How Quiet Flows the Don? An Analysis of Labor Productivity Trends in Rural Rostov Oblast 2010-2021

Dr. Gregory Brock
Dept. of Economics
College of Business
Georgia Southern University
Statesboro, GA USA, 30460-8153
United States of America

Abstract

Labor productivity in rural Rostov Oblast is examined before and after the 2014 Ukrainian incursion across forty-three districts using six economic sectors' wages and labor force. A shift-share analysis indicates that throughout 2010-2021 improved aggregate labor productivity was primarily due to intra-sectoral rather than inter-sectoral labor reallocation. The re-allocation of labor toward relatively less productive sectors substantially declines 2014-2019 compared to 2010-2013 but then rises again in comparison with a longer period 2014-2021 suggesting labor misallocation may have been influenced by the onset of the pandemic. While descriptive statistics such as labor shares and real wage growth appear unaffected by the adjacent Ukrainian 2014 incursion, rayons directly on the border with Ukraine exhibit a reversal of intra-sectoral labor allocation importance relative to inter-sectoral labor allocation after 2013 with the latter now responsible for improved labor productivity.

Keywords: Ukrainian Crisis, Rostov Oblast, Labor Productivity

JEL Codes: J22, J24, O15, O47

1. Introduction

While much has been written about the impact of the 2014 sanctions on Russia at the federal level after the Ukrainian incursion, much less work has been done at the regional and sub-regional level plus only a few studies look at individual firms (e.g. Iwasaki and Kim, 2018). We seek to understand changes within a single region's forty-three rural districts (*rayoni)* 2010-2021 using 2010-2013 performance as a pre-sanction base for comparison. As Rostov region is adjacent to Ukraine, some of the rayons are rural areas that those fleeing Ukraine since 2014 will live in at least temporarily though they are not always welcome (Denisova, 2014). After 2013 there was a huge influx of workers from Ukraine into border rayons doubling the size of small towns and even creating temporary settlements with better wages and social benefits than in rural Ukraine (Zotova et al., 2021). The local labor markets that are potentially disrupted were understudied in both the English and Russian language literature (Antonov, 2019) even before 2014. Labor productivity is low in Russian regions but key to economic growth (Panshin et al., 2019, Voskoboynikov, 2023) especially with the brain drain caused by the Ukrainian war. We therefore examine the aggregate and decomposed labor productivity in Rostov region's rural rayons leaving the 12 Rostov region cities (Rostov-on-the-Don, Taganrog etc.) which are much more developed but also quite heterogeneous to later work. The paper can also be seen as contributing to the growing literature on local area resiliency after exogenous shocks in border areas including Russia (Li et al., 2022; Sensier and Artis, 2016).

Whether the rayons near the Ukrainian border have a different labor productivity experience than other districts due to a combination of migration, sanctions, higher military activity and Russian counter measures bolstering domestic agricultural performance via import substitution can be tested with no impact suggesting resilience at the local level. The last of these is even incorporated in local regional decision-making software as "efficient import substitution" for higher economic growth with opening to foreign trade only a potential future idea and not a current choice reflecting the growing isolation of Russian policy (Patrakeeva and Kryukov, 2016). Rostov Oblast is a leading agricultural region in general and compared to other steppe regions of European Russia (Chibilev et al., 2019). It is the regional center of the Russian south (O'Neal, 2016) and receives one of the highest amounts of federal subsidies of any Russian region (Kluge and Libman, 2017). Prior to Brock (2015), economic analysis of the region is quite limited in either Russian or English especially the rural areas. The few studies found in English that go beyond simply mentioning rural Rostov include a 1990s fiscal federalism paper (Alexeev and Kurlyandskaya, 2003), some farms in the region compared to farms in a few other regions in 2001 (Grazhdaninova and Brock, 2004) and a World Bank study of housing construction in 2006 that includes one rural rayon (World Bank, 2006). Studies in Russian by local economists have attempted to group the districts into several zones outside the capital city Rostov-on-the-Don but do not account for any impact from the Ukrainian incursion in their zones (Gorochnaya and Mikhaylov, 2020; Mikhaylov and Gorochnaya, 2022; Patrakeeva and Kryukov, 2016) or how the pandemic might have impacted districts.

Brock (2015 and 2019) constructs the shadow rayon aggregate output called for by some Russian economists (Kolechkov, 2014) to fit a stochastic production function model to produce an index of technical efficiency for each rayon which can be compared with other performance indices across rayons. In addition, the technical efficiency index measuring how well a rayon combines capital and labor to produce output relative to the other forty-two can be compared with an ongoing regional government grant program (e.g. Pravitel'stvo Rostovskoy Oblasti. 2014) promoting efficient performance that used a ranking of development indices but no model. Brock (2019) finds the grants do not go to the most technically efficient rayons. Following Brock (2015), we group rural rayons into three groups. Nine rayons directly border eastern Ukraine and constitute a direct "border area." Six additional rayons adjacent to the border area including rayons with known military buildup are added to create an "extended border area."[1] These two areas are then compared with all 43 rayons. Perhaps indicating how unexpected the 2022 war was to even local government officials in Rostov, a very recent report (Rosstat-Rostov, 2021) outlines in detail how the Oblast intends to meet the United Nations Sustainability goals by 2025 including rural areas. The sector-by-sector plans for the region in this descriptive and detailed 300-page paper suggest the period 2014-2019 was not highly disrupted by either the war on the western border, the consequent sanctions or the known strong divergence in local labor market conditions across Russia's regions (Antonov, 2019). Published just before the pandemic struck Russia, it does not discuss 2020-2021 which we now do to empirically examine any COVID impact on rural rayon labor productivity. We found no empirical work on the potential impact of the pandemic on Rostov region's districts 2020-2021 using any economic performance measure.

2. *The Data*

Statistics on all rayons were taken from the federal and Rostov region web sites maintained by the federal statistical service (Rosstat) which has branch offices in all regions and rayons (Table 1). Most of these data are no longer available starting in March 2022. A statistical reform in 2017 by Rosstat expanded the number of sectors in the All-Russian Classification of Economic Activities (OKVED) from 16 to 20. Only a few of these sectors have proxies that can be used for gross sector output at the local level (Kosareva & Polidi, 2017). We avoid using an explicit output variable by focusing on the labor market data. Because of the 2017 reclassification, we use only those sectors that consistently are reported throughout 2010-2021 and that exist in all forty-three rayons. The six sectors that meet these criteria are Agriculture & Fisheries, Retail & Wholesale Trade, Real Estate, Government Administration and Military Security, Education, Health and Social Services. These six sectors are where most of the labor force works in all rayons and years with a few exceptions just below 50%. During 2010-2021, the total rural labor force steadily declined every year from 293,570 to 238,958 except 2020 when the value was 237,546. In any year, the border area labor employed in these six sectors is a steady 22% of the overall regional number. The percentage of the border area labor force employed in each of the six sectors in the 9-district area also remains constant with only a 1 or 2% variation throughout the sample period (Agriculture & Fisheries -14%, Retail & Wholesale Trade – 3%, Real Estate -2%, Government Administration and Military Security -9%, Education -20%, Health and Social Services -16%). On average, the real monthly wage steadily rose from 18,244 rubles in 2010 to 29,403 rubles in 2021 except for a small decline in 2015-2016. The same trend with a slightly higher wage is found for rayons in the border area. From 2012-2019 the Rostov region statistical bureau also converted the aggregate monthly ruble wage to US$ using the Central Bank's exchange rate and published US$ wage tables at a time when the federal government was criticizing the dominance of the US$ in the world economy. The dollar wage only exceeded $1000 a month once in December 2013 with that month being unusually high in any year due to a tradition of year-end bonuses. By December 2019, the wage had fallen back to $600-$800 in any given month.

We assume the real wage is a good measure of district labor productivity in the aggregate and for individual sectors. Annual rayon data 2010-2021 are available for the average monthly wage and labor force across sectors which serves to control for varying output mix across rayons. All ruble values are converted to 2019 rubles using the Rostov region's annual CPI with 2019 chosen as the base year because it was the last year before the pandemic. A given district's aggregate (across all sectors) real average monthly wage is the overall rayon labor productivity. To capture potential labor market disruption we consider three time periods: 2010-2013 (pre sanctions and Ukrainian incursion), 2014-2019 (sanctions, Ukrainian incursion but no pandemic), 2014-2021 (sanctions and pandemic). Like other papers, we have no way of separating out a lower oil price effect from sanctions, so though we use the term "sanctions" we acknowledge that a lower oil price negatively impacting the economy could also be involved. Unfortunately, Rostov region statistics at the local level abruptly disappear after Feb. 2022 so it is not possible to include the current wartime period with martial law just declared in Rostov region in late 2022.

3. *The Method*

The method consists of two stages with the first being a shift-share analysis the results of which are in the second stage used as the dependent variable in OLS regressions to control for time invariant rayon characteristics potentially influencing labor productivity. Shift-share analysis decomposes labor productivity into an intra-sectoral (within effect) and structural change (inter-sectoral) effect. We fit the model found in Fontanari & Palumbo (2022) that they applied to the United States. Structural change is further separated into a static sectoral effect due to the varying weight of sectors with different levels of productivity and a dynamic effect due to the varying weight of sectors with different growth rates of productivity. The equation is:

1) $[LP_t - LP_0]/ LP_0 = \sum_{i=1-6} \{[(s_{i,0} \text{ x } delLP_{i,t})/ LP_0] + [(LP_{i,0} \text{ x } dels_{i,t})/ LP_0] + [(delLP_{i,t} \text{ x } dels_{i,t})/ LP_0]\}$

LP is labor productivity (annual average monthly wage in 2019 rubles) either in the aggregate or for a given sector "i". "s" is the share of each sector in total employment in a given rayon and year. "del" represents the change in a variable between the initial year (e.g. 2010) and the final year of a period (e.g. 2013). The first term represents productivity gains due to improvements internal to a given sector. The second term represents aggregate average productivity gains due to labor reallocation towards sectors with higher levels of productivity. The third term represents changes in aggregate productivity due to labor reallocated towards sectors with faster productivity growth. The null hypothesis is that though the base period 2010-2013 performance might be quite like later periods in rural Rostov in general, the border area (direct and extended) will be different than the other rayons.

Once the three terms are calculated on the right-hand side, we can compare their impact on the total labor productivity change in percentages. Each of the three right hand terms can contribute positively or negatively to productivity change so a given effect exhibiting more than 100% is possible when the other two effects are negative. An overall negative structural change effect (the combined effect of the last two terms on the right-hand side) is interpreted as a re-allocation of labor towards less productive sectors which Fontanari & Palumbo (2022) argue has occurred in the United States 2010-2018. Though the absolute numbers are interesting, we are more interested in how the signs and relative within/structural effects percentages change over the sample period. Unfortunately, data limitations make a sector-by-sector analysis to discover leading and lagging sectors purely speculative.

Stage two uses the within and decomposed structural change percentages as dependent variables in an OLS regression where various time invariant factors that influence relative labor productivity are on the right-hand side.

2) $SSPer_{,i,t} = \alpha_t + \beta_t \cdot X_i + v_{i,t}$

Here "i" refers to the 42 rayons and "t" refers to one of the three time periods examined. "SSPer" is one of the three shift share percentages derived in stage one (within percentage, static structural percentage, and dynamic structural percentage). "X" is a vector of time invariant characteristics of individual rayons. One characteristic is the ability of a rayon to produce aggregate output using capital and labor which, as no direct measure of output at this level of disaggregation is produced by Rosstat, is proxied by the amount of 3-year average technical efficiency found across Rostov rayons 2013-2015 (Brock, 2019). The technical efficiency index is derived from a stochastic frontier production function method with details of its application to Rostov including how a proxy rayon aggregate output value is created found in Brock (2015). A second characteristic is the percentage of roads in a rayon that are below standard usually meaning they are unpaved or are paved but in poor condition. Russian roads are notoriously bad and in Rostov Oblast the percentage is highly and positively correlated with the percentage of a rayon's households that do not have access to centralized natural gas so it is a good proxy for relative underdevelopment in general not just roads. A third characteristic is the distance the rayon capital is to a federal road to control for how isolated the rayon is from the mainline transportation network within the region. A fourth characteristic is a dummy variable equal to one if the rayon is in the extended border area and zero otherwise. A second set of regressions is run with the dummy variable equal to one only for the nine rayons directly on the border with Ukraine and all other variables the same. Finally, a fifth element is the stock of human capital of a rayon at the start of the sample period proxied by the percentage of people 15 years and older with secondary education per one thousand residents in 2010. This variable is from a household survey and is unavailable for other years in the sample. We compare the base period with 2014-2019 and 2014-2021. The regression is therefore a multivariate analysis of several time invariant variables impact on a shift-share percentage.

4. Results

Total labor productivity is positive in all districts and time periods except the outlier Sovetskiy rayon after 2013 (Table 2).[2] The mean aggregate labor productivity rises over the three periods from 0.22 - 0.271 - 0.309. Both the border area mean and extended border area mean are similar and well within one standard deviation of the overall mean. The base year aggregate labor productivity is highly (0.42) and positively correlated with the later periods meaning a rayon with relatively higher labor productivity maintains the difference over the sample period. All the rayons on the immediate border area have higher aggregate labor productivity over the three time periods with several having much higher labor productivity 2014-2021 that even exceeds the 2014-2019 period.

Leading rayons also maintain a higher level of strong performance using the within component which has an even higher and positive (0.65) correlation with the within component in the other two periods. The structural change component is just the opposite with a negative correlation (-0.35) meaning rayons with higher internal sector improvements in the base period exhibited relatively lower inter-sectoral improvements after 2013. There was a re-allocation of labor towards less productive sectors. As the structural change is decomposed into static and dynamic, we find the negative correlation value is driven by the static component (-0.42) value and not the dynamic (-0.15) though both are negative. The inter-sectoral experience across rayons is therefore different 2014-2019 and 2014-2021 compared to 2010-2013.

Looking more closely at the values, the within change always dominates structural change in a district and time period except Oktyabr'skiy rayon 2014-2021. The total structural change effect was negative for twenty-seven rayons 2010-2013, but only for fourteen rayons 2014-2019 and 22 rayons 2014-2021. Inter-sectoral structural change contributed more to aggregate labor productivity after 2013 but may have been negatively (14 rising to 22) influenced by the pandemic. Within the structural change component, the ratio of negative static structural change to dynamic structural change rayons was 24/26 in 2010-2013, 14/16 in 2014-2019 and 24/20 in 2014-2021. The number of rayons that had static and dynamic with opposite signs is almost constant (12-2010 to 2013; 9 – 2014-2019; 13 – 2014-2021). Therefore, much of the 2014-2021 period in terms of values is characterized as being quite similar to 2010-2013.

Using the total labor productivity value as 100%, we can also examine the percentage

contribution of each component and how correlated the cross-rayon percentages are (Table 3). In 2014-2019 and 2014-2021, the cross-rayon within percentage rates is highly and positively correlated (0.67). However, the within percentage rates in the base period are highly and negatively correlated (-0.4) with both later periods. While the same is true for both the overall structural and static structural percentages, the dynamic structural percentage is unrelated (-0.11) to the within in the base period. Rayons with relatively high within and overall structural change in the base period driving up labor productivity had the relatively lowest changes after 2013. Looking at the mean percentages across the three periods and groups (Table 4), there is substantial change after 2013. While all the overall structural change and decomposition (static and dynamic) percentages are negative in the base period, only one of them is in 2014-2019. Adding in the two pandemic years, these percentages remain positive except for the overall sample ones that become negative again though with lower values. This longer period also exhibits many more rayons (18) having a dynamic component larger than or equal to the static component than 2014-2019 (only 12 rayons) suggesting the pandemic increased the importance of dynamic structural change in rural Rostov Oblast. In particular, nine rayons (Kagal'nits, Kamen, Kashar, Oktyabr, Rod.-Nesvetai, Tarasov, Tselin, Chertkov) with the biggest improvements in higher aggregate labor productivity 2014-2021 than 2010-2013 also had their highest dynamic structural change level in 2014-2021 indicating that those rayons where labor was more re-allocated towards high productivity growth sectors were rewarded with higher overall labor productivity growth.

The border districts in particular exhibit a large drop in the positive within contribution and a new positive and substantial contribution from the structural component. The extended border area also shows this change but with lower values. Once 2020-2021 are added in, the border area and extended border area are quite similar in these percentage terms. The border area structural improvement was much greater than the region overall with labor reallocated toward more productive sectors in terms of both levels and growth of productivity. By the end of 2021, the improvement continued but was not as strong and now resembles the extended border area with both areas showing improvement though the overall sample means now has negative values.

Regression results (Tables 5-7) with one exception discussed below have overall R-square values around 0.2 using robust standard errors and a constant sample size of 42 rayons. Comparing the within percent results across time and varying border dummy variable (Table 5), we find in the base period the further a rayon is from a federal highway, the less of a contribution intra-sectoral labor productivity (within) makes to overall labor productivity regardless of which time period or border dummy variable is controlled for. However, only in the base period using an extended border dummy is the coefficient statistically significant. In relatively less developed (using bad roads as a proxy) rayons, less developed rayons have a relatively higher contribution of within allocation in the base period but the reverse is true after 2014 though the statistical significance is quite low. Human capital also switches signs after 2014 meaning rayons with higher 2010 levels of human capital exhibit lower within labor allocation though there are no statistically significant coefficients. The technical efficiency index is statistically insignificant and negative in all regressions through 2019 but becomes positive 2014-2021 using either border dummy variable. As the main shock to the economy 2020-2021 was COVID, we interpret this sign switch as COVID changing the rural economy enough so those rayons that were relatively technically efficient 2010-2013 now exhibit improved labor allocation within sectors and since the within component is the dominant factor in improve aggregate labor productivity there is a positive association with efficiency as well. Looking specifically at the border dummy variable, the extended border dummy coefficient is always negative indicating this area has lower within values than other rayons.

However, the direct border area dummy shows a sign reversal and becomes statistically significant and negative 2014-2019 and remains negative 2014-2019. There is evidence of an immediate border effect but not for the extended border area. The Ukraine incursion and refugee situation switched these rayons from having relatively higher within labor productivity values to relatively lower labor productivity values which, in turn, would reduce aggregate labor productivity overall.

With the level of negative static structural change reduced by almost 50% (27 rayons to 14 rayons) between 2010-2013 and 2014-2019 and then rising again with the inclusion of 2020-2021 (22 rayons), analyzing the influence of time invariant rayon characteristics (Table 6) is particularly important during this decade. Being in the direct or extended border area increases a rayon's relative static structural change value except in 2010-2013 on the immediate border.[3] The border dummy variable signs using either border definition are the opposite of the within dummy coefficient signs with the 2014-2019 direct border dummy statistically significant. After 2014 human capital and a lower level of development are associated with a higher static structural value. Further distance from federal highways also increases the value. By 2014-2021 higher technical efficiency reduces labor being allocated to sectors with higher productivity levels unlike 2010-2013 and 2014-2019. Like within results, the main impact of the two pandemic years is a switching sign on the technical efficiency index coefficient but in addition the overall explanatory power (R-squared) of the two 2014-2021 regressions is substantially reduced.

Regressions with dynamic structural change as the dependent variable using either border definition are in Table 7. Being in either area enhances the relative value of a rayon's re-allocation of labor towards sectors with higher productivity growth in any time period. The extended border dummy coefficient is statistically significant 2010-2013 as is the direct border dummy coefficient 2014-2019. Human capital and road quality have the same coefficient signs across time periods as the static structural results in Table 6 with both becoming positive after 2014. Distance to federal highways while having a positive and even statistically significant coefficient in the 2010-2013 regression using the extended border area dummy changes to having no impact using either border definition by 2014-2021. The technical efficiency index coefficient switches sign twice unlike within and static structural results. The overall fit for the direct border area regression 2010-2013 is very low (0.049) but then improves to levels found in other regressions after 2014. As dynamic structural change is important to increase aggregate labor productivity across rayons and time periods, a rayon in either border area is relatively more likely to experience positive dynamic change *ceteris paribus.* Structural changes revealed by shift-share analysis therefore support the idea of the border rayons being different than the others in any time period.

Conclusions

Labor productivity and real wages in rural Rostov Oblast districts increased steadily 2010-2021. In dollar terms, the monthly wage varies from $400 to $1000 across districts and between 6 (Agriculture & Fisheries, Retail & Wholesale Trade, Real Estate, Government Administration and Military Security, Education, Health and Social Services) sectors of the region's economy which does not have many large industrial firms or mineral resources (World Bank, 2006). Using the sector-by-sector wages and the overall monthly wage for each district, intra-sectoral labor allocation dominates inter-sectoral labor allocation as the main source of aggregate labor productivity growth across three time periods. Some evidence was found that the direct border area that contains a time invariant 22% of the overall labor force and was disrupted by the Ukrainian 2014 incursion, in-migration and sanctions has a labor productivity experience different than other rayons. This is so even when descriptive statistics such as mean wages and labor force shares don't show differences. The slowdown in aggregate labor productivity growth like other countries is due to lower intra-sectoral or within productivity growth for Rostov's rayons which is likely to continue given the needed investment and human capital inputs to improve productivity within sectors will be much harder to come by with the international isolation of Russia.

Looking at inter-sectoral structural change, districts 2010-2013 that had relatively positive values switched to having relatively negative values 2014-2019. In the latter period, both a border and extended border area exhibited labor being allocated toward sectors with higher productivity levels and growth unlike the other districts where labor continued to be allocated away from the relatively high productivity sectors as in 2010-2013. Using an OLS regression to control for factors such as infrastructure, human capital and technical efficiency, the border area districts across the entire period 2010-2021 exhibit more positive labor allocation towards higher productivity than other districts. A comparison of 2014-2019 relative to 2014-2021 found some evidence for the two pandemic years exhibiting changing labor productivity of districts especially some of those on the border with higher dynamic structural change instead of within change.

Further research will hopefully examine the war impact on Rostov Oblast should the data ever be made public. As the region is not as industrialized as many other regions, the impact of deindustrialization should the Russian economy be forced into a long overdue fundamental restructuring away from oil and gas as the war continues will not be as influential on the labor market as a typical region. The migration from Ukraine 2014-2021 to Rostov's cities needs to be analyzed as well. Regional government initiatives 2010-2021 to promote investment and attain UN sustainability goals must have suffered a substantial setback with Russia's 2022 isolation but even before Feb.

2022 appear to not be improving the rural labor market. More studies of cross-district economic performance up to 2022 are also called for to provide a basis for understanding the impact on the local Russian economy of the Ukrainian war in the future.

Notes:

1. See Table 2 for the names of the districts in each of the three areas.
2. Sovietskiy rayon is in the northeast area of the region and unlike the other rayons has less reported wage and labor data across the six sectors. It also has a very small labor force overall of less than 1000. We therefore omit this rayon from further analysis giving a sample of 42 rayons.
3. Of course in the shift-share equation the *overall* structural change value and within value can be highly correlated in absolute value constrained by the total change level, but here we are only looking at the two sub-components of structural change separately so this reciprocal relationship isn't subject to that constraint.

References

Alexeev, M. & Kurlyandskaya, G. (2003). Fiscal Federalism and Incentives in a Russian Region. *Journal of Comparative Economics*, 31(1), 20-33.

Antonov, E.V. (2019). Development and Current State of Labour Markets in Russia. *Population and Economics*, 3(1), pp. 75-90.

Brock, G. (2015). The Informal Economy of Rostov Oblast on the Eve of the Ukrainian Refugee Crisis. *Journal of Policy Modeling,* 37(5), 789-803.

Brock, G. (2019). A Remote Sensing Look at the Economy of a Russian Region (Rostov) Adjacent to the Ukrainian Crisis. *Journal of Policy Modeling*, Vol. 41(2), 416-431.

Chibilev, A.A., Petrishchev, V.P., Kosykh, P.A., Levykin, S.V. (2019). Cluster-Based Differentiation of the Socioeconomic Development Level for Municipal Units in the Steppe Regions of European Russia, *Regional Research of Russia*, 9(2), pp. 181-192.

Denisova, G. (2014). Modern migration trend in the South of Russia: A new challenge? *The Russian Academic Journal*, *29*(3), 60–64.

Fontanari, C. & Palumbo, A. (2022). Permanent Scars: The Effects of Wages on Productivity. Working Paper #187. Institute for New Economic Thinking. New York, NY USA.

Grazhdaninova, M. and Brock, G. (2004). Grain and Sunflower on Russian Farms in 2001: How Efficient is Crop Production? *Post-Communist Economies*, 16(3), 297-306.

Gorochnaya, V. and Mikhaylov, A. (2020) "Spatial Configuration of Rostov Agglomeration in Southwestern Russia – Territorial, Demographical and Functional Dynamics," *Human Geographies – Journal of Studies and Research in Human Geography*, 14(2), 301-320.

Iwasaki, I. and Kim, B-Y. (2018). Firm Failure in Russia During Economic Crises and Growth:
A Large Survival Analysis. Working Paper Series No. 76. Russian Research Center, Institute of Economic Research, Hitotsubashi University, Kunitachi, Tokyo, JAPAN.

Kosareva, N. and Polidi, T. (2017). Assessment of Gross Urban Product in Russian Cities and its Contribution to Russian GDP in 2000-2015. *Russian Journal of Economics*, 3, pp. 263-279.

Kluge, J.N. & Libman, A. (2017). Sticks or Carrots? Comparing Effectiveness of Government Shadow Economy Policies in Russia. IOS Working Paper #364, Institute for East and Southeast European Studies, Regensburg, FRG.

Kolechkov, D. V. (2014). Gross Municipal Product in Economic Management (through the example of the Komi Republic). *Studies on Russian Economic Development*, *25*(5), 523–528.

Li, Y., Zhang, P., Lo, K., Tan, J. and Yang, Q. (2022). Borderland Economic Resilience under of COVID-19: Evidence from China–Russia Border Regions, *International Journal of Environmental Research and Public Health*, 19, 13042, https://doi.org/10.3390/ijerph19201304

Mikhaylova, A. and Gorochnaya, V. (2022). Spatial Scale of Urban Agglomeration Externalities on the Rostov Region in Russia, *Regions & Cohesion*, 12(1), pp. 78-101.

O'Neal, M. (2016). The Rostov Region: Limits of Patrimonial Exchange. in Democracy, Civic Culture and Small Business in Russia's Regions: Social Processes in Comparative Historical Perspective, New York: Routledge (Taylor & Francis Group).

Panshin, I.V., Markhaichuk, M.M. and Yares, O.B. (2019). Interregional Labor Migration as a Tool to Increase Regional Labor Productivity: The Case of Russia, *International Journal of Economics and Business Administration*, 7(1), pp. 125-137.

Patrakeeva, O.Yu. and Kryukov, S.V. (2016). System-Dynamic Model of Regional Economy: The Case of Rostov Oblast, *Studies in Russian Economic Development*, 27(3), pp. 286-290.

Pravitel'stvo Rostovskoy Oblasti. (2014). *O raspredelenii grantov gorodskim okrugam I munitsipal'nym raionam v 2014godu (Concerning the distribution of grants to cities and raions in 2013)*. Decree No. 483. October 10 Rostov Governor's Office: Rostov-on-the-Don.

Rosstat-Rostov (2021). Rostovskaya Oblast' – Dvizhenie K Tselyam Ustoychivovo Razvitiya: 2016-2020 (Rostov Region – Moving Towards Sustainable Development Goals: 2016-2020), In Russian. Regional Dept of Rosstat Located in Rostov Oblast. Rostov-on-the-Don, Rostov Region RUSSIA.

Sensier, M. and Artis, M. (2016). The Resilience of Employment in Wales: Through Recession and into Recovery, *Regional Studies*, 50(4), pp. 586-599.

Voskoboynikov, I.B. (2023). Sources of Productivity Growth in Eastern Europe and Russia Before the Global Financial Crisis. *Journal of Productivity Analysis*, http://doi.org/10.1007/s11123-023-00662-7.

World Bank (2006). Housing Production Challenges in Rostov Oblast,' World Bank: Moscow-Rostov-on-Don.

Zotova, M.V., Gritsenko, A.A., and von Lowis, S. (2021). Friends or Foes? Changes in Cross-Border Practices and Attitudes Toward Neighbors Along the Russian-Ukrainian Border After 2014. *Etnograficheskoye Obozreniye*, 1, pp. 124-44. http://journal.iea.ras.ru.

Table 1. Descriptive Statistics Comparing Border Area District Averages with other Districts

	Years	**Border (9 districts)**	**Extended Border (15 districts)**	**All (42) Districts**
Average Labor Force	2010-21	61117	112722	264183
Average Real Monthly Wage (2019 rubles)	2010-21	24659	24879	24098
Distance of District center to a federal road (km)	any	23.9	23.8	82
Percentage of Below Standard Roads	2010-21	52	50	47
Average Technical Efficiency Index	2010-13	0.66	0.63	0.64
# 15 years and older with Secondary Ed. Per 1000 residents	2010	218	223	222

Note: Education is from a 2010 survey of the population, TE Index from Brock (2015)

Table 2. Shift-share Values of Districts 2010-2021

(bold = extended border area, bold and underlined = border area)

	2010-2013					2014-2019				
	Within	Struct.	S.Static	S.Dyn.	Total	Within	Struct.	S.Static	S.Dyn.	Total
Azov	0.31	0.0067	0.0034	0.0032	0.31	0.27	-0.106	-0.055	-0.051	0.16
Aksai	0.20	0.0300	0.0358	-0.0058	0.23	0.24	-0.135	-0.084	-0.051	0.10
Bagaev	0.28	-0.1471	-0.1205	-0.0265	0.14	0.23	0.109	0.078	0.030	0.34
Belokalitvin	0.16	0.0074	0.0063	0.0011	0.17	0.19	-0.063	-0.039	-0.024	0.12
Bokov	0.29	-0.0469	-0.0446	-0.0024	0.24	0.31	0.007	0.010	-0.003	0.32
Verkhnedon	0.28	-0.0347	-0.0282	-0.0064	0.25	0.25	0.048	0.028	0.020	0.30
Veselov	0.29	-0.0376	-0.0235	-0.0142	0.26	0.29	0.006	-0.001	0.007	0.30
Volgodon	0.28	-0.0041	0.0004	-0.0045	0.28	0.32	-0.008	-0.004	-0.004	0.32
Dubov	0.29	0.0022	0.0089	-0.0067	0.29	0.29	0.038	0.010	0.028	0.33
Egorlyk	0.23	-0.0418	-0.0343	-0.0075	0.19	0.26	0.033	0.023	0.011	0.29
Zavetin	0.30	0.0365	0.0188	0.0176	0.34	0.26	0.061	0.042	0.019	0.32
Zernograd	0.25	0.0003	-0.0004	0.0007	0.25	0.33	-0.032	-0.022	-0.010	0.30

Zimovnikov	0.21	-0.0243	-0.0280	0.0037	0.18	0.30	0.003	0.008	-0.005	0.31
Kagal'nits	0.24	-0.0420	-0.0357	-0.0064	0.20	0.27	0.120	0.113	0.007	0.39
Kamen	0.13	-0.0714	-0.0815	0.0100	0.06	0.13	0.073	0.044	0.029	0.21
Kashar	0.30	0.0168	0.0076	0.0093	0.31	0.40	0.088	0.041	0.046	0.49
Constantinov	0.30	0.0219	0.0185	0.0034	0.32	0.24	-0.054	-0.025	-0.030	0.19
Krasnosulin	0.16	-0.0401	-0.0259	-0.0143	0.12	0.13	0.048	0.035	0.013	0.18
Kuibyshev	0.27	-0.0030	-0.0069	0.0039	0.26	0.29	0.029	0.026	0.002	0.32
Martynov	0.28	0.0020	0.0024	-0.0004	0.28	0.28	-0.006	-0.005	-0.001	0.28
Mat.-Kurgan	0.24	0.0238	0.0161	0.0077	0.27	0.28	0.019	0.013	0.007	0.30
Millerov	0.16	0.0291	0.0280	0.0012	0.19	0.19	0.021	0.020	0.001	0.21
Milyutin	0.30	-0.0511	-0.0460	-0.0051	0.25	0.41	-0.073	-0.028	-0.046	0.34
Morozov	0.27	-0.0540	-0.0241	-0.0299	0.21	0.20	-0.042	-0.024	-0.018	0.16
Myasnikov	0.32	-0.0474	-0.0494	0.0020	0.27	0.32	0.047	0.045	0.001	0.37
Neklinov	0.22	0.0216	0.0172	0.0044	0.24	0.35	0.037	0.031	0.006	0.39
Obliv	0.36	-0.0881	-0.0609	-0.0271	0.27	0.31	0.038	0.021	0.017	0.35
Oktyabr	0.17	-0.0110	-0.0097	-0.0014	0.16	0.13	0.060	0.046	0.014	0.19
Orlov	0.21	-0.0950	-0.0702	-0.0248	0.11	0.23	0.061	0.045	0.016	0.29
Peschanokop	0.29	-0.0287	-0.0163	-0.0124	0.26	0.36	-0.013	-0.003	-0.010	0.34
Proletar	0.24	-0.0238	-0.0180	-0.0057	0.22	0.30	-0.002	-0.006	0.004	0.29
Remontnen	0.27	-0.0050	0.0000	-0.0050	0.26	0.25	0.014	0.013	0.001	0.26
Rod.-Nesvetai	0.23	-0.0899	-0.0731	-0.0168	0.14	0.24	0.004	0.019	-0.014	0.25
Sal'skiy	0.16	0.0014	-0.0018	0.0032	0.16	0.19	0.011	0.009	0.002	0.20
Semikarakor	0.15	-0.0089	-0.0104	0.0015	0.14	0.19	0.007	0.004	0.003	0.20
Tarasov	0.21	-0.0634	-0.0489	-0.0145	0.15	0.17	0.059	0.028	0.030	0.23

Table 2. Continued										
(bold = extended border area, bold and underlined = border area)										
	2010-2013					2014-2019				
	Within	Struct.	S.Static	S.Dyn.	Total	Within	Struct.	S.Static	S.Dyn.	Total
Tatsin	0.20	-0.0894	-0.0670	-0.0225	0.11	0.17	-0.001	-0.017	0.016	0.16
Ust'-Donetsk	0.19	0.0458	0.0156	0.0301	0.24	0.30	-0.040	-0.013	-0.027	0.26
Tselin	0.30	0.0136	0.0139	-0.0003	0.31	0.42	0.003	0.006	-0.003	0.42
Tsimlyan	0.17	-0.0572	-0.0450	-0.0122	0.11	0.17	0.015	0.015	0.000	0.19
Chertkov	0.25	-0.0163	-0.0119	-0.0044	0.24	0.25	0.010	0.008	0.002	0.26
Sholokhov	0.22	0.0103	0.0057	0.0046	0.23	0.17	0.011	-0.001	0.012	0.18
Mean	0.242	-0.0227	-0.0187	-0.0040	0.22	0.259	0.01201	0.0109	0.0011	0.27
Std Dev.	0.056	0.0422	0.0338	0.0120	0.069	0.074	0.05153	0.0339	0.02112	0.08

Table 3. Shift-share Percentages (of Total Value) of Districts 2010-2021

(bold = extended border area, bold and underlined = border area)

	2010-2013				2014-2019			
	Within	Struct.	S.Static	S.Dyn.	Within	Struct.	S.Static	S.Dyn.
Azov	98	2.1	1.10	1.03	165	-64.7	-33.39	-31.33
Aksai	87	13.3	15.86	-2.59	232	-132.1	-81.75	-50.38
Bagaev	208	-107.8	-88.36	-19.45	68	32.2	23.22	9.02
Belokalitvin	96	4.4	3.78	0.65	152	-51.9	-32.29	-19.58
Bokov	120	-19.5	-18.54	-0.98	98	2.3	3.19	-0.94
Verkhnedon	114	-14.0	-11.37	-2.59	84	16.0	9.40	6.59
Veselov	115	-14.6	-9.13	-5.51	98	2.0	-0.29	2.30
Volgodon	101	-1.5	0.16	-1.61	103	-2.6	-1.35	-1.22
Dubov	99	0.7	3.04	-2.29	88	11.7	3.17	8.54
Egorlyk	122	-22.4	-18.43	-4.01	88	11.6	7.82	3.78
Zavetin	89	10.7	5.55	5.20	81	19.3	13.33	6.01
Zernograd	100	0.1	-0.15	0.28	110	-10.4	-7.12	-3.32
Zimovnikov	113	-13.2	-15.24	2.02	99	0.9	2.70	-1.76
Kagal'nits	121	-20.9	-17.76	-3.16	69	30.8	28.95	1.84
<u>**Kamen**</u>	227	-127.1	-144.99	17.85	65	35.2	21.33	13.85
Kashar	95	5.4	2.41	2.95	82	17.9	8.40	9.48
Constantinov	93	6.7	5.71	1.04	129	-29.1	-13.14	-15.92
<u>**Krasnosulin**</u>	135	-34.7	-22.32	-12.33	73	27.1	19.76	7.31
<u>**Kuibyshev**</u>	101	-1.2	-2.61	1.46	91	9.0	8.32	0.67
Martynov	99	0.7	0.86	-0.14	102	-2.3	-1.93	-0.32
<u>**Mat.-Kurgan**</u>	91	8.9	6.04	2.88	93	6.5	4.29	2.26
<u>**Millerov**</u>	84	15.6	14.93	0.63	90	9.9	9.65	0.24
Milyutin	120	-20.5	-18.41	-2.05	122	-21.7	-8.19	-13.49
Morozov	125	-25.3	-11.32	-14.02	127	-26.9	-15.39	-11.49
Myasnikov	118	-17.7	-18.41	0.76	87	12.7	12.29	0.40
<u>**Neklinov**</u>	91	9.0	7.15	1.82	91	9.4	7.94	1.49
Obliv	132	-32.5	-22.46	-10.00	89	11.0	6.03	4.96
Oktyabr	107	-7.0	-6.10	-0.87	68	31.7	24.17	7.58
Orlov	183	-83.2	-61.44	-21.71	79	21.0	15.45	5.55
Peschanokop	111	-11.1	-6.32	-4.78	104	-3.7	-0.86	-2.84
Proletar	111	-10.8	-8.16	-2.60	101	-0.8	-2.12	1.29
Remontnen	102	-1.9	0.01	-1.90	95	5.3	5.05	0.22
<u>**Rod.-Nesvetai**</u>	164	-63.7	-51.77	-11.93	98	1.8	7.45	-5.67
Sal'skiy	99	0.9	-1.16	2.06	94	5.5	4.33	1.17
Semikarakor	106	-6.2	-7.24	1.02	96	3.6	2.19	1.38
<u>**Tarasov**</u>	144	-43.5	-33.59	-9.95	75	25.4	12.36	13.07

Table 3. Continued							
(bold = extended border area, bold and underlined = border area)							
	2010-2013			2014-2019			
	Within	Struct.	S.Static	S.Dyn.	Within	Struct.	S.Static	S.Dyn.
Tatsin	178.29	-78.29	-58.62	-19.68	100.56	-0.56	-10.16	9.60
Ust'-Donetsk	80.83	19.17	6.55	12.62	115.53	-15.53	-4.98	-10.56
Tselin	95.67	4.33	4.42	-0.10	99.35	0.65	1.44	-0.79
Tsimlyan	150.41	-50.41	-39.66	-10.75	91.93	8.07	8.10	-0.03
Chertkov	106.84	-6.84	-4.99	-1.85	96.30	3.70	3.08	0.62
Sholokhov	95.44	4.56	2.51	2.05	93.88	6.12	-0.66	6.78

Table 4. Cross-District Percentage Means 2010-2021 By Area								
	2010-2013				**2014-2019**			
	Within	Struct.	S.Static	S.Dyn.	Within	Struct.	S.Static	S.Dyn.
All Districts	117.4	-17.4	-14.7	-2.6	99.6	0.4	1.4	-1.0
Border Area	127.1	-27.1	-25.8	-1.3	85.8	14.2	10.5	3.8
Extended Border Area	118.0	-18.0	-17.4	-0.6	94.0	6.0	5.5	0.5

Table 5. Comparison Using Different Border Dummy Variables and the Within Percent Dependent Variable						
	2010-2013		2014-2019		2014-2021	
A. Extended Border Area Dummy						
	Coef.	T. stat	Coef.	T. stat	Coef.	T. stat
Constant	37.97	0.74	**207.43	2.49	**137.57	3.3
Ext. Border	-14.60	-1.23	-14.80	-1.35	-9.55	-0.88
HK	2.64	1.52	-2.73	-1.19	-1.55	-1.07
DistToFedRd	*-0.121	-1.79	-0.08	-1.62	-0.02	-0.36
BadRoads	*0.79	1.79	-0.25	-0.9	-0.29	-1.17
TechEffIndex	-0.02	-0.05	-0.37	-0.8	0.27	0.96
R sq.	0.20		0.19		0.14	
B.Direct Border Area Dummy						
	Coef.	T. stat	Coef.	T. stat	Coef.	T. stat
Constant	39.505	0.86	**205.5784	2.51	**137.078	3.25
Border	4.794	0.32	**-22.693	-2.25	-8.92	-0.75
HK	2.356	1.44	-3.033	-1.34	-1.74	-1.26
DistToFedRd	-0.069	-1.36	-0.077	-1.61	-0.01	-0.17
BadRoads	0.680	1.58	-0.234	-0.78	-0.30	-1.21
TechEffIndex	-0.032	-0.07	-0.259	-0.6	0.32	1.06
R sq.	0.173		0.236		0.14	
Note: *,**,*** is 10, 5, 1% significance level						

Table 6. Comparison Using Different Border Dummy Variables and the Static Structural Dependent Variable					
	2010-2013		2014-2019		2014-2021
A. Extended Border Area Dummy					
	Coef.	T. stat	Coef.	T. stat	Coef.
Constant	56.675	1.31	-67.358	-1.32	-18.65
Ext. Border	8.628	0.85	9.991	1.42	6.48
HK	-2.370	-1.65	1.644	1.19	0.68
DistToFedRd	0.093	1.56	0.048	1.5	0.02
BadRoads	*-0.723	-1.72	0.173	1.01	0.17
TechEffIndex	0.074	0.19	0.260	0.92	-0.16
R sq.	0.194		0.198		0.13
B.Direct Border Area Dummy					
	Coef.	T. stat	Coef.	T. stat	Coef.
Constant	55.118	1.42	-66.247	-1.31	-18.31
Border	-8.076	-0.54	**14.182	2.38	6.10
HK	-2.209	-1.59	1.846	1.35	0.81
DistToFedRd	0.053	1.25	0.044	1.49	0.01
BadRoads	-0.632	-1.6	0.168	0.92	0.18
TechEffIndex	0.102	0.27	0.191	0.72	-0.19
R sq.	0.191		0.236		0.12
Note: *,**,*** is 10, 5, 1% significance level					

Table 7. Comparison Using Different Border Dummy Variables and the Dynamic Structural Dependent Variable						
	2010-2013		2014-2019		2014-2021	
A. Extended Border Area Dummy						
	Coef.	T. stat	Coef.	T. stat	Coef.	T. stat
Constant	5.356	0.43	-40.075	-1.2	-18.915	-0.93
Ext. Border	**5.971	2.2	4.810	1.08	3.078	0.65
HK	-0.265	-0.6	1.088	1.11	0.867	1.16
DistToFedRd	*0.028	1.86	0.032	1.55	0.004	0.14
BadRoads	-0.070	-0.64	0.076	0.68	0.116	1.14
TechEffIndex	-0.051	-0.45	0.109	0.59	-0.114	-0.98
R sq.	0.121		0.159		0.135	
B.Direct Border Area Dummy						
	Coef.	T. stat	Coef.	T. stat	Coef.	T. stat
Constant	5.377	0.45	-39.332	-1.21	-18.7647	-0.89
Border	3.282	0.89	*8.511	1.89	2.8158	0.49
HK	-0.147	-0.33	1.187	1.25	0.9281	1.28
DistToFedRd	0.016	1.16	0.033	1.6	-0.0004	-0.02
BadRoads	-0.048	-0.44	0.066	0.54	0.1213	1.17
TechEffIndex	-0.070	-0.59	0.069	0.39	-0.1284	-0.98
R sq.	0.049		0.207		0.132	
Note: *,**,*** is 10, 5, 1% significance level						