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Russian Volatility

Obstacle to Firm Survival and Diversification

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Abstract

The need for economic diversification receives a great deal of attention in Russia. This paper looks at a way to improve it that is essential but largely ignored: how to help diversifying firms better survive economic cycles. By definition, economic diversification means doing new things in new sectors and/or in new markets. The fate of emerging firms, therefore, should be of great concern to policy makers. This paper indicates that the ups and downs—the volatility—of Russian economic growth are key to that fate. Volatility of growth is higher in Russia than in comparable economies because its slumps are both longer and deeper. They go beyond the cleansing effects of eliminating the least efficient firms; relatively efficient ones get swept away as well. In fact, an incumbency advantage improves a firm's chances of weathering the ups and downs of the economy, regardless of a firm's relative efficiency. Finally, firms in sectors where competition is less intense are less likely to exit the market, regardless of their relative efficiency. Two policy conclusions emerge from these findings—one macroeconomic and one microeconomic. First, the importance of countercyclical policies is heightened to include efficiency elements. Second, strengthening competition and other factors that support the survival of new, emerging and efficient firms will promote economic diversification. Efforts to help small and medium enterprises may be better spent on removing the obstacles that young, infant firms face as they attempt to enter, survive and grow.

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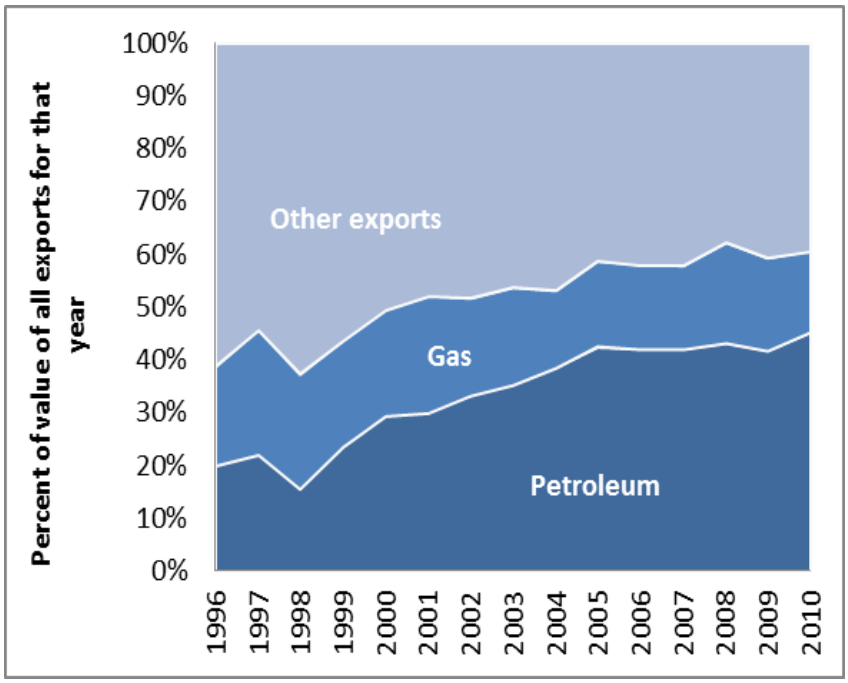
INTRODUCTION

Russia is much less diversified today than it was during the Soviet Era (EBRD, 2012).[1] Post-2000 economic growth in Russia has been reliant on natural resources, especially hydrocarbons, and this is a trend that is likely to persist. Exports data tell the same story: Figure 1 highlights the increasing reliance on natural gas and petroleum exports. The oil and gas sector has experienced double-digit annual export growth in the last decade and has accounted for nearly 69 percent of the value of Russia's exports in 2010. Such strength originating from so few sectors may already be a risk in the economy.

Figure 1: Petroleum and gas increasingly dominate Russia's exports



Source United Nations, Comtrade, retrieved June 12, 2012

The export story is repeated for the rest of the economy as a whole; namely, while there is growth in the Russian economy, there are concerns that this growth has been limited to a few sectors. The economy does not appear to be diversifying as expected under these favorable economic conditions. What could be the causes of this lack of diversification?

This study looks at the role of growth volatility as a possible explanation. It examines the role of surges and slumps in manufacturing output and its microeconomic implications in the dynamics of emergence and sustainability of nascent economic activities. The dynamics and emergence industrial output of the economy as whole, between 1993 and 2009, are the economic activities of focus in this study.

The volatility in Russian economic output, which is the focus in this study, goes beyond the ups and downs of regular business cycles.[2] It examines the downturns that magnify and accelerate the cleansing effects to the economy in forcing inefficient firms to exit and the upturns that set the foundation economic diversification by giving new economic activities the opportunity to emerge.

[1] http://www.ebrd.com/downloads/research/economics/publications/specials/diversifying-russia.pdf

[2] Nickell, S., D. Nicolitsas and M. Patterson (2001) "Does doing badly encourage management Innovation?", Oxford Bulletin of Economics and Statistics, Department of Economics, University of Oxford, vol. 63(1), pages 5-28, February.

Finding evidence that businesses are created in times of economic expansion is important because much of the policy debate about diversification is based on the assertion that few emerge. As the argument goes, Russia does not seem to produce much beyond what it has produced in the recent past. This claim is used to support direct intervention to help new economic activities emerge. But one of this study's hypotheses is that emergence may not be the problem, rather that sustainability is what is lacking in the Russian economy. Therefore, addressing sustainability may be the central economic issue for diversification: it means making sure that efficient firms that emerge in booms survive downturns. Thus, reducing volatility in economic output is a good way to improve their chances of survival.

LITERATURE

Interest in growth and volatility largely began with macroeconomic studies on booms and busts and the divergence of long-term economic growth between low- and high-income countries. These studies showed that the "peaks-and-valleys" unsustained growth and volatility, characterize low-performing, poorer countries. Poorer economies tend to have high variances in growth rates across time. In comparison, better economic performers are less volatile and are characterized by "peaks and plateaus"—no valleys (Pritchett, 2000).[3] The current study extends this look at booms and busts, or surges and slumps as they are referred to here, to understand the effects of these on industry and firm-level dynamics.

This study is also closely related to the emerging literature on the links between volatility and economic structure. This new literature points to a reverse causality between a relative lack of diversification and economic volatility. Koren and Tenreyro (2007)[4] decompose volatility into three components: sector-specific shocks, country shocks and covariance between the two to show that less developed countries experience greater growth volatility due to increased concentration in volatile sectors. Moore and Walkes (2010),[5] show that less diversified economies have higher rates of output, investment and consumption growth volatility.

This study explores volatility to question the sustainability of Russian economic growth and whether this type of growth can generate economic diversification. While volatility may hinder economic diversification, at the same time, a lack of diversification characterized by increasing concentration of economic output into a few sectors and/or a few firms may increase the chances of more volatility of this economic output. Breaking this cycle may require concerted effort, maybe from policymakers, but it first needs to be identified, confirmed and then better understood. This study makes progress on identification and understanding.

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[3] Pritchett, Lant (2000) "Understanding patterns of economic growth: Searching for hills among plateaus, mountains, and plains", *World Bank Economic Review,* 221–50.

[4] Koren, Miklós, and Silvana Tenreyro. "Volatility and development*." *Quarterly Journal of Economics* 122.1 (2007): 243-87. Print.

[5] Moore, Winston, and Carlon Walkes. "Does industrial concentration impact on the relationship between policies and volatility?" *International Review of Applied Economics* 24.2 (2010): 179-202. Print.

COMPARATIVE ANALYSIS OF CONCENTRATION OF RUSSIAN INDUSTRIAL PRODUCTION AND POTENTIAL CONSEQUENCES

There are high levels of concentration of output in a few manufacturing sector in Russia.[6] The bottom quartile of sectors, ranked in order of their size in terms of operating revenue, contribute 0.6 percent of the total manufacturing output in Russia. In comparison, the top quartile contributes 80 percent (Refer to Table A11 a in Annex for a yearly breakdown). The levels of concentration of output within sector (between firms) in Russia is even more noteworthy. The average share of output for the bottom quartile of firms (in terms of operating revenue) in a manufacturing sector[7] is 0.06 percent. The share of the top quartile is 94.7 percent.[8]

These relatively high levels of output concentrated in either a few sectors or in a handful of firms may lead to more volatile economic growth. High economic concentration makes an economy vulnerable and sensitive to the fate of fewer economic events such as changes in the price of the most prevalent commodity sold or goods produced. For example, some highly concentrated economies expand and contract in response to rises and dips in the price of the output that dominates total national economic output. In addition, these types of economies are more likely to produce spillover volatility from dominant fluctuating sectors to other sectors that are not directly affected by external events. Evidence shown here supports this characterization of growth volatility in Russia.

In turn, volatility may exacerbate the concentration of economic output. This study also suggests that volatility in growth may increase the likelihood of (premature) exit of new, emerging firms. This means that the structural change that new, emerging firms bring is stunted by high levels of economic volatility. As a result, the economy can experiences a vicious cycle of comparatively higher "premature death" of new firms due to economic volatility and increased volatility driven by an economic structure that remains undiversified or even more concentrated as a result of the high exit rate of new firms.

The reinforcing dynamics between volatility and concentration of output is also a possible explaniation of Russia's relatively larger manufacturing firms. As the four graphs above indicate, the average size of Russian manufacturing firms, whether measured by annual operating revenue or by the size of their labor force, is larger than the average size of manufacturing firms in the rest of world or in Russia's closest neighboring economies (Europe and Central Asia[9]).[10] A relatively

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[6] The characteristics of the dataset used for the descriptive statistics presented here are further explained in the Annex.

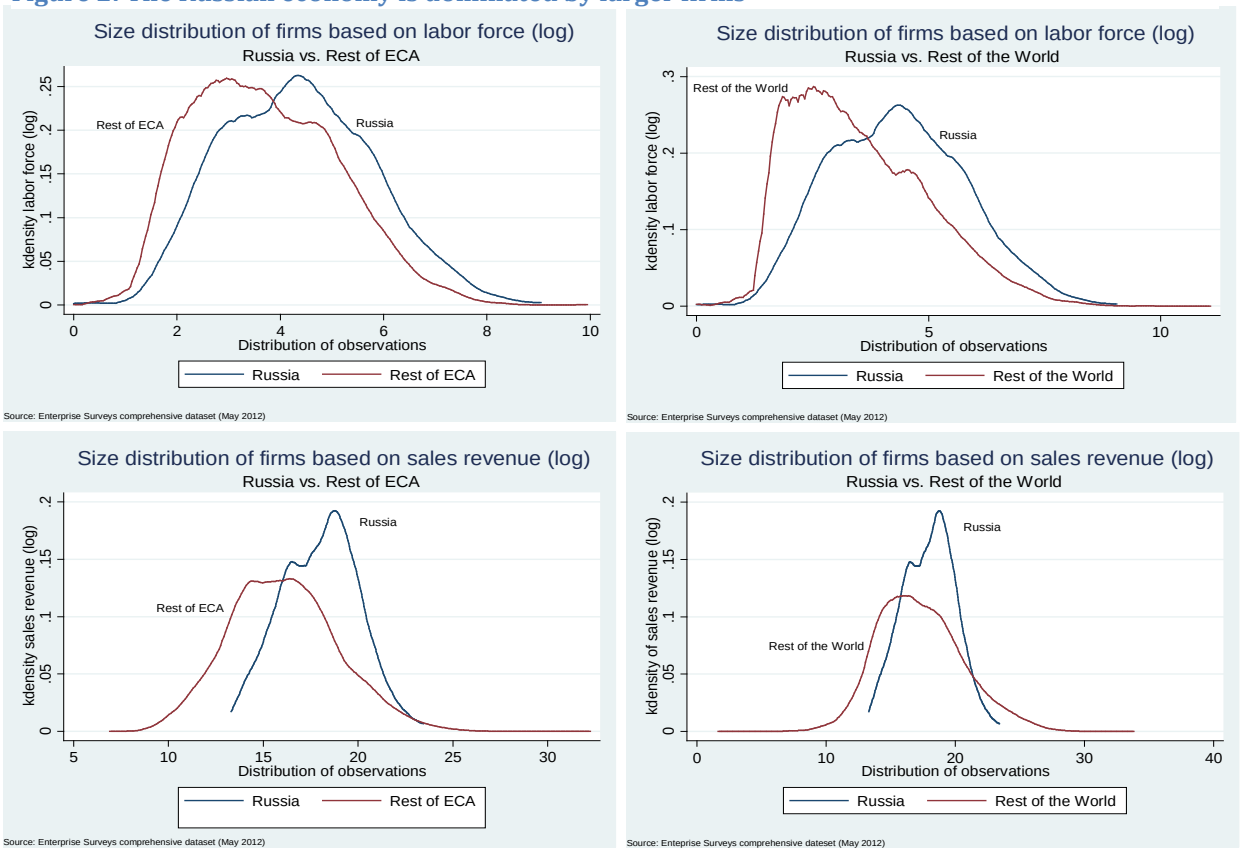
[7] When referring to sectors, these are defined by 4-digit NACE 1.1. The higher the digit, the more disaggregated the sector data will be.

[8] See Table A12 of the Annex.

[9] The 28 economies included in the Europe and Central Asia (ECA) region are (in alphabetical order): Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kosovo, Kyrgyz Republic, Latvia, Lithuania, Macedonia, Moldova, Montenegro, Poland, Romania, Serbia, Slovak Republic, Slovenia, Tajikistan, Turkey, Ukraine, Uzbekistan. Turkmenistan is not included.

high mortality rate of young Russian firms likely explains the size distribution since this eliminates smaller firms from the average size estimation (the left-hand side tail of the distribution). Young firms tend to be small. that younger and smaller manufacturing firms tend to have a high mortality rate (not unusual in any economy) irrespective of their level of efficiency (a relatively less common finding) which is a cause of concern. In addition, as discussed later in more detail, this relatively high mortality rate is associated with the deep and long downturns that characterize some cycles in the short history of the modern Russian economy.

Figure 2: The Russian economy is dominated by larger firms

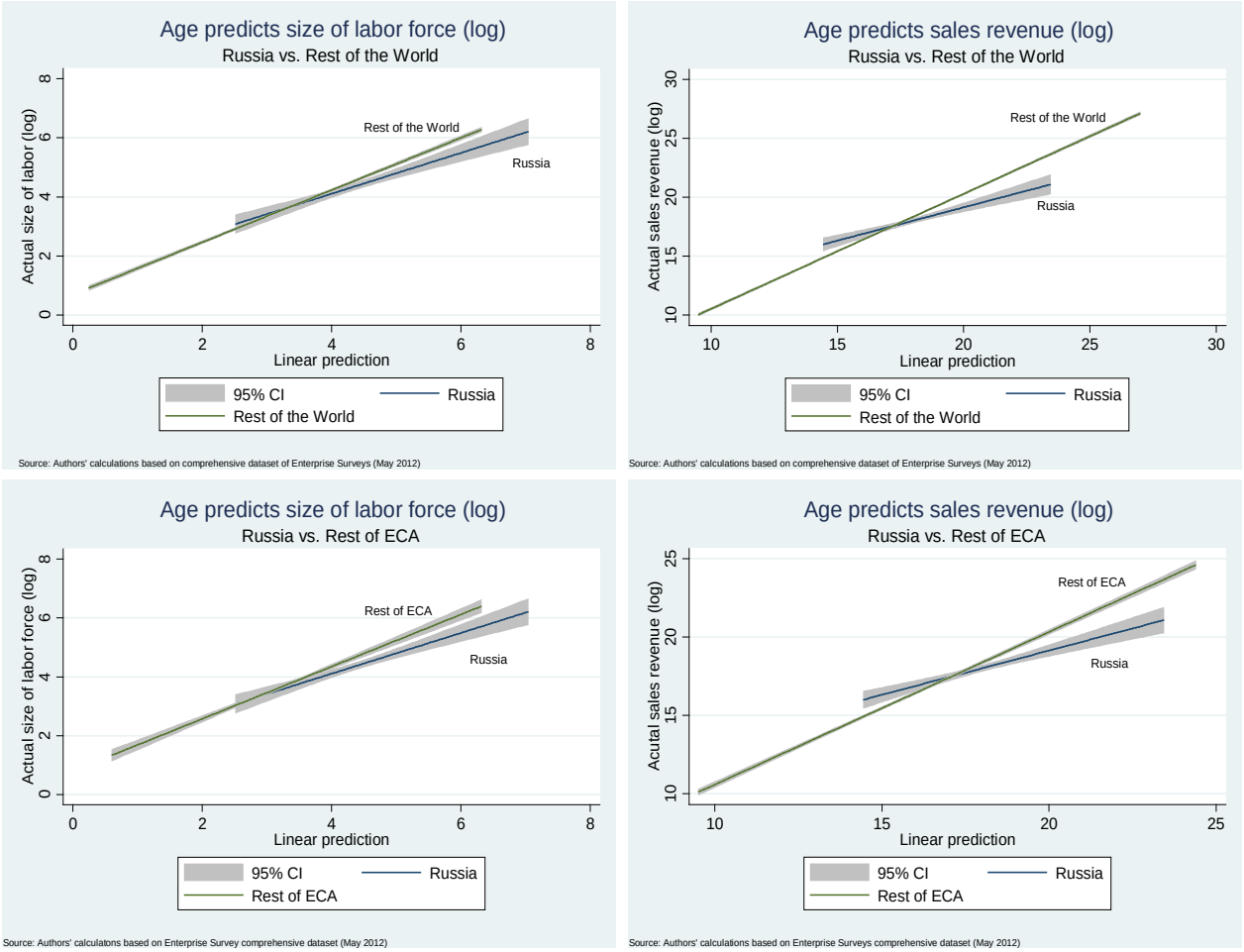


Of equal concern is the indication that the right-hand side of the size distribution of manufacturing firms in Russia may also be shorter than that of other economies. In other words, the biggest firms do not grow to be as big in Russia as in other parts of the world. Examining Figure 2 (above) once again, the reader can see that the right-hand side tail of the distribution is also shorter for Russia than in other economies. This finding calls into question whether even efficient firms get the resources they require to grow in the Russian economy. In well-functioning economies, markets efficiently allocate resources to the most productive firms irrespective of their size and age (Hsieh

[10] The data are taken from the World Bank's Enterprise Surveys on May 2012. For each country, only the latest survey is used. This size comparison controls for differences in the composition of manufacturing sectors across these economies.

and Klenow 2009).[11] This implies that holding for all other explanatory factors (location, sector and economic activity, for example), firms of the same age, across different economies should employ a similar number of people and make about the same sales revenue if economies are all equally efficient in allocating resources to the most productive firms. If some economies are not allocating the resources that firms need to grow, in economic terminology, they exhibit allocative inefficiencies.

Figure 3: Older firms in Russia employ fewer workers and earn less sales revenue than similar firms in other economies



One way to determine the relative allocative efficiency of economies is to compare firm-size and age data across economies. As firms get older and grow, they employ more workers and increase their sales revenue. For that reason, there should be a positive relation between firm size and age and this relation should demonstrate a statistical regularity across economies. Figure 3 depicts this relationship between firm size and age for Russia and other comparator economies. The size of the

[11] Hsieh, Chaing-Tai, and Peter J. Klenow "Misallocation and manufacturing TFP in China and India." The Quarterly Journal of Economics:124.4 (2009): 1404-447. Print.

manufacturing firm is measured either by annual sales revenue or number of employees. Indeed, the space between the two, near forty-five degree lines in Figure 3 indicate that firm growth is relatively stunted in Russia compared to other economies. If all firms grew in size at about the same rate in Russia as in other economies, the lines in this figure would be on top of each other and indistinguishable one from the other. They are not; the size-age line trajectories cross and separate at a certain point. The Russian trajectory falls below that of comparator economies. Moreover, the figure indicates that the differences in trajectory are statistically significant to a 95-percent confidence interval. The grey shading around these lines depicts that band of confidence. Where these grey bands do not cross, the reader can conclude that the estimates are statistically significantly different from each other. After a certain age, the size of firms in Russia slows. Based on these data, Russia is seems relatively less allocatively efficient than many of the economies to which it was compared.

At this point, findings on the relatively lower levels of allocative efficiency in the Russian economy are indicative, not conclusive, but nonetheless important. They point to an additional factor that may hamper growth and diversification of the economy. Specifically, the staying power of inefficient firms, stunted in growth, but that do not exit the market may be a problem. In relation to how they affect the entrance of new firms, these stunted firms that stay put hold on to productive resources (labor and finance) that newer, possibly more productive firms in emerging sectors could make use of to survive and grow. The staying power of these stunted firms also calls into question how fierce competition may be since the forces of economic rivalry do not seem to be enough to escort them to the exits. Research is just starting to provide support for the relationship between allocative efficiency, firm entry and competition in other economies.

COMPARATIVE ANALYSIS OF RUSSIAN ECONOMIC VOLATILITY AND FIRM SURVIVAL

VOLATILITY OF RUSSIA'S SECTOR-LEVEL OUTPUT RELATIVE TO OTHER ECONOMIES

The first question to answer is whether Russia's economy is more volatile than others. The study does this by comparing year to year changes in sector-level[12] economic output of the Russian economy, between 1993 and 2009, to that of other economies.[13] To determine if the Russian

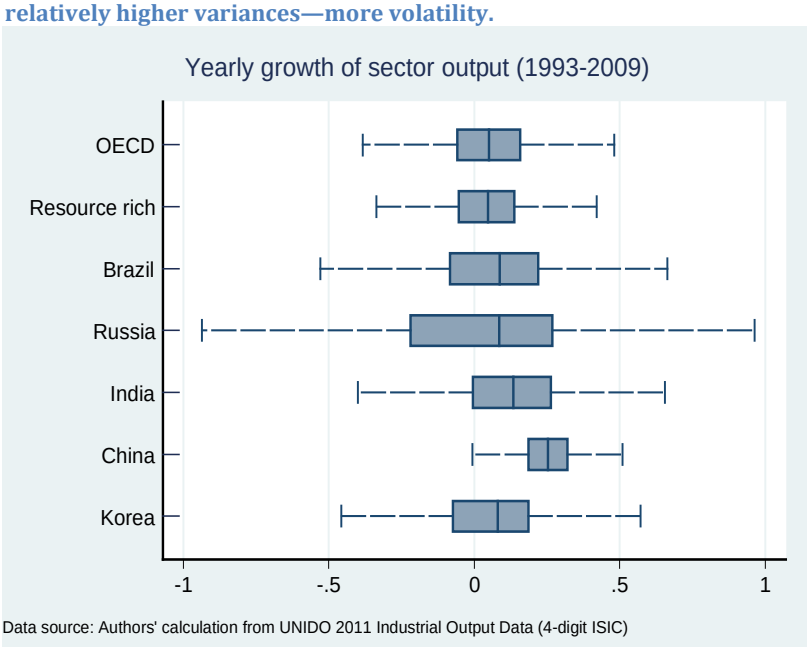
[12] For the sector analysis, a shortened panel that included the period between 1993 and 2009 was used. UNIDO data for Russia start in 1994. In addition, outlier observations – identified as output growth outside 3 standard deviations above or below the mean growth rate for each sector in each country – were removed. Doing this resulted in dropping about 45 percent of the observations in the dataset (Refer to Table 23 Annex for a detailed breakdown of the dataset pre and post sample selection).

[13] For the sector-level comparative analysis across economies, the following groups of economies and countries are considered: Brazil, India and China, which along with Russia comprise country grouping called BRICs; Australia, Canada, Chile, and New Zealand are high growth countries that like Russia have an abundance of natural resources but, unlike Russia, have largely diversified economies and these are grouped together under Resource Rich Countries; and finally Korea and the set of economies grouped under the Organization of Economic Cooperation and Development (OECD) are compared to Russia because of their relatively long periods of steady and positive growth that serves as reference of long-term economic performance. Of course, there are overlaps between these groups and some of these economies. For example, Australia, Canada, Chile, Korea and New Zealand are all members of the OECD.

economy is relatively more volatile than other economies, the variance of the average sector-level growth rate across several years is the statistic of import—a high variance means high volatility.

A box and whisker plot (Figure 4) is a graphical depiction that allows the reader to visually determine whether the average annual industrial growth at the sector level in Russia indicates higher variances across time than that of other economies. The vertical line inside the grey box represents the median growth for each country between 1993 and 2009. The right and left boundaries of the grey rectangles represent the middle half of the data; they define the 25thpercentile to the 75th percentile of annual rate of sector-level industrial output growth per economy or group of economies. The lines or whiskers, outside of these boxes, delineate the most extreme values.[14]

Figure 4: The annual growth in output of Russian sectors exhibit relatively higher variances—more volatility.



Data source: Authors' calculation from UNIDO 2011 Industrial Output Data (4-digit ISIC)

As can be verified, both the grey rectangles and the whiskers in the figure are markedly more extended for Russia than any other comparator. This means that the variance of average annual industrial growth in Russia is statistically larger than that of other economies, meaning that Russian sector-level growth has higher variances and is more volatile.

Having established that the variance of average annual industrial growth, for the period of time examined here, is higher than that of comparator economies, the next question is whether this volatility is the result of fluctuations in annual growth between sectors or between years. In other words, is the variance of annual growth explained by fluctuations in the growth of some sectors that in certain years grow fast then slow or is it that all sectors, year by year, generally grow fast or slow?

This is an important question because it may point to spillover or to macro-economic drivers of volatility. In other words, if fluctuations are explained by year or temporal fluctuations, where generally all sectors are in slumps or surges at the same time, that may indicate that these

[14] Inter-Quartile Range (IQR) = x[75] – x[25]

Highest Value <= x[75] + 1.5*IQR

Lowest Value => x[25] – 1.5*IQR

industrial sectors are interlinked in such a way that they are all pulled down or up together or there are macroeconomic factors that affect all of them. Alternatively, if a few sectors are continually in flux, while others grow at a steady, even pace throughout the years, this suggests that there are comparatively few spillovers and relatively little linkage between sectors.

The analysis of variances presented in the table below indicates that sector-level growth rates in Russia are highly correlated to each other, year to year. This conclusion is based on the relatively higher coefficient for the year variable as compared to other economies and as compared to the sector variable coefficient as well. These results imply that nearly the entire set of Russian industrial sectors experience fluctuations in growth rates in tandem. This lends support to the spillover hypothesis; namely, that the relatively high levels of concentration of economic output, both across firms and sectors, contributes to volatility.

Table 1: ANOVA Partial Sum of Squares

	ANOVA FOR 1993-1999					ANOVA FOR 2000-2009				
	Russia	**Brazil**	**India**	**China**	**Korea**	**Russia**	**Brazil**	**India**	**China**	**Korea**
Model	28.35	1.27	14.02	NA	29.24	16.32	4.96	6.68	3.86	7.88
Sector	4.72	0.21	8.15	NA	7.62	2.25	0.54	1.75	1.27	3.33
Year	23.63	1.05	5.86	NA	21.62	13.70	4.44	4.92	2.58	4.53
Residual	21.35	0.95	44.85	NA	37.80	23.15	3.99	25.12	2.54	16.31
Total	49.70	2.22	58.87	NA	67.03	39.47	8.95	31.80	6.40	24.19

Source: Author's calculation from UNIDO 2011 Industrial Output Data (4-digit NACE)

The reader will note that the empirical results for the analysis of variances are presented for two separate periods: 1993-1999 and 2000-2009. The first represents the period following the economic collapse of the Soviet Union, between 1993 and 1999. The second covers the years of economic recovery where relatively higher growth (2000-2009) took hold. While these are two dramatically different periods for recent Russian economic history, the empirical results on the possible explanation for the patterns of economic output volatility is remarkably similar for both. In both, the year-to-year fluctuations in sector-level annual industrial output explain more of the variation in growth rates than the composition of sectors that contribute to output growth. This similarity in results demonstrates the persistence in the nature and sources of volatility of the Russian economy. While this temporal effect is seemingly less prominent in the latter period, the data indicate that in Russia, changes in sectors output generally move in tandem across the years.

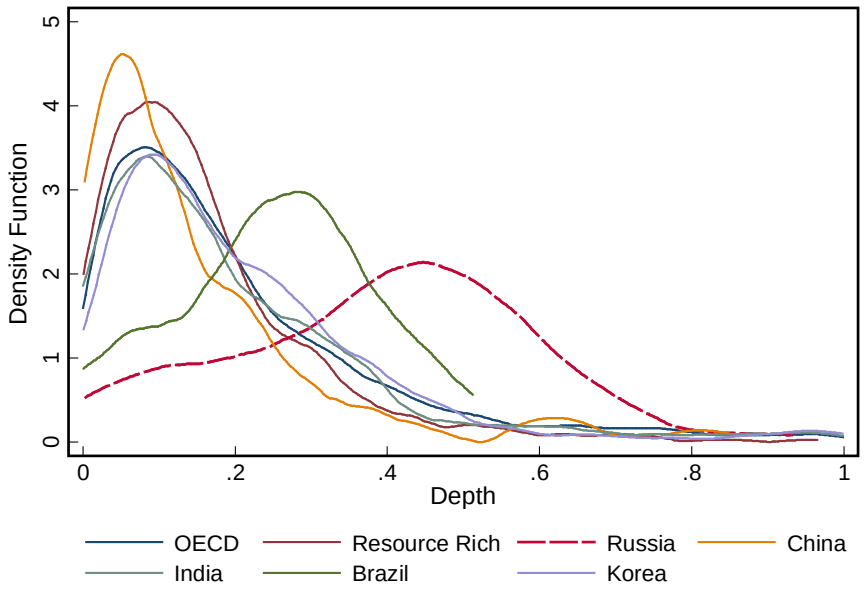
THE NATURE OF VOLATILITY COMPARED WITH OTHER ECONOMIES

Recent sector-level growth rates in Russia exhibit more volatility than in other economies. All volatility is made up of booms, referred to here as surges, and busts, referred to here as slumps. These two can be examined separately since they are quite different—surges foster firm entry

while slumps cause firm exits. But before getting to the dynamics of firm entry and exit, the next task is to understand the characteristics of slumps and surges in the Russian economy.

Slumps and surges have two characteristics: depth and endurance. In the case of slumps, the depth is characterized by how much the economy shrinks. Similarly, to determine the endurance of a slump, the task is to determine from beginning to end, how long a slump lasted without interruption of at least one period of positive growth. With respect to the data, to ascertain the depth of slumps, one looks at period when a slump takes place and one asks how often these slumps are characterized by rates of 0, -1, -2, or -3 percent average annual growth, for example. To get a picture of how long slumps last, one records how long (how many years) each slump remained in negative territory once the slump began.

Figure 5: The average slump in Russia is deeper than in other economies (1993-2009)



Source: Author's calculation from UNIDO 2011 Industrial Output Data (4-digit NACE)

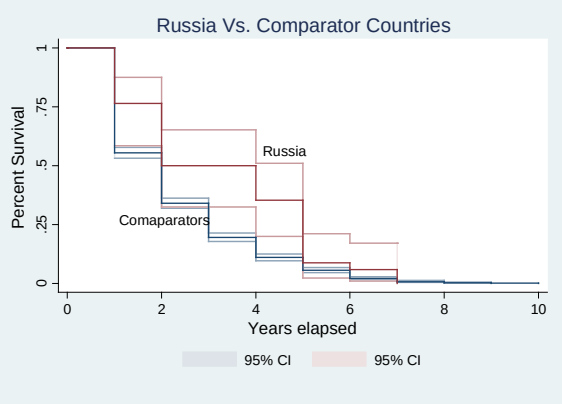
To illustrate the depth of Russian slumps and compare these to that of other economies, a kernel density estimator [15] is used. Figure 5 is a kernel density plot where the horizontal axis, from left to right, indicates progressively deeper slumps (higher negative growth rates). The vertical axis, from bottom to top, records how often a particular negative growth rate is recorded. The data lines record how often a negative growth rate is recorded for all of the slumps that took place in these economies between 1993 and 2009. The respective top of each hill marks the most common negative rate of growth registered in slumps for each economy.

This graph confirms that for Russia—because the top of the hill is to the right of all other comparator economies—the common slump is characterized by higher negative growth than that found in any of the economies to which it is compared.

[15] Smoothing the duration of slumps data with a kernel density estimator can be more effective than using a histogram to identify features that might be obscured by the choice of histogram bins or sampling variation.

To compare and contrast differences in the duration of slumps across economies, a different analysis than that used to examine depth is appropriate. A survival analysis and simple comparisons of the proportion of slumps that lasted 1, 2, 3 or more periods are used. The same time-series data of sector-level output that were used to calculate the volatility of output comparators are used to determine whether the length of slumps in Russia differ significantly from those of other economies. It is found that they do: they are generally longer.

Figure 6: The average slumps last longer in Russia (1993-2009)



Source: Author's calculation from UNIDO 2011 Industrial Output Data (4-digit NACE)

Figure 7: A greater proportion of slumps last longer (years) in Russia (1993-2009)

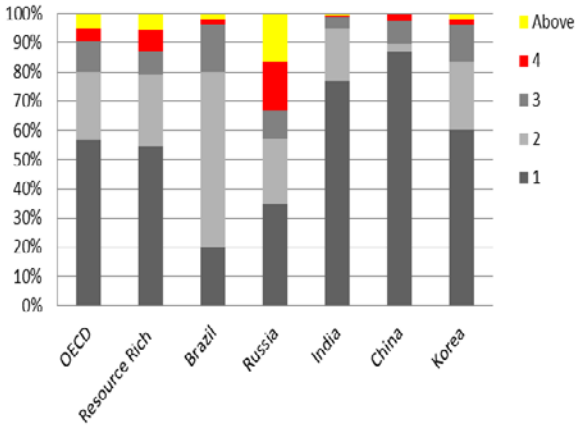


Figure 6, above, is a graphical depiction of how data answer the following question: given that a slump has started, what is the likelihood that it will last at least one year? Given that the slump has lasted one year, what is the likelihood that it will last an additional year? And so on. This graphical depiction of the endurance of slumps (Figure 6) indicates that slumps are likely to last longer in Russia than in other economies. This conclusion is based on the fact that for slumps of less than 6 years (the horizontal axis), the probability (the vertical axis) of a slump persisting for another period is higher in Russia (the step–like line is above that of the other economies) than in the comparator group. Since these probabilities are estimates, a 95 percent confidence interval is also estimated to make sure that the probability estimates are indeed significantly different across economies. The grey lines above and beyond Russia's and the other economies' step-like probability estimates delineate these confidence intervals. Where these intervals do not overlap (up to 5 periods) the differences in probability that a slump will last longer in Russia than in other economies can be safely assumed to be significant. Finally, to check these results, a simple proportions analysis is provided. This analysis simply answers the following question; for all of the slumps recorded during the period of these data, how many of the slumps last 1, 2, 3, etc. periods? Figure 7 clearly indicates that a disproportionately higher number of slumps are 4 or more years in duration. In sum, Russian slumps also last longer than those of comparable economies (see Figure A2 in the Annex).

A similar analysis on the duration of economic surges in Russia and comparator economies was performed as well. Interestingly, that analysis showed that Russia is no different in terms of height or duration of surges than that of other economies. In sum, Russian slumps, not Russian surges, distinguishes its growth dynamics from other economies examined.

DETERMINANTS FOR FIRM SURVIVAL IN RUSSIA

The comparative analysis of slumps and surges using the UNIDO dataset indicate that the Russian economy exhibits significantly deeper and longer slumps than other economies. But should these features of the Russian economy be of concern? One answer is that these macroeconomic features of the economy may have specific microeconomic consequences. Slumps may slow or halt firm growth, may force the exit of relatively efficient, newer firms and hinder the allocation of resources from less efficient firms to more efficient ones. To see if these concerns are warranted, this section focuses on identifying and describing the link between firm exits and surges and slumps, sector-level competition the role firm-level productivity plays into firm mortality.

Given the pattern of deep and long slumps discovered in the previous analysis there is particular emphasis on these results to identify and explain the implications of these slumps on firm mortality. For that reason, only the following findings, out of many, are highlighted and discussed here:[16]

1. More productive firms are relatively less likely to exit than less productive ones. Productivity is more of a factor in improved firm mortality during surges than slumps;
2. Older firms are relatively less likely to exit than younger ones. The age of the firm is also more of a factor in improved firm mortality during surges than slumps; and
3. In sectors where competition is less intense, unproductive firms are less likely to exit than in sectors where competition is more intense.

On average, the likelihood of surviving the ups and downs of the Russian economy improves if a firm is more productive than others, holding for all other factors.[17] The data however, also provide a slight nuance to this result. Being more productive improves the odds of survival during more so surges than during slumps. This nuanced finding supports the conjecture that during a surge (a boom) started by an expansion of demand for goods, the intra-sectoral reallocation of resources between firms will favor those that are more productive. To respond to increased demand, firms expand the purchase of their inputs to increase production. Expanded demand for inputs raises prices for inputs. In this situation, the least productive firms, which by definition are already burdened with higher costs of production, are unable to stay in the market as higher input prices further raises their costs and these cannot be recuperated with higher prices. This forces uncompetitive firms to exit even during economic booms. [18] This finding is good news for the Russian economy. If during surges emerging, more efficient firms enter to present new products to new markets, this dynamic could serve as the basis for economic diversification. However, issues arise during the long and deep Russian economic slumps that were described in previous sections.

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[16] The econometric results are displayed in Tables A17, A18 and A19 of the Annex.

[17] See Tables A17, A18 and A19 of the Annex where the variable **ln(value added per worker)** serves as a productivity measure. In all cases, the coefficient for this variable is negative and statistically significant at the 99 percent level.

[18] This is consistent with a heterogeneous firm-model of Melitz (2003).

Slumps, however, temper this positive news. Productivity is expected to be equally important in the survival of firms during both slumps and surges. However, the Russian data indicate that this is not the case.[19] Part of the explanation may be that the dynamics for slumps are dissimilar to those described for surges. The empirical results may just be a reflection of that fact.[20] Nevertheless, while the dynamics may be different, in healthy, competitive economies, productivity is equally important to the survival of firm in the ups and downs. In Russia, during the long and deep slumps, other factors are important in determining the survival of firm.

The age of the firm plays a more significant role during slumps than in surges. Older firms are less likely to exit the market.[21] Regardless of their relative productivity, older, incumbent, firms will remain in the market.[22] This finding, when coupled with the discovery that Russian slumps are more frequent, longer and deeper, there is cause to whether this premium on incumbency and age is an adaptation, a not very healthy one, to the nature of Russian slumps. Incumbents are often not the champions of change and innovation that must be the basis for economic diversification.

The last finding also suggests that firms in less competitive sectors are more likely to survive than would otherwise be the case. This result reinforces the incumbency premium and has implications for the allocative efficiency of the economy. The staying power of relatively inefficient firms in uncompetitive sectors is a problem. Indirectly, these incumbents affect the entrance of new firms, by holding on to the resources that young, emerging, possibly more productive, firms could employ to grow.

Based on the benchmark of health of Russian economic dynamics, namely, whether relatively productive firms stay in the market and grow while inefficient ones exit, there is some room for both optimism and for pessimism. Economic surges reward productivity. On the other hand, the staying power of inefficient, incumbent firms hints at a problem, however.

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[19] The reader can see in Tables A17, A18 and A19 of the Annex that the coefficient for the interaction term between productivity and slump or surge (**surge/slump × ln(value added per worker**) is always negative and statistically significant at the 99 percent confidence level. Since a surge is coded as value=1, the coefficient of this interaction term indicates that during surges, being more productive is more important than during slumps (coded as value=0). If productivity had been as equally important to firm survival during slumps as in surges, the coefficient for this interaction would have been zero.

[20] Unlike surges, in slumps demand falls and prices fall; the most efficient firms can meet these prices cuts because they are lower cost producers and survive the slump. During slumps, within sector resource allocation may not be as important in survival as it is in surges. Thru slumps, firms are releasing resources as demand shrinks and this would likely force input prices to drop as well.

[21] See Tables A17, A18 and A19 of the Annex where the coefficient for the variable **age**, in all cases, is negative and statistically significant at the 99 percent level.

[22] In the regression displayed on Tables A17, A18 and A19 of the Annex, the reader will note that the coefficients for the size categories (**small, medium and large**) are statistically significant and negative. However, to determine the complete effect of size on the likelihood of survival, the coefficients to all of the interaction terms with age must be considered. Once all coefficients are summed for each size category, they add up to zero, indicating that while there are benefits to being small, medium or large in comparison to a microenterprise (the omitted category absorbed by the constant), there is no statistical difference between being small, medium or large.

CONCLUSION

The results of this study point to three main findings. First, Russian manufacturing output growth is characterized by a higher volatility than other comparator countries. Second, higher volatility is mostly driven by the presence of more numerous, deeper and longer slumps and is mostly associated with aggregate slumps with yearly effects. When the Russian economy slumps or surges, few sectors can escape the gravity of the downward or upward pull. Third, while the economic surges increase the probability that productive firms remain in the market, the same is not true of economic slumps—older firms, not necessarily more productive ones, are more likely to survive the downturn. Furthermore, in sectors in which competition is less fierce, firms in these sectors have a higher likelihood of weathering a slump.

The economic ramifications of these findings to the Russian economy are what matter. In that sense, the evidence presented indicates that slumps affect the nature of firm mortality and allocative efficiency. If Russia is going to rely on new firms in new sectors doing new things in new markets as a source of economic diversification, there will be a need to address volatility, competition and a too heave public policy and programmatic focus on small and medium enterprises to one on young, infant and productive firms.

The econometric results on the relationship between firm exit and competition have important policy implications. First, at the micro-level promoting competition would seem to go a good way forward in addressing them. More specifically, policymakers may want to provide new emphasis to the role of emerging firms, not their size, to address the fact that some of the efficient firms that exit the market are young. Possibly, in a less volatile more competitive economy, these young firms would remain in the market, grow and form the basis for the economic diversification so many Russian policy makers want. However, Russia, like most governments around the world, is focused on SMEs (small and medium enterprises) as a target for policy aid. The findings here indicate that it may be time to change focus to seeing what ails YIFs (young and infant firms) emerging in the Russian market.

Russia's policy makers may want to worry more about the economic costs of these sharp ups and downs of the economy. At the macro level, Russia, like other resource-rich countries such as Norway and Chile, may want to consider adopting counter-cyclical policies. Historically, many countries have suffered a pattern of pro-cyclical fiscal policy: spending too much in booms and then forced to cut back in recessions. This problem has especially plagued Latin American commodity exporters. Since 2000, fiscal policy in Chile has been governed by a structural budget rule that has succeeded in implementing a countercyclical fiscal policy. Official estimates of trend output and the 10-year price of its main export, copper, are made by expert panels insulated from the political process. Their estimates are essential in highlighting which parts of the budget are structural and which are cyclical. Chile's fiscal institutions hold useful lessons everywhere, but especially in other commodity-exporting countries like Russia.

ANNEX

DATA

For the cross-country, sector-level comparative analysis of manufacturing output, the INDSTAT 4 2009 Revision 2[23] and INDSTAT 4 2012 Revision 3[24] datasets from the United Nations Industrial Development Organization (UNIDO) are used. The two UNIDO datasets were combined to create a database representing 84 sectors (4-digit NACE)[25] from 134 countries for the time-period 1977 to 2009. The analysis is supplemented with data from the World Development Indicators,[26] and the World Bank's *Enterprise Surveys.*

The list of countries included in the UNIDO dataset, the average length of the panel per country, the number of observations per country and the number of sectors included in the data is listed in Table A1, below.

Table A1: Panel Statistics

COUNTRY NAME	AVERAGE LENGTH OF THE PANEL	NO. OF OBS.	NUMBER OF SECTORS
Afghanistan	6.8	31	4
Albania	4.7	332	63
Algeria	0.0	40	40
Argentina	10.0	339	81
Armenia	10.3	685	62
Aruba		0	
Australia	21.6	1539	77
Austria	22.2	1584	76
Azerbaijan	15.5	1192	76
Bahamas	7.7	194	38
Bahrain	0.0	39	39
Bangladesh	14.0	911	78
Belarus	1.0	14	7
Belgium	14.3	932	68

[23] http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=8&Lg=1

[24] http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=2&Lg=1

[25] NACE is the acronym used to designate the various statistical classifications of economic activities developed since 1970 in the European Union (EU). NACE provides the framework for collecting and presenting a large range of statistical data according to economic activity in the fields of economic statistics (e.g. production, employment, national accounts) and in other statistical domains. This classification was designed to delineate broad economic categories, into large economic classes of commodities, distinguishing food, industrial supplies, capital equipment, consumer durables and consumer non-durables. It is broadly used to stand for sectors. The higher the number of digits for the NACE, the more detailed the sector; from the most aggregate to the least, the classifications are organized by Section, Division, Group and finally Class. The analysis here is at the 4-digit NACE level; namely at the Group level. For more information, see http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=27&Lg=1.

[26] http://data.worldbank.org/data-catalog/world-development-indicators

Country Name	Average Length of the Panel	No. of Obs.	Number of sectors
Benin	3.0	20	5
Bermuda	2.8	50	13
Bolivia	11.2	881	73
Bosnia	.	0	
Botswana	2.6	40	12
Brazil	10.3	302	27
Bulgaria	7.1	537	67
Burkina-Faso		0	
Cambodia	5.3	20	8
Cameroon	9.6	295	38
Canada	23.4	1926	79
Cape Verde	1.6	64	36
Central African Republic		0	
Chad		0	
Chile	13.6	1012	80
China	6.0	476	68
Colombia	22.2	1798	81
Congo		0	
Cook Islands		0	
Costa Rica	21.3	1705	77
Croatia		0	
Curaçao		0	
Cyprus	22.6	1490	64
Czech Republic	8.3	577	64
Côte d'Ivore	4.1	217	43
Denmark	15.9	1208	79
Dominican Republic		0	
Ecuador	21.1	1656	77
Egypt	20.9	1364	78
El Salvador	4.3	382	75
Eritrea	13.6	645	45
Estonia	15.0	933	63
Ethiopia	17.1	703	39
Ethiopia and Eritrea	6.0	278	40
Fiji	14.7	563	46
Finland	24.6	2018	81
France	20.6	1510	73
Gabon	3.4	128	30
Gambia	3.6	7	5
Georgia	9.6	545	56

Country Name	Average Length of the Panel	No. of Obs.	Number of sectors
Germany	15.0	1266	80
Germany East	9.8	723	79
Ghana	15.8	475	70
Greece	22.4	1170	79
Grenada		0	
Guatemala	14.2	887	72
Haiti	9.0	70	7
Honduras	14.8	993	63
Hong Kong	19.7	1540	78
Hungary	15.7	1093	69
Iceland	15.7	676	41
India	24.9	2096	81
Indonesia	24.5	1991	80
Iran	20.3	1363	78
Iraq	0.0	4	4
Israel	12.1	248	19
Italy	17.1	1337	76
Jamaica		0	
Japan	19.7	1679	81
Jordan	18.2	1265	66
Kazakhstan	12.9	916	67
Kenya	7.5	119	14
Korea	24.9	2092	81
Kuwait	16.4	908	59
Kyrgyzstan	16.4	1161	70
Lao	0.0	7	7
Latvia	16.2	1072	66
Lebanon	7.0	105	59
Lesotho		0	
Liechtenstein		0	
Lithuania	13.8	1127	79
Luxembourg	11.4	329	28
Macao	12.2	694	62
Macedonia	7.0	506	68
Madagascar	9.1	263	37
Malawi	15.4	455	51
Malaysia	24.6	1903	78
Maldives		0	
Malta	19.3	1344	74
Mauritius	11.8	831	66

Country Name	Average Length of the Panel	No. of Obs.	Number of sectors
Mexico	18.1	1302	73
Moldova	12.0	806	63
Mongolia	8.1	487	62
Morocco	11.0	948	80
Mozambique	.	0	
Myanmar	9.6	487	54
Namibia	0.0	8	8
Nepal	15.4	524	63
Netherlands	18.0	1237	72
Netherlands (Antilles)		0	
New Zealand	2.7	206	78
Nicaragua	1.8	179	63
Niger	3.5	73	17
Nigeria	8.2	484	68
Norway	23.2	1793	79
Oman	12.6	694	55
Pakistan	17.8	480	78
Palestinian	5.6	380	59
Panama	18.1	862	60
Papua		0	
Paraguay	0.9	19	10
Peru	22.4	1544	81
Philippines	21.3	1191	79
Poland	12.9	932	69
Portugal	24.2	1822	81
Puerto Rico	15.7	234	14
Qatar	5.6	191	29
Republic of Ireland	15.1	851	60
Romania	12.0	900	73
Russia	10.1	833	79
Rwanda	0.0	10	10
Saint Lucia	3.8	139	29
Saint Vincent		0	
Saudi Arabia	9.0	19	10
Senegal	13.7	702	65
Serbia	4.0	50	10
Sierra Leone		0	
Singapore	21.4	1498	70
Slovakia	14.7	1059	74
Slovenia	13.3	920	69

Country Name	Average Length of the Panel	No. of Obs.	Number of sectors
Somalia	0.0	36	36
South Africa	11.6	783	77
Spain	25.2	2083	80
Sri Lanka	15.1	1015	78
Sudan	0.0	49	49
Suriname		0	
Swaziland	3.4	150	34
Sweden	24.9	1898	80
Switzerland	8.9	64	8
Syrian	9.0	32	4
Taiwan	0.0	45	45
Tajikistan	14.3	621	43
Tanzania	18.5	888	73
Thailand	21.8	885	78
Tonga	5.3	46	8
Trinidad	12.8	729	60
Tunisia	12.6	417	33
Turkey	24.1	1933	81
Turkmenistan	4.0	30	6
United States	24.9	2006	80
Uganda	0.0	55	55
Ukraine	14.9	1253	79
United Kingdom	19.5	1562	81
Uruguay	18.7	884	73
Venezuela	12.4	911	80
Vietnam	3.1	211	67
Yemen	7.3	66	8
Zambia	7.9	174	62
Zimbabwe	17.1	759	42

Source: INDSTAT 4 2009 Revision 2 and INDSTAT 4 2012 Revision 3[27] datasets from the United Nations Industrial Development Organization (UNIDO) http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=2&Lg=1

Table A2: Summary of Output (pre and post sample selection)

Country and comparator groups	Number of Observations	Mean Output (in millions US$)	Number of Observations	Mean Output (in millions US$)
	Pre-sample selection		Post-sample selection	
Russia	833	3,660	738	3,970
OECD	41,560	6,690	24,661	8,100
Resource rich countries	4,683	2,770	2,232	3,780
China	476	60,700	408	66,800
India	2,096	2,850	1,072	4,290
Korea	2,092	5,330	1,041	8,600

Source: Author's calculation from UNIDO 2011 Industrial Output Data (4-digit NACE)

Table A3: Number of observations removed from UNIDO dataset

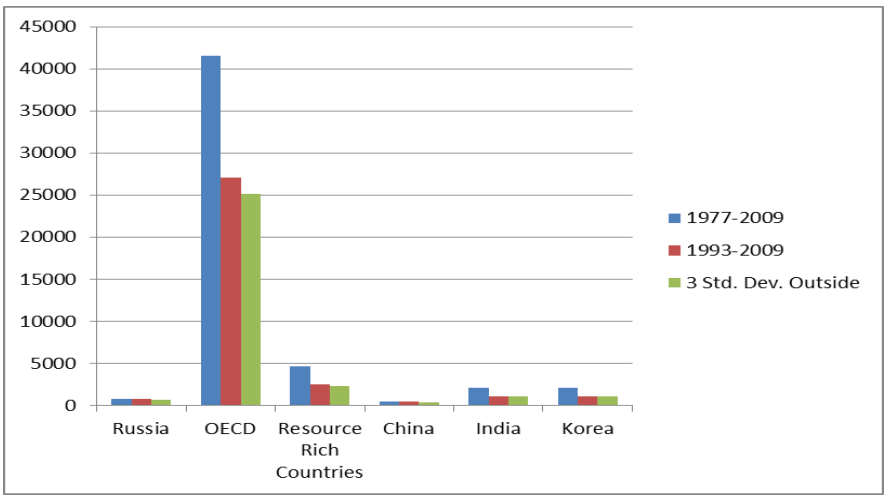
Economies	No. of Obs.	No. of Obs. in sample	Percent
Russia	833	738	88.6%
OECD	41,560	25,157	60.5%
Resource rich countries	4,683	2,349	50.2%
China	476	408	85.7%
India	2,096	1,137	54.2%
Korea	2,092	1,097	52.4%

Source: Author's calculation from UNIDO 2011 Industrial Output Data (4-digit NACE)

For the sector analysis, a shortened panel for the period between 1993 and 2009 is used. Since the UNIDO data for Russia start in 1993, this was the earliest period that the pane could begin.

Outlier observations – identified as growth greater than 3 standard deviations above or below the mean for each sector in each country– were removed. This results in dropping about 45 percent of the observations in the dataset. Table A2, above, provides details on the breakdown of the dataset pre- and post-sample selection.

Figure A1: Drop in number of observations after removing years from the panel



A graphical depiction of the proportion of observations dropped by periods of time and each economy or economic grouping, Figure A1 provides that representation. Because the set of economies included in the OECD has a more complete data time series, the majority of the dropped observations came from the OECD.

Source: Author's calculation from UNIDO 2011 Industrial Output Data (4-digit NACE)

Firm-level analysis using the World Bank's Enterprise Surveys

The analysis comparing manufacturing firm sizes and age, presented in figures 2 and 3 were based on the latest available firm-level data collected by the World Bank's Enterprise Analysis Unit. This unit designs and implements *Enterprise Surveys* (www.enterprisesurveys.org) which are firm-level surveys of a representative sample of an economy's private sector. The surveys cover a broad range of business environment topics including access to finance, corruption, infrastructure, crime, competition, and performance measures. The *Enterprise Surveys* implemented in Eastern Europe and Central Asian countries are also known as Business Environment and Enterprise Performance Surveys (BEEPS) and are jointly conducted by the World Bank and the European Bank for Reconstruction and Development.

Firm-level analysis using RUSLANA

For the firm-level analysis for Russia, a time series data from the RUSLANA database (from Bureau Van Djik) was used.[28] RUSLANA is an extensive dataset that provides up to 10 years of financial, administrative, locational and managerial information on 7,268,986 registered firms in Russia.

In the case of the firm level dataset, RUSLANA, manufacturing firms are the only firms used in the analysis. In addition, all observations with negative values for any of the following variables: operating revenue, tangible fixed assets and number of employees, were dropped from the dataset. Outlier values are defined as those values that are 3 standard deviations above (and below) the mean for the variables operating revenue, cost of goods sold, value added, value added per worker, and number of employees. Outliers are also defined as, and exclude from the analysis, firms for which the cost of goods sold is twice the operating revenue.

[28] http://www.bvdinfo.com/About-BvD/Brochure-Library/Brochures/RUSLANA-brochure

Table A5: Summary statistics with outliers

2 DIGIT NACE 1.1 (MANUFACTURING SUBSECTIONS)	NUMBER OF WORKERS		COST OF GOODS SOLD		OPERATING REVENUE	
	MEAN	COUNT	MEAN (IN MILLIONS)	COUNT	MEAN (IN MILLIONS)	COUNT
Manufacture of food products, beverages	127.31	81,216	4.0	117,624	4.9	117,624
Manufacture of textiles and textile products	58.86	34,279	0.9	50,948	1.1	50,948
Manufacture of leather and leather products	61.36	32,291	1.2	47,792	1.4	47,792
Manufacture of pulp, paper and paper products	59.20	32,253	1.8	44,147	2.2	44,147
Manufacture of coke, refined petroleum	384.39	2,670	46.2	4,049	60.0	4,049
Manufacture of chemicals, chemical products	134.16	25,346	5.1	35,305	6.6	35,305
Manufacture of rubber and plastic products	67.05	30,755	1.9	39,747	2.1	39,747
Manufacture of other non-metallic minerals	107.14	37,138	2.6	50,464	3.3	50,464
Manufacture of basic metals and fabrications	115.85	59,236	5.2	77,808	6.3	77,808
Manufacture of machinery and equipment	90.51	67,617	2.4	94,175	2.8	94,175
Manufacture of electrical and optical equipment	86.50	53,503	2.5	74,309	3.0	74,309
Manufacture of transport equipment	297.08	15,231	12.2	21,645	13.9	21,645
Manufacturing n.e.c.	50.63	25,907	1.4	36,497	1.6	36,497

Source: RUSLANA and Author's calculations.

Table A6: Summary statistics after removing outliers

2 DIGIT NACE 1.1 (MANUFACTURING SUBSECTIONS)	NUMBER OF WORKERS		COST OF GOODS SOLD		OPERATING REVENUE	
	MEAN	COUNT	MEAN (IN MILLIONS)	COUNT	MEAN (IN MILLIONS)	COUNT
Manufacture of food products, beverages	95.55	72,694	2.46	99,988	2.75	99,988
Manufacture of textiles and textile products	36.31	30,544	0.50	43,418	0.55	43,418
Manufacture of leather and leather products	35.43	27,338	0.59	37,551	0.65	37,551
Manufacture of pulp, paper and paper products	36.91	29,574	0.77	38,915	0.86	38,915
Manufacture of coke, refined petroleum	215.99	2,070	22.30	2,783	26.80	2,783
Manufacture of chemicals, chemical products	80.12	22,553	2.35	29,078	2.75	29,078
Manufacture of rubber and plastic products	44.33	27,992	1.02	34,272	1.14	34,272
Manufacture of other non-metallic minerals	77.72	32,320	1.67	40,982	1.88	40,982
Manufacture of basic metals and fabrications	62.19	54,406	1.75	67,876	1.94	67,876
Manufacture of machinery and equipment	59.12	61,269	1.20	81,237	1.35	81,237
Manufacture of electrical and optical equipment	58.72	48,287	1.32	63,982	1.51	63,982
Manufacture of transport equipment	164.77	13,505	4.76	18,244	5.23	18,244
Manufacturing n.e.c.	35.72	23,028	0.75	30,611	0.85	30,611

Source: RUSLANA and Author's calculations.

Firm size is defined by the number of employees that the firm has. See table below for summary statistics.

Table A7: Number of observations by size

FIRM SIZE	NO. OF WORKERS	FREQ.	PERCENT
Micro	<15	169,762	39.25
Small	15-99	194,704	45.01
Medium	100-249	37,141	8.59
Large	>=250	30,925	7.15

Source: RUSLANA and Author's calculations.

The names, definition of the key variables and how they are derived are provided in Table A8, below.

TableA8: Variable definitions

VARIABLE NAME	DEFINITION
Cost of goods sold	Cost of sold goods, production, services. Costs directly related to the production of the goods sold + depreciation of those costs
Operating revenue	Total operating revenues (Net sales + Other operating revenues+ Stock variations). The figures do not include VAT.
Current assets	Total amount of current assets (Stocks + Debtors + Other current assets).
Size	Whether a firm is micro, small, medium or large. See table above.
Age	Year of analysis – date of incorporation
Value added	operating revenue – cost of goods sold
Number of employees	Total number of employees included in the company's payroll
Value added per worker	Value added/no. of employees
Price-cost margin(PCM)	PCM=(operating revenue – cost of goods sold)/cost of goods sold
	In the case of sector, PCM = median(PCM_{firms}) of firms in that sector
Entry of firm	Date of incorporation
Exit of firm	Two consecutive years of missing or zero operating revenues combined with a status that is not active.

Table A9 below provides summary statistics of key variables before and after removing outliers.

Table A9: Mean and median of key variables used in firm-level analysis

VARIABLE	MEAN	MEDIAN
Operating Revenue	1,844,960.00	278,885.90
Cost of goods sold	1,638,562.00	241,428.00
Age	7.48	6.00
Number of employees	65.11	21.00
Value added per worker	2,838.22	1,296.86
Price cost margin	0.09	0.09

Source: RUSLANA and Author's calculations.

MEASURING FIRM ENTRY AND EXIT

The firm-level database, RUSLANA, provides information on whether a Russian firm is active or inactive. If a firm is taken out of the dataset, the data also indicates why it has been removed. This is used as one of indications that the firm has exited the market. However, in addition to checking whether firms are active a condition was added that verifies whether a firm has two consecutive years in which either data for that firm are missing or it reports zero turnover. This extra condition provides additional reliability in defining whether a firm has exited rather than just relying solely on the information provided by the dataset. [29] In sum, a firm is considered to have exited the market if it is listed as inactive and is missing two consecutive years of data. RUSLANA also provides the date of incorporation of a company; this is used as the date of establishment for a firm. Table A10 provides a summary of number of exits and entries per year.

Table A10: Number of exits and entrants per year

Year	Number of exits	Number of new entrants	Number of firms
1999	609	2,652	21,585
2000	659	3,176	28,311
2001	873	3,584	35,680
2002	2,390	4,480	53,018
2003	2,148	6,379	57,395
2004	5,647	6,055	65,955
2005	5,366	6,365	65,151
2006	4,295	6,269	64,549
2007	4,067	6,105	65,508
2008	3,588	4,840	64,036
2009	2,727	3,618	61,045
2010	2,360	3,839	59,186

Source: Author's calculations using RUSLANA

An obvious concern with this method is the ability to separate entry and exit in the dataset with that from the economy. In case of entries, this is straightforward since RUSLANA provides information on the date of incorporation (separate from entry into the dataset), thus clearly delineating entry into the economy. The information on exit more complicated since it relies on administrative data, which could experience varying lags in reporting. There is confidence, however, that the additional condition of two consecutive years of missing or zero turnover would be enough to correct for these lags and accurately capture the time of exit since even if the firm is falsely reported as still present in the economy when it has not been operational it will be captured by this condition checking for missing or zero values. The inability to reliably distinguish between an exit and when a firm merges is acquired or makes other drastic changes of this kind is an issue that could not be resolved using these data. The criteria used here would classify instances where companies were only technically closed due to a merger or an acquisition, a change of name, etc. as an exit. Estimating growth rates, volatility, surges, slumps, depth and duration

The methodology used to compare growth rates and, identify growth surges and slumps, and measure the depth (height) and duration of slumps and surges is described below. In addition, the metric used to measure firm exits and entry is explained.

[29] The information on the reason and time of exit are based on administrative datasets such as the tax directorate or social security, hence the exit of certain firms in the dataset at times occur after few years it has been created.

CALCULATING GROWTH RATES

For the purpose of this paper, growth rates are based on the measure proposed in Haltiwanger et al. (2010).[30] The growth rate is calculated as follows:

$$g = 2\frac{(y_t - y_{t-1})}{(y_t + y_{t-1})}$$

Where g is growth and y_t is output at time t and y_{t-1} is output in the previous period. A result in the value of 1, using this measure, implies a growth rate of 200 (Refer to Table A4for correspondences between the Haltiwanger growth measure and the regular measure). This measure has similarities to log differences while also accommodating entry and exit in the growth rate. In addition to the benefit of accommodating entry and exit of firms, this measure is used instead of the more standard measures of growth so there is no need to be concerned about the differences in the size of the base from which growth is calculated; a relatively smaller base yields higher growth rates, all things being equal, meaning that even small changes in output, when starting out from a small base, look like big changes in growth.

This measure of growth rate however, requires particular attention to the start and end of a panel of output figures. For a firm/sector entering the panel at time t output does not exist in t-1, similarly a firm/sector leaving the panel output does not exist at the time of exit. Adjustment for this was made by calculating growth rates from year 2 in the panel and not calculating growth rates for the year of exit. In addition, any change from or to an output level of zero implies a growth rate of either +2/-2 (signifying infinite growth rates). This is particularly tricky when the zero value appears in the middle of the panel. Adjustment for these is made by removing them from the analysis of growth rates.

Table A4: Comparison with the Haltiwanger growth rate

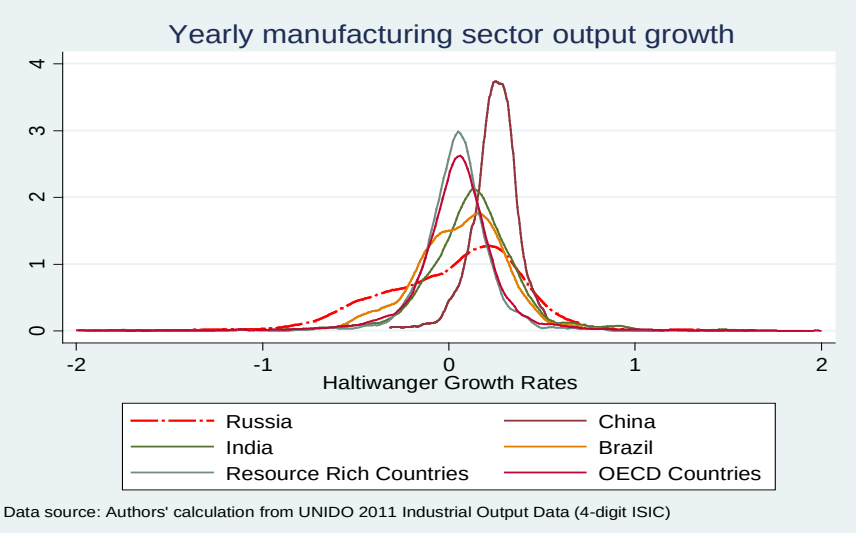
STANDARD GROWTH RATE	HALTIWANGER GROWTH RATE
5%	0.05
10%	0.10
20%	0.18
50%	0.40
100%	0.67
200%	1.00
500%	1.43
1000%	1.67
2000%	1.82
5000%	1.92

In addition, this way of calculating growth yields symmetrical results whether growth is positive or negative. For example, growth in output from 100 to 200 units represents 100 percent increase. However, when growth is negative, from 200 to 100 units, this represents a 50 percent decrease. Using the growth calculation proposed by Haltiwanger et al., using the same example, the growth rates would be 2/3 and -2/3, respectively. This symmetry in positive and negative growth is important for the analysis.

[30] Haltiwanger, John C., Jarmin, Ron S. and Miranda, Javier, "Who creates jobs?: Small vs. large vs. young (August 1, 2010). United States Census Bureau, Center for Economic Studies, Paper No. CES-WP-10-17. Available at SSRN: http://ssrn.com/abstract=1666157 or http://dx.doi.org/10.2139/ssrn.1666157

For the sector-level comparative analysis across economies, the following country groups and countries are considered; namely, India, China, Brazil and Korea for their similarity to Russia in terms of level of economic development or their classification as BRICs. Australia, Canada, New Zealand and Chile are high growth countries that likely Russia have an abundance of natural resources but, unlikely Russia, have largely diversified. Finally the set of Organization of Economic Cooperation and Development (OECD) economies are included because of their relatively long periods of steady and positive growth that may serve as a good reference for Russia. The kernel density shows that for growth of output, spurts, Russia looks little diffierent than its comparators.

Figure A2: Kernel density plots of year on year growth of sector



Data source: Authors' calculation from UNIDO 2011 Industrial Output Data (4-digit ISIC)

IDENTIFYING SURGES AND SLUMPS

In order to identify surges and slumps a trend growth rate for each sector is defined first. An average global trend for each 4-digit NACE sector by income quartiles is then defined as well. In order to account for life product cycle effects, the countries are split into four groups based on their GDP per capita, and calculate an average growth trend for each one of these quartiles.[31] To increase the robustness of the results sectors with fewer than 60 observations from the trend regressions are dropped. Using the regression described above, an average global trend for each sector and GDP per capita quartile can be established.

A sector is considered to be surging if in that particular year or set of years it outperforms the expected global trend growth rate for that sector. Conversely, a sector is considered in slump when in that particular year or set of years it underperforms the expected global trend growth rate for that sector. Two statistics to measure the "degree" of slumps and surges are calculated.

[31] It is reasonable to assume that sectors that are booming in poorer countries may be shrinking in richer ones. To take this into account, countries with different income levels are allowed to have different sectoral growth trends.

First, duration is measured in terms of number of years ("length"), for a surge or slump. Second, the depth of the slump or surge is defined as the ratio between the projected output at the start of the event and the greatest deviation from the trend.

$$Y_{trend\,(t)} = Y_{t-1} \times (1 + g_{\text{trend}})$$

$$Y_{trend\,(t)} > Y_t \rightarrow slump$$

$$Y_{trend\,(t)} < Y_t \rightarrow surge$$

$$Duration\ = t_n - t_0$$

$$Depth = max\left(\frac{(Y_{trend\,(t_i)} - Y_{(t_i)})}{Y_{trend\,(t_0)}}\right)$$

$$Height = max\left(\frac{(Y_{(t_i)} - Y_{trend\,(t_i)})}{Y_{trend\,(t_0)}}\right)$$

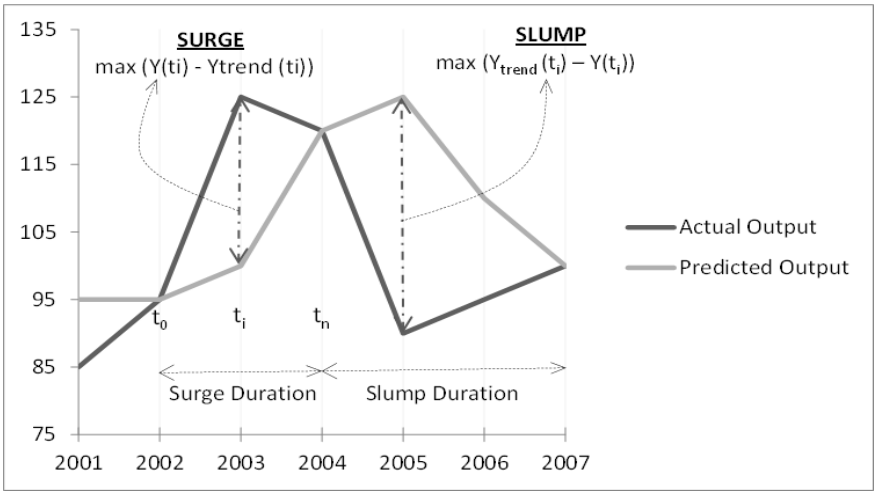
Where,

g_{trend} = trend growth rate for each sector

t_0 marks the start of the event either $\begin{cases} surge \\ slump \end{cases}$,

t_n marks the end of the event either $\begin{cases} surge \\ slump \end{cases}$ and

$0 < i < n$,



Source: Author's illustration using hypothetical data (does not use a trend growth rate)

For the entire UNIDO dataset, between 1993 to 2009, the measure identify 10,251 instances of surges with an average duration of 1.9 years and 11,754 incidents of slumps with an average duration of 2.2 years. In the same period, Russia experienced 136 instances of slumps with an average duration of 2.67 years and 111 surges with an average duration of 2.12 years.

STATISTICS AND ESTIMATES ON OUTPUT CONCENTRATION IN RUSSIA

Table A11: Concentration of output

YEAR	SHARE OF BOTTOM QUARTILE OF SECTORS IN TERMS OF OPERATING REVENUE	SHARE OF TOP QUARTILE OF SECTORS IN TERMS OF OPERATING REVENUE	TOTAL OPERATING REVENUE (IN MILLION USD)
1999	0.4%	81.8%	45,700
2000	0.2%	90.7%	106,000
2001	0.6%	81.7%	76,300
2002	0.6%	79.2%	168,000
2003	0.6%	77.4%	190,000
2004	0.6%	78.3%	221,000
2005	0.6%	79.5%	234,000
2006	0.7%	81.0%	306,000
2007	0.7%	81.2%	394,000
2008	0.8%	79.9%	299,000
2009	0.7%	78.4%	259,000
2010	0.7%	78.7%	282,000
2011	0.7%	80.2%	278,000

Source: Author's calculations using RUSLANA

Table A12: Concentration of output within sectors

2 DIGIT NACE 1.1 (MANUFACTURING SUBSECTION)	AVERAGE SHARE OF BOTTOM QUARTILE (WITHIN 4-DIGIT NACE1.1) OF FIRMS IN TERMS OF OPERATING REVENUE	SHARE OF TOP QUARTILE (WITHIN 4-DIGIT NACE1.1) OF FIRMS IN TERMS OF OPERATING REVENUE	AVERAGE OF TOTAL OPERATING REVENUE IN 4-DIGIT NACE1.1 (IN MILLION USD)
Manufacture of food products, beverages	0.08%	93.6%	29,600
Manufacture of textiles and textile products	0.14%	94.2%	4,160
Manufacture of leather and leather products	0.01%	96.1%	15,400
Manufacture of pulp, paper and paper products	0.14%	94.6%	9,790
Manufacture of coke, refined petroleum	0.0002%	99.5%	215,000
Manufacture of chemicals, chemical products	0.02%	97.1%	13,800
Manufacture of rubber and plastic products	0.13%	91.9%	11,100
Manufacture of other non-metallic minerals	0.04%	91.9%	16,100
Manufacture of basic metals and fabrications	0.07%	95.8%	19,200
Manufacture of machinery and equipment	0.09%	94.3%	15,800

Manufacture of electrical and optical equipment	0.06%	94.8%	19,100
Manufacture of transport equipment	0.01%	97.7%	48,400
Manufacturing n.e.c.	0.05%	95.7%	7,630

Source: Author's calculations using RUSLANA

ANALYSIS OF EXITS, SLUMPS, SURGES AND COMPETITION

For firm-level data for Russian firms, the study exploits a rich, firm-level dataset called RUSLANA.[32] However, the same method is used to calculate sector-level[33] surges and slumps in RUSLANA. To measure productivity, value added per worker is used. [34] The current assets of the firm are used along with value added per worker to approximate firm-level estimates of total factor productivity. The price cost margin (PCM) measures of competition. [35]

Controls are used for regressions: an interaction between 2-digit- industry codes and years to control to time-varying sector specific shocks, and controls for location fixed effects using 85 regions dummies. The controls for years account for overall macroeconomic shocks as well as time-varying industry-level factors such as political economy, demand shocks or technological shocks, while the location controls adjust for region-specific characteristics that are time-invariant. The regressions are also clustered sectors and years as the main explanatory variables do vary at the level of sector and year.[36] Finally also included is the age of the firm and dummies for size[37] as additional controls. Clearly, there are other firm-level time varying shocks which could influence the results that not captured here. However, to the extent that these are uncorrelated with other key variables (surge/slump, competition) conditional on the covariates the results are unbiased.

[32] As with the growth rate calculation, operating revenue is used to calculate surges and slumps. Operating revenue was summed at the level of 4-digit NACE 1.1 for every year to calculate surges and slumps.

[33] 4-digit NACE 1.1 is used to define sectors.

[34] The ideal measure of firm productivity would be total factor productivity (TFP) however data limitations do not allow to estimate it. The main drawback of labor productivity is that it is influenced by the capital intensity of the company. In other words, two companies that have exactly the same productivity measured using TFP but differ in their capital intensity will appear to have different labor productivity as the one with more capital will be able to produce more value added per worker. In order to address this problem, all regressions include the stock of capital (assets) of the company.

[35] PCM=(Operating revenue - Cost of goods sold)/Cost of goods sold. A higher PCM means a lower the level of competition.

[36] In this case the variables of interest are at the firm level while some of the main regressors vary at the sector-year level, hence clustering of standard error at the sector-year level is required as suggested by Moulton(1990)

[37]Refer to this link for definitions for micro, small and medium in Russia.
http://www.gks.ru/free_doc/new_site/business/inst-preob/obsled/mal_bisnes.htm

Table A13: Firm-level statistics - current assets (in 1000s)

Size	N	Mean	Std. dev.	p10	p25	p50	p75	p90
Micro	199,242	201780	4164167	696.0193	4258.19	18245.55	60785.59	172630.1
Small	202,450	860909.3	1.38E+07	17474.07	65299.63	199388.3	539761.1	1293593
Medium	40,217	2890061	1.01E+07	209437.4	563468.2	1276528	2713552	5648698
Large	42,068	1.80E+07	1.81E+08	742631.3	1719325	4249895	1.07E+07	2.86E+07

Source: Author's calculations using RUSLANA

TableA14: Firm-level statistics - value added per worker (in 1000s)

Size	N	Mean	Std. dev	p10	p25	p50	p75	p90
Micro	199,242	3370.888	35761.82	-469.968	89.83334	848.6792	3300.341	8142.333
Small	202,450	3859.066	2.22E+04	6.107754	322.6116	1569.344	4351.495	9116.152
Medium	40,217	3821.288	6.61E+03	-11.8224	563.0723	2154.832	5117.769	9690.881
Large	42,068	3.20E+03	4.92E+03	4.85822	569.4197	1932.481	4.36E+03	7.86E+03

Source: Author's calculations using RUSLANA

Table A15: Firm-level statistics - age

Size	N	Mean	Std. dev	p10	p25	p50	p75	p90
Micro	199,242	5.4	5.2	0	1	4	9	12
Small	202,450	7.9	7.0	2	3	6	11	15
Medium	40,217	10.8	12.5	2	5	9	13	17
Large	42,068	21.5	30.0	4	8	13	17	57

Source: Author's calculations using RUSLANA

Table A16: Sector-level statistics - price cost margin

Industry Subsection	N	Mean	Std. dev	p10	p25	p50	p75	p90
Food products, beverages	117,624	0.09	0.05	0.03	0.05	0.08	0.11	0.16
Textiles and textile products	50,947	0.07	0.04	0.04	0.05	0.07	0.09	0.12
Leather and leather products	47,792	0.07	0.03	0.04	0.05	0.07	0.09	0.10
Pulp, paper and paper products	44,142	0.08	0.05	0.06	0.07	0.08	0.10	0.11
Coke, refined petroleum	4,049	0.10	0.04	0.06	0.08	0.10	0.12	0.12
Chemicals, chemical products	35,305	0.14	0.06	0.08	0.10	0.14	0.17	0.24
Rubber and plastic products	39,747	0.09	0.02	0.06	0.08	0.09	0.10	0.12
Other non-metallic minerals	50,464	0.09	0.04	0.05	0.06	0.08	0.11	0.14
Basic metals and fabrications	77,807	0.09	0.03	0.06	0.07	0.09	0.11	0.12
Machinery and equipment	94,175	0.10	0.03	0.05	0.07	0.09	0.12	0.14
Electrical and optical equipment	74,309	0.11	0.05	0.07	0.09	0.11	0.14	0.16
Food products, beverages	21,632	0.09	0.03	0.06	0.07	0.08	0.10	0.11
Textiles and textile products	36,497	0.11	0.04	0.07	0.08	0.10	0.14	0.15

Source: Author's calculations using RUSLANA

Table A17: Firm-level regression – likelihood of exit

Year, industry and location controls Clustered at sector (4-digit NACE) and year	(1)	(2)	(3)	(4)
Independent variables	**exit={1 if yes, 0 if no**	**exit={1 if yes, 0 if no**	**exit={1 if yes, 0 if no**	**exit={1 if yes, 0 if no**
surge/slump (surge=1, slump=0)	0.0106***	-0.00313	0.00437	-0.00345
	(0.00334)	(0.00212)	(0.00292)	(0.00433)
ln(value added per worker)	-0.00566***	-0.00538***	-0.00531***	-0.00560***
	(0.000345)	(0.000331)	(0.000428)	(0.000449)
ln(current assets)	0.000845**	0.000304	0.000356	0.000981**
	(0.000365)	(0.000318)	(0.000420)	(0.000482)
small (15-99 employees)	-0.00436***	-0.00376***	-0.0196***	-0.0210***
	(0.00125)	(0.00126)	(0.00174)	(0.00173)
medium (100-249 employees)	-0.00945***	-0.00854***	-0.0217***	-0.0249***
	(0.00184)	(0.00185)	(0.00260)	(0.00260)
large (250+ employees)	-0.0171***	-0.0165***	-0.0308***	-0.0358***
	(0.00205)	(0.00206)	(0.00288)	(0.00287)
age	-0.000492***	-0.000385***	-0.000836***	-0.000645***
	(3.32e-05)	(3.21e-05)	(4.46e-05)	(4.09e-05)
surge/slump × ln(value added per worker)	-0.00202***	-0.00298***	-0.00434***	-0.00381***
	(0.000597)	(0.000538)	(0.000712)	(0.000792)
surge/slump × ln(current assets)	-0.00165***			-0.00250***
	(0.000502)			(0.000857)
surge/slump × age		0.0154***		0.0365***
		(0.00149)		(0.00228)
surge/slump × small			0.00182	0.0128***
			(0.00240)	(0.00269)
surge/slump × medium			-0.00352	0.0154***
			(0.00356)	(0.00433)
surge/slump × large			0.00124	0.0259***
			(0.00346)	(0.00471)
Constant	0.0535***	0.0549***	0.0803***	0.0773***
	(0.00423)	(0.00407)	(0.00466)	(0.00477)
Observations	357,252	357,252	256,544	256,544
R-squared	0.016	0.016	0.019	0.021

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Note: Microenterprises is the omitted category and absorbed by the constant.
Source: Author's calculations using RUSLANA

Table A18: Firm-level regression including PCM variable – likelihood of exit

Year, industry and location controls Clustered at sector (4-digit NACE) and year	(1)	(2)	(3)	(4)
	exit={1 if yes, 0 if no	exit={1 if yes, 0 if no	exit={1 if yes, 0 if no	exit={1 if yes, 0 if no
surge/slump (surge=1, slump=0)	0.0101***	-0.00354*	0.00406	-0.00405
	(0.00330)	(0.00213)	(0.00277)	(0.00421)
ln(value added per worker)	-0.00551***	-0.00522***	-0.00506***	-0.00534***
	(0.000344)	(0.000330)	(0.000428)	(0.000450)
ln(current assets)	0.000713*	0.000176	0.000136	0.000734
	(0.000364)	(0.000313)	(0.000414)	(0.000476)
PCM_{sector}	-0.106***	-0.105***	-0.157***	-0.152***
	(0.0214)	(0.0216)	(0.0227)	(0.0229)
small (15-99 employees)	-0.00401***	-0.00341***	-0.0190***	-0.0204***
	(0.00121)	(0.00122)	(0.00166)	(0.00165)
medium (100-249 employees)	-0.00930***	-0.00841***	-0.0214***	-0.0245***
	(0.00182)	(0.00182)	(0.00254)	(0.00253)
large (250+ employees)	-0.0169***	-0.0163***	-0.0303***	-0.0352***
	(0.00201)	(0.00201)	(0.00279)	(0.00276)
age	-0.000479***	-0.000373***	-0.000819***	-0.000629***
	(3.32e-05)	(3.20e-05)	(4.49e-05)	(4.11e-05)
surge/slump × ln(value added per worker)	-0.00203***	-0.00299***	-0.00434***	-0.00386***
	(0.000598)	(0.000537)	(0.000713)	(0.000790)
surge/slump × ln(current assets)	-0.00164***			-0.00239***
	(0.000504)			(0.000854)
surge/slump × age		0.0153***		0.0363***
		(0.00148)		(0.00228)
surge/slump × small			0.00178	0.0126***
			(0.00238)	(0.00267)
surge/slump × medium			-0.00362	0.0149***
			(0.00357)	(0.00432)
surge/slump × large			0.00111	0.0252***
			(0.00342)	(0.00465)
Constant	0.0640***	0.0653***	0.0963***	0.0930***
	(0.00503)	(0.00485)	(0.00522)	(0.00534)
Observations	357,252	357,252	256,544	256,544
R-squared	0.016	0.016	0.020	0.022

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Note: Microenterprises is the omitted category and absorbed by the constant.
Source: Author's calculations using RUSLANA

Table A19: Firm-level regression with PCM variable with interactions – likelihood of exit

Year, industry and location controls Clustered at sector (4-digit NACE) and year	(1)	(2)	(3)	(4)
	exit={1 if yes, 0 if no	exit={1 if yes, 0 if no	exit={1 if yes, 0 if no	exit={1 if yes, 0 if no
surge/slump (surge=1, slump=0)	0.0101***	-0.00354*	0.00407	-0.00413
	(0.00330)	(0.00213)	(0.00277)	(0.00421)
ln(value added per worker)	-0.00595***	-0.00568***	-0.00553***	-0.00580***
	(0.000388)	(0.000373)	(0.000472)	(0.000491)
ln(current assets)	0.000649*	0.000112	6.25e-05	0.000654
	(0.000364)	(0.000314)	(0.000416)	(0.000477)
PCM_{sector}	-0.116***	-0.115***	-0.167***	-0.162***
	(0.0217)	(0.0219)	(0.0232)	(0.0233)
PCM_{sector} × ln(value added per worker)	0.00203***	0.00207***	0.00226***	0.00222***
	(0.000647)	(0.000649)	(0.000819)	(0.000814)
small (15-99 employees)	-0.00376***	-0.00316***	-0.0189***	-0.0203***
	(0.00122)	(0.00122)	(0.00166)	(0.00165)
medium (100-249 employees)	-0.00898***	-0.00808***	-0.0211***	-0.0242***
	(0.00182)	(0.00183)	(0.00254)	(0.00253)
large (250+ employees)	-0.0164***	-0.0158***	-0.0299***	-0.0348***
	(0.00202)	(0.00202)	(0.00279)	(0.00276)
age	-0.000479***	-0.000373***	-0.000819***	-0.000628***
	(3.32e-05)	(3.20e-05)	(4.50e-05)	(4.11e-05)
surge/slump × ln(value added per worker)	-0.00200***	-0.00295***	-0.00435***	-0.00387***
	(0.000601)	(0.000538)	(0.000715)	(0.000792)
surge/slump × ln(current assets)	-0.00164***			-0.00236***
	(0.000504)			(0.000854)
surge/slump × age		0.0153***		0.0363***
		(0.00148)		(0.00228)
surge/slump × small			0.00178	0.0125***
			(0.00238)	(0.00267)
surge/slump × medium			-0.00360	0.0148***
			(0.00356)	(0.00431)
surge/slump × large			0.00115	0.0251***
			(0.00342)	(0.00465)
Constant	0.0645***	0.0657***	0.0969***	0.0935***
	(0.00504)	(0.00486)	(0.00524)	(0.00536)
Observations	357,252	357,252	256,544	256,544
R-squared	0.016	0.017	0.020	0.022

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Note: Microenterprises is the omitted category and absorbed by the constant.
Source: Author's calculations using RUSLANA