the data. First, we use consider only firms with 20 or more employees to avoid highly volatile micro firms and produce results comparable to recent research [1-2]. We also exclude firms that do not have at least two years of consecutive observations. This limitation is necessary, as we cannot produce dynamic estimates otherwise.

Since sanctions were introduced in early 2014, we divide our dataset in two segments – 2006-2013 and 2014-2017 onwards. The fist can be called pre-sanctions period and the other one is sanctions period. First period includes 52.67% of observations and the second one includes the remaining 47.33%. So both period are of a comparable size and we should not expected skewed overall results.

IV. RESULTS

In Table I, main descriptive statistics for revenue growth, labor productivity and firm size are presented for the overall dataset as well as for two aforementioned segments. First, it is worth mentioning that gap between average labor productivity and its median value is rather significant, suggesting that certain number of extremely productive firms exist on the market. We also see moderate growth of the firms, with the median value of 8.8%.

Comparing periods before and after the sanctions produces some interesting results. For both indicators (revenue growth and labor productivity) we observe considerably higher averages and medians. Namely, median revenue growth during the ‘sanction period’ is almost three times larger than before 2014. We also observe higher productivity for the period from 2014. This may suggest that sanctions brought some change to the competitive markets in the UFD.

In Table II, we present standard deviations on the industry level both for the revenue growth rates and a logarithm of the productivities (the results are averaged over years). In this case, high standard deviation indicates higher heterogeneity, implying that highly productive (or faster growing) and lagging firms can coexist in the same industry. We see that for every single industry, deviations are higher in the second period. On average, standard deviation of the revenue growth increased by 0.25 and standard deviation of the productivity grew by 0.26. This points to the fact that in the recent years firms became even more heterogeneous than before. As Okawa and Sanghi suggest, this may be a sign of a weak market selection [10].

To check the statistical significance of this change, we run the pairwise Mann-Whitney test on the following pairs for both productivity and growth standard deviations: ‘Overall’ and ‘2006-2013’, ‘Overall’ and ‘2014-2017’, ‘2006-2013’ and ‘2014-2017’. In all six cases, we find significant differences between compared vectors.

We proceed with the decomposition as described in the previous section. Table III presents the results of the decomposition of the sectorial productivity growth. With this exercise, we aim to measure the contribution of the between component – that captures the redistribution of market shares towards more productive firms – to the aggregated productivity growth. Conducting the exercise on the three different time frames we aim to see whether there was any shift in the role of the between component after the introduction of sanctions. At this step, we exclude all industries with less than 100 observations to avoid unreliable estimates, specifically, we exclude leather manufacturing, coke and petroleum manufacturing and pharmaceutical industry.

Our results suggest dominance of the «within» component for almost every industry under consideration, which in turn, highlights a weak role of the market selection (between component) in the aggregate productivity growth. This result is comparable to previous findings regarding regions of the UFD [3]. In some cases, we even observe negative «between» component, which describes a situation when employees (capturing firm market shares) are relocated to less productive firms.

Next, two periods are considered. We find that mean and median values of the «between» component were higher before 2014, suggesting that market selection forces were much stronger then. On the other hand, results for the ‘sanction period’ closely resemble overall results, with weak market selection role and a number of industries where employment shares are reallocated to less productive firms. In addition, it is the only period when there is no industry with the dominating «between» component. Such result goes in line with our previous findings regarding standard deviations, as weaker market selection allows for more heterogeneity on the market.

TABLE II. GROWTH AND PRODUCTIVITY STANDARD DEVIATIONS

NACE 2	Standard deviations					
	Overall		*2006-2013*		*2014-2017*	
	SD Growth	*SD Productivity*	*SD Growth*	*SD Productivity*	*SD Growth*	*SD Productivity*
Food products	0.67	1.56	0.53	1.41	0.80	1.69
Beverages	0.87	1.64	0.54	1.53	1.13	1.77
Textile	0.57	1.43	0.43	1.20	0.70	1.66
Wearing apparel	0.85	1.59	0.94	1.56	0.73	1.60
Leather	1.28	1.72	0.39	1.38	1.75	1.97
Wood and wooden products	0.89	1.66	0.88	1.53	0.90	1.77
Paper	0.48	1.34	0.33	1.25	0.59	1.41
Recorded media	0.84	1.47	0.67	1.32	1.03	1.63
Coke and petroleum	0.66	1.77	0.53	1.44	0.81	2.06
Chemical products	0.72	1.56	0.63	1.40	0.81	1.68
Pharmaceuticals	0.58	1.25	0.41	0.97	0.75	1.49
Rubber and plastic	0.73	1.48	0.68	1.33	0.78	1.59
Non-metallic products	0.85	1.69	0.72	1.57	0.99	1.79
Basic metal	0.93	1.88	0.85	1.80	1.03	1.97
Fabricated metal	0.79	1.57	0.68	1.44	0.88	1.65
Electronics	0.70	1.47	0.52	1.30	0.91	1.58
Electrical equipment	0.77	1.54	0.63	1.42	0.90	1.65
Machinery	0.90	1.57	0.82	1.47	1.00	1.69
Motor vehicles	0.86	1.44	0.83	1.31	0.88	1.57
Transport equipment	0.67	1.56	0.58	1.29	0.76	1.80
Furniture	0.97	1.69	0.81	1.48	1.08	1.84
Other manufacturing	0.64	1.49	0.57	1.32	0.71	1.66
Mean	**0.78**	**1.56**	**0.64**	**1.40**	**0.91**	**1.70**
Median	**0.78**	**1.56**	**0.63**	**1.41**	**0.88**	**1.67**

To statistically confirm that the significant change in power of market selection did take place, we, again, utilize the pairwise Mann-Whitney test. We run the test on the «between» component values for all three periods mentioned above. However, in this case, we find no statistical difference between the values for all the periods. Namely, we get the following p-values: 'Overall' vs. '2006-2013' – 0.275; 'Overall' vs. '2014-2017' – 0.312; '2006-2013' vs. '2014-2017' – 0.241. Therefore, even though we do find differences in the components' estimates before and after sanctions were introduced, one cannot conclude that they have led to clearly rising of falling role of market selection. In other words, while some industries experienced an increase in the between component (e.g., beverages, non-metallic products, motor vehicles), other industries experienced a decline in the strength market selection (e.g. textile and wearing, paper, chemical products and other manufacturing).

Next, we continue with the econometric estimation as described in a previous section In Table 4 results of the regression analysis on the productivity-growth relation are summarized. Explained variances are given in the following order for each of the periods: static component, dynamic component, overall explained variance.

We observe that over all industries during all three periods dynamic component of the productivity explains higher share of the growth variance. Same is observed in almost every particular industry, except for furniture manufacturing during pre-sanctions period. With that being said, median value of the static component explanatory power is around 1%, while results for dynamic component are close to the overall explained variance. Such estimates are close to the one obtained for the UFD regions, Russia overall [4] and for the foreign economies [2] indicating that it is mainly the recent changes in the productivity and not their levels explaining variation in firm sales.

Overall median explained variance 17% for the whole observation period, 19% for the pre-sanctions period and 18% for 2014 and onwards. To confirm that there are no statistically significant differences, we again run the pairwise Mann-Whitney test. Results of the test suggest that there are no systematic differences in either of three pairs, i.e. the explanatory power of the model was not systematically growing or shrinking over the industries after sanctions were introduced, compared to the pre-sanctions period. We can also conclude that the power of market selection in explaining the revenue growth is consistently low.

TABLE III. AGREGATE PRODUCTIVITY DECOMPOSITION

NACE 2	Productivity growth decomposition					
	Overall		*2006-2013*		*2014-2017*	
	«Within» component	*«Between» component*	*«Within» component*	*«Between» component*	*«Within» component*	*«Between» component*
Food products	0.82	0.18	0.60	0.40	0.90	0.10
Beverages	-1.83	2.83	0.79	0.21	-3.90	4.90
Textile	1.43	-0.43	0.87	0.13	1.51	-0.51
Wearing apparel	1.63	-0.63	0.74	0.26	1.23	-0.23
Leather	-	-	-	-	-	-
Wood and wooden products	1.35	-0.35	-1.35	2.35	1.23	-0.23
Paper	2.14	-1.14	-0.33	1.33	2.44	-1.44
Recorded media	1.08	-0.08	1.52	-0.52	1.12	-0.12
Coke and petroleum	-	-	-	-	-	-
Chemical products	2.10	-1.10	1.29	-0.29	3.45	-2.45
Pharmaceuticals	-	-	-	-	-	-

NACE 2	Productivity growth decomposition					
	Overall		*2006-2013*		*2014-2017*	
	«Within» component	*«Between» component*	*«Within» component*	*«Between» component*	*«Within» component*	*«Between» component*
Rubber and plastic	0.62	0.38	0.68	0.32	0.61	0.39
Non-metallic products	0.62	0.38	0.84	0.16	0.52	0.48
Basic metal	0.89	0.11	0.77	0.23	0.90	0.10
Fabricated metal	0.93	0.07	0.89	0.11	0.97	0.03
Electronics	1.03	-0.03	0.74	0.26	1.08	-0.08
Electrical equipment	0.88	0.12	0.26	0.74	0.95	0.05
Machinery	0.41	0.59	0.20	0.80	0.49	0.51
Motor vehicles	0.49	0.51	2.02	-1.02	0.90	0.10
Transport equipment	0.94	0.06	2.18	-1.18	0.91	0.09
Furniture	0.75	0.25	0.53	0.47	0.74	0.26
Other manufacturing	1.44	-0.44	1.04	-0.04	1.54	-0.54
Mean	**0.93**	**0.07**	**0.75**	**0.25**	**0.93**	**0.07**
Median	**0.93**	**0.07**	**0.77**	**0.23**	**0.95**	**0.05**

V. CONCLUSIONS

In this research, we have looked at competition and productivity dynamics in the Urals Federal District. We have also considered how introduction of trade sanctions on Russia in 2014 has affected these factors and their relation. We find several novel results that contribute to the research on market selection forces and effects of sanctions.

First, we observe high heterogeneity in the UFD industries, especially after the onset of sanctions. Therefore, there are extremely different firms coexist on the same markets, both in terms of revenue growth and in terms of productivity. This may be a good hint at a low power of a market selection.

Second, in line with our earlier findings in [3], decomposition of the aggregate productivity suggests predominance of the firm level of the productivity growth over market shares reallocation. What is new is that after sanctions have been imposed, the role of the «within» component even became stronger (on average and median) . Although if we test per industry the role of sanctions on the magnitude of the between component, the results are mixed not showing a significant univocal increase or decrease of the effect.

In the last step of the empirical research, we confirm that role of the market selection is weak for all industries in the UFD for the whole period of observation. Again, we fail to find a clear rise or fall in the explanatory power of the productivity-growth relationship after the sanctions have been introduced.

As an overall conclusion, we can say that sanctions have had mixed impact on the effectiveness of the market selection processes in the Urals Federal District. Thus, while in some industries, the estimates on the strength of market selection have considerably risen, in other industries we observe the opposite situation.

Core limitation of this research is connected to the fact that industrial classification is not a perfect tool for defining the markets on which final goods compete. For example, a wooden table and a bed do not directly compete, even though both goods are produced in a furniture sector. At the same time, goods from different industries can be close competitors, for example, leather can be a viable alternative to textile, when manufacturing car interior.

TABLE IV. PRODUCTIVITY-GROWTH RELATION. EXPLAINED VARIENCE

NACE 2	Productivity-growth relation								
	Overall			*2006-2013*			*2014-2017*		
	$S^2_{\overline{\pi_{i,t}}}$	$S^2_{\Delta\pi_{i,t}}$	S^2	$S^2_{\overline{\pi_{i,t}}}$	$S^2_{\Delta\pi_{i,t}}$	S^2	$S^2_{\overline{\pi_{i,t}}}$	$S^2_{\Delta\pi_{i,t}}$	S^2
Food products	0.03	0.07	0.10	0.03	0.06	0.09	0.00	0.11	0.11
Beverages	0.03	0.25	0.28	0.04	0.16	0.20	0.04	0.34	0.38
Textile	0.05	0.13	0.18	0.02	0.28	0.29	0.01	0.11	0.12
Wearing apparel	0.01	0.13	0.14	0.05	0.22	0.28	0.00	0.17	0.17
Leather	0.06	0.15	0.21	0.10	0.10	0.20	0.11	0.38	0.49
Wood and wooden products	0.04	0.11	0.15	0.12	0.15	0.27	0.01	0.10	0.11
Paper	0.00	0.04	0.04	0.00	0.02	0.02	0.01	0.12	0.13
Recorded media	0.00	0.07	0.07	0.01	0.07	0.08	0.00	0.07	0.07
Coke and petroleum	0.01	0.17	0.17	0.04	0.23	0.27	0.03	0.19	0.22
Chemical products	0.00	0.06	0.06	0.00	0.07	0.07	0.02	0.08	0.10
Pharmaceuticals	0.01	0.21	0.22	0.00	0.18	0.18	0.01	0.27	0.28
Rubber and plastic	0.00	0.13	0.13	0.01	0.07	0.08	0.01	0.20	0.21
Non-metallic products	0.01	0.12	0.13	0.00	0.11	0.11	0.01	0.15	0.16
Basic metal	0.00	0.17	0.17	0.00	0.08	0.09	0.03	0.31	0.34
Fabricated metal	0.00	0.12	0.12	0.01	0.09	0.10	0.00	0.16	0.16
Electronics	0.02	0.22	0.23	0.02	0.22	0.25	0.01	0.32	0.33
Electrical equipment	0.01	0.18	0.19	0.00	0.17	0.17	0.02	0.22	0.24
Machinery	0.00	0.17	0.17	0.00	0.22	0.22	0.01	0.14	0.15
Motor vehicles	0.00	0.16	0.16	0.01	0.21	0.22	0.00	0.09	0.09
Transport equipment	0.01	0.16	0.17	0.00	0.21	0.21	0.00	0.20	0.20
Furniture	0.08	0.06	0.14	0.22	0.08	0.30	0.01	0.20	0.21

NACE 2	Productivity-growth relation								
	Overall			*2006-2013*			*2014-2017*		
	$S^2_{\overline{\pi_{i,t}}}$	$S^2_{\Delta\pi_{i,t}}$	S^2	$S^2_{\overline{\pi_{i,t}}}$	$S^2_{\Delta\pi_{i,t}}$	S^2	$S^2_{\overline{\pi_{i,t}}}$	$S^2_{\Delta\pi_{i,t}}$	S^2
Other manufacturing	0.08	0.11	0.19	0.05	0.04	0.09	0.05	0.18	0.23
Mean	**0.02**	**0.14**	**0.16**	**0.03**	**0.14**	**0.17**	**0.02**	**0.19**	**0.21**
Median	**0.01**	**0.13**	**0.17**	**0.01**	**0.13**	**0.19**	**0.01**	**0.17**	**0.18**

As a prospect for further research, we want to look at the effects on the sanctions on the country level as well as consider the effects for the firms of different size.

REFERENCES

[1] G. Bottazzi, G. Dosi, N. Jacoby, A. Secchi and F. Tamagni, "Corporate performances and market selection: Some comparative evidence," Industrial and Corporate Change, Vol. 19, pp. 1953–1996, 2010.

[2] G. Dosi, D. Moschella, E. Pugliese and F. Tamagni, "Productivity, market selection, and corporate growth: comparative evidence across US and Europe," Small Business Economics, Vol. 45, pp. 643–672, 2015.

[3] I. Savin, O. Mariev and A. Pushkarev, "Survival of the Fittest? Measuring the Strength of Market Selection on the Example of the Urals Federal District," Ekonomicheskij zhurnal Vysshej Shkoly Ekonomiki (HSE Economic Journal), Vol. 23, No. 1, pp. 90–117, 2019. (in russ.)

[4] I. Savin, O. Mariev and A. Pushkarev, "Measuring the strength of market selection in Russia: When the (firm) size matters," Voprosy Ekonomiki (Question of economy), 2019. (in russ.)

[5] M.N. Baily, C. Hulten and D. Campbell, "Productivity dynamics in manufacturing plants," Brookings Papers on Economic Activity. Microeconomics, pp. 187-267, 1992.

[6] Z. Griliches and H. Regev, "Firm productivity in Israeli industry 1979–1988," Journal of Econometrics, Vol. 65, pp. 175–203, 1995.

[7] J.R. Baldwin and W. Gu, "Plant turnover and productivity growth in Canadian manufacturing," Industrial and Corporate Change, Vol. 15, pp. 417–465, 2016.

[8] L. Foster, J. Haltiwanger and C.J. Krizan, "New Developments in Productivity Analysis," Chicago: University of Chicago Press, chap. Aggregate Productivity Growth: Lessons from Microeconomic Evidence, pp. 303–372, 2001.

[9] E. Brynjolfsson and L.M. Hitt, "Computing productivity: Firm-level evidence," Review of Economics and Statistics, Vol. 85, pp. 793–808, 2003.

[10] Y. Okawa and A. Sanghi, Potential Growth: Outlook and Options for the Russian Federation (Policy Research working paper, No. WPS 8663). Documents & Reports. http://documents.worldbank.org/curated/en/437251543855591590/Potential-Growth-Outlook-and-Options-for-the-Russian-Federation