Original Paper

Innovation-Export Diversification Nexus in Russian Regions: Does Trade Globalization, Business Potential and Geopolitics Matter?

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Abstract. Russia's regions exhibit a limited degree of export diversification, mostly due to the overwhelming dominance of hydrocarbon exports and their consequential impact on public income within the regions. Nevertheless, in light of the current geopolitical tensions and economic uncertainty, Russia is compelled to prioritize the diversification of its export. Amidst this backdrop, this study empirically scrutinizes whether innovation can to some extend augment export diversification of Russia's regions, substantiating the significance of factors such as trade globalization through Russia's WTO accession, regional-level business potential, and the economic ramifications of the 2014 sanctions. Data were collected for 66 Russian regions ranging from 2009 to 2019. Given the considerable heterogeneity in data across the regions and over the time period, this study applies the Method of Moments Quantile Regression (MMQR) to investigate the panel dataset. The major findings of this study reveal that innovation propels export diversification in the Russian regions under different macroeconomic scenarios, where the role of innovation is pivotal at the middle to highest quantiles. This study also observes that Russia's entry into the WTO platform propels innovation-led export diversification of the country. Additionally, this study observes a strong magnitude of innovation-export diversification dynamics in the Russian regions with high business potential. Moreover, this study finds that the economic sanction imposed in 2014 enforces export diversification through innovation in the Russian regions. The fresh insights that this research delivers might assist policymakers in adopting practical approaches to stimulate innovation within the private sector and foster export diversification in the Russian regions.

Key words: innovation; export diversification; trade globalization; WTO; geopolitics; sanction; business potential; MMQR, Russia.

1. Introduction

Russia enjoys a relatively small degree of export diversification since hydrocarbon dominates its export and government income. The Federal Tax Service of the Russian Federation reports that, as of January 2020, more than 65 % of Russian exports are fuel and energy products [1] a study was made of its implications for energy and the economy of Russia. The damage from the declining export of Russian fuel due to the acceleration of technological progress (TP.

Russia is a major exporter, but its global competitiveness is mostly based on its mineral wealth because of its low volume of innovation and high-tech export [2, 3]. However, current geopolitical tensions and economic volatility drive Russia to prioritize export diversification [4, 5].

Rozhkova & Karaseva [6] state that innovation can play a critical role in

boosting export diversification in Russia. Zemtsov et al. [7] state that the aftermath of sanctions increased Russia's reliance on innovation led economic diversity which eventually increased the innovation spending over the years. Several studies stress on the importance of innovation in improving different macroeconomic indicators. Innovations are seen as potential avenues for expediting recovery from the economic downturns by facilitating the implementation of transformative technical advancements. The standard for a robust economy is established via the dynamic imbalance resulting from the actions of the innovator-entrepreneur. Considering the importance of innovation in reducing the reliance on resource-based export earnings, Russian federation has recently improved their volume of innovation across the regions.

However, significant disparities exist in performance between and within the regions. Therefore, this study tries to investigate to what extent innovation promotes export diversification in the Russian regions under different economic scenarios.

The motivation for investigating the impact of innovation in strengthening export diversification in the Russian region is driven by some theoretical and empirical propositions.

First, existing literature documents that export diversification determines the direction of economic and structural change that regions encounter, with stronger growth resulting from increased manufacturing exports [8–11].

Balavac & Pugh [12] state that increased export diversity may lead to increased production while also lowering sensitivity to external shocks and macroeconomic instability.

Ngassam [13] proposes that export diversification significantly reduces reliance on a single export product and mitigates the hazards associated with export concentration. Russian export is highly concentrated on natural resources.

Rosstat, the Federal Statistics of Russia reports that, in 2019, the total exports from Russia were made up of 30.3 % crude oil, 16.3 % refined oil, and 6.46 % petroleum gas.

Barinova et al. [14] state that only around 15 % of Russia's net export is high-tech products. Besides, just 0.5 % of global high-tech exports come from Russia.

Lopez et al. [15] state that export diversification contributes to national economic well-being while innovation augments nations' global trade competitiveness [16].

Gokhberg et al. [17] state that despite receiving notable federal support, Russia's level of innovation is still significantly low.

Dutta et al. [18] state that Russia placed 45 out of 132 nations in the Global Innovation Index for 2021 indicating its insignificant engagement in innovative activities.

Amidst this empirical debate, this study intends to explore the degree of contribution of innovation in diversifying Russian export.

Second, prior studies find that accession to the WTO platform aids countries to augment trade diversification [19–21]. Export diversification deals with several bottlenecks like shortage of capital, barriers to trade, and unsystematic risks. WTO membership offers different measures to help members lessen those hurdles.

Beverelli et al. [20] find that WTO minimizes unsystematic risks of the exporters by facilitating diversification.

Gnangnon [22] states that WTO's "Aid to Trade" scheme reduces the trade barriers for developing countries through negotiations. Moreover, the "Trade facilitation" initiative of the WTO remarkably reduces the trade costs of the exporters [23]. Russian accession to the World Trade Organization (WTO) has been a vital step for diversifying export in its regions.

Connolly [24] states that WTO membership might increase competitiveness in the Russian economy, encouraging economic modernization, meaning reducing the country's reliance on commodity-based trade. This resource-based status quo, however, doesn't appear to be the path to Russia's long-term economic development. Connolly [24] argues that WTO membership can contribute to Russia's economic modernization by providing transparent conditions for trade and opportunities for investment. Eventually, this economic modernization can ensure trade diversification in the country. This study sees that extant studies offer convincing arguments regarding the role of WTO in the context of export diversification in the Russian Federation.

However, there has been no substantial empirical study that describes the role of WTO membership in the context of the innovation-export diversification nexus of the Russian regions. Therefore, this study endeavors to investigate if WTO membership has any influence on the innovation-led export diversification of the Russian regions.

Third, a credible investment climate is one of the major prerequisites to promote innovation and export diversification. The development of new export requires long-term investments in innovative projects.

Freeman et al. [25] state that export diversification requires significant investment to set up new technologies for product modification, distribution networks, and explore overseas markets. Besides, exporting companies need to maintain liquidity to bear the initial costs i. e., market research, information collection, and documentation. Financial institutions provide loans to those exporters as working capital or other financial instruments to mitigate exporters' financial constraints [26]. However, banks are typically risk averse and they provide loans based on the investment potential of the lending firms.

Gulzar et al. [27] argue that banks tend to invest in low-risk projects due to their inherent risk-averse attitude. Russian regions experience high levels of economic and financial disparities. Therefore, attracting investment for export diversification for the companies depends largely on the investment climate of the regions they are located.

Tagoe et al. [28] using six case studies. Its findings, which confirm and extend the conclusions of previous studies, are integrated into a framework that explains the impact of FSL and the factors at work. The main financial challenge facing SMEs is access to affordable credit over a reasonable period. This is determined by the financing needs of SMEs and the action of investors. SME financing needs reflect their operational requirements, while the action of investors depends on their risk perception and the attractiveness of alternative investment (which affects their willingness to investstate that the business potential of the regions is shaped by strong public debt management, healthy macro-economic indicators, available access to collateral, corporate governance, and investor relations.

Alexandrov et al. [29] argue that the region's existing social, economic, and political circumstances constitute a business environment in which certain projects are deemed to be favorable for investment. Banks promote growth and diversity by facilitating businesses with the necessary finances, but they examine the industry's economic scenario, business prospects, and its position in the regional and national economy before granting loans.

Considering the disparities in the investment potentials of Russian regions and the skeptical nature of banks in financing innovative projects it is prevalent to study the dynamics of innovation and export diversification under the preview of regional business potential of the Russian regions.

Fourth, economic sanctions are increasingly being used by powerful nations

to force policy changes and demonstrate the intention to criticize transgressions of international rules. Several studies suggest that sanctions restrict the regular flow of trade and hinder economic growth [30–32]. The Russia-Ukraine conflict began in March 2014 and prompted Western countries to impose economic sanctions on the Russian Federation which substantially impacted the Russian economy [33–35].

Davis [36] states that sanctions largely affected Russian trade since they restricted Russia's access to international funding, including government and private sector loans, as well as FDIs. Besides, western sanctions contributed to a reduction in oil prices, further straining the Russian budget and depreciating the ruble [37]. Meanwhile, some of the existing literature argues that sanctions affect target economies in the short run only. In the long run, countries can find newer markets and diversify trade in those new marketplaces.

Early & Peksen [38] argue that exporting countries under sanction can transfer their trade to neighboring countries that have economic networks with the sanctioning countries.

Shakib et al. [39] propose that to tackle the complicated geopolitical situation, the imposition of sanctions, and the volatility of prices for the main export goods, resource-rich countries like Russia might take advantage of export diversification.

Motivated by this debate, this study aspires to explore the effect of sanctions on the innovation-export diversification relationship of the Russian regions.

The aforesaid motivational arguments disclose that prior studies explored the dynamics of the innovation-export diversification from several macroeconomic fronts. However, very few studies considered studying the response of export diversification with regard to innovation in the Russian regions. *This study establishes* its core research objective to assess the role of innovation in promoting export diversification in regional Russia. *This study also aims* at discovering the impact of trade globalization, business potential, and sanctions in promoting export diversification through innovation in Russian regions.

This study develops the following *research hypotheses*:

H1: Innovation augments export diversification in Russian regions.

H2: WTO accelerates export diversification in Russian regions through innovation.

H3*: Regional business potential influences innovation-export diversification nexus in Russia.*

H4: Western Sanctions positively affects innovation-export diversification nexus in Russian regions.

In this regard, this study considers data for Gross Regional Product per capita and total number of patents of the 66 Russian regions from 2009 to 2019. This study applies a modern econometric technique like the Quantiles via moments (MMQR) proposed by Machado and Silva [40] to address regional heterogeneity and potential endogeneity in the finance-economic growth relationship.

The originality of this research establishes the proposition that innovation positively spurs export diversification in the regions of Russia. Moreover, this study deserves profound academic attention because it reveals fresh intuitions regarding the influence of trade diversification, business potential, and sanctions in measuring the role of innovation in export diversification of market economies.

From the novelty perspective, this study contributes to the existing literature that focuses on the dynamics of innovation-export diversification from several aspects.

First, to the best of my knowledge, this study is the first to investigate the effect of innovation on export diversification in the context of Russian regions under different

macroeconomic scenarios like trade globalization, investment potential and geopolitics.

Second, the main estimation results report that innovation tangibly contributes to export diversification in the Russian regions where the role of innovation is more pronounced in the middle and highest quantiles (moderate to most concentrated regions).

Third, this study discloses that Russia's participation in WTO platform augments innovation-led export diversification of the country.

Fourth, this study observes a strong magnitude of innovation-export diversification dynamics in the Russian regions with high business potential.

Fifth, this study reveals that the economic sanction imposed in 2014 significantly enforces export diversification through innovation in the Russian regions.

Moreover, from the control variables perspective, the findings of this study shows that Gross Regional Product per capita, employment, and natural resource rent adversely affect Russian export diversification. Innovation in Russian regions is yet to reach the height of any advanced economies. Russian innovation inarguably depends on the financial development of the country and policy formulation of the Russian government.

The remainder of this paper is organized as follows: In section 2 this study discusses the existing literature and derives the research hypotheses on the impact of innovation on export diversification in regional Russia under macroeconomic circumstances. Section 3 describes the data and variables, specification of model, and the method of econometric investigation. In Section 4 this study presents the investigation results and in section 5 a discussion regarding those results is presented. This study is concluded by providing some policy measures in section 6.

2. Literature Review

This section presents a theoretical and empirical underpinning about how innovation can affect export diversification under different economic circumstances. In the first subsection, this study discusses how innovation spurs export diversification. Then, this study discusses the role of WTO membership in export diversification through innovation. After that, this study discusses the importance of business potential for export diversification through innovation. Finally, this study discusses the impact of sanctions on innovation-export export diversity.

2.1. Innovation and Export Diversification

The growth theory suggests that the endogenous promotion impact of innovative development can drive economic growth without the need for external pressures [41]. As economic globalization progresses, innovation-driven exporting has an ever-greater role in driving economic expansion [42]. A growing body of research on the introduction of new exports at the national level stresses the significance of export diversification in lowering uncertainty, minimizing exchange rate volatility, and avoiding negative economic externalities [43].

Sarin et al. [9] state that export diversification can help economies to reduce inconsistencies in export earnings and drive economic growth.

Herzer & Nowak-Lehnmann [44] state that export diversification serves as a distribution mechanism to transfer profits from the resource-based industries to the other sectors of the economy, forming a steady future cashflow base and regional equity.

Alaya [45] proposes that export diversification leads to stable foreign exchange revenue, job creation, improved production capacity, and economic growth. Meanwhile, prior literature that discusses the drivers of

export diversification focuses on the significance of productivity and innovation for a successful entrance to the global export market landscape [46].

Melitz [47] finds that firms with greater productivity tend to export more than then firms that are less productive.

Bernard et al. [48] finds that exporting companies are more engaged in innovation than non-exporting companies.

Faiazova [49] finds innovation and export carries a synergetic association. She argues that innovations allow exporting firms to diversify their exports.

Song et al. [50] also find that innovation minimizes export concertation in China. However, some prior literature argues that there is no evidence of a significant relationship between innovation and export diversification [51]. Amidst these contrasting outcomes from the previous research, this study considers investigating the dynamics of the innovation and export diversification relationship in the Russian region on the basis of following hypothesis.

H1: Innovation augments export diversification in Russian regions.

2.2. Innovation and Export Diversification: The role of trade globalization

The World Trade Organization (WTO), the apex body of global trade affairs emerged in the 1990s with the agenda of promoting trade, minimizing barriers and conflict of international trade [52].

Rose [53] in his seminal work argues that WTO plays no significant role as the advocate of bilateral trade. Later, a good body of literature tried to corroborate or overrule his argument.

Subramanian & Wei [54] argue that WTO mostly benefits developed economies only.

Tomz et al. [55] argue that Rose [53] excluded many economies which were the de facto WTO members enjoying equal rights and responsibilities and such exclusion makes WTO's role in trade expansion biased.

Paul [56] finds that India imported more than double after getting the WTO membership while the effect of WTO membership on China's international trade is inconclusive and insignificant. Meanwhile, recent studies reveal that WTO membership works as a strong determinant for export diversification.

Felbermayr & Kohler [57] finds that WTO membership promotes export diversification by minimizing export risks arising from idiosyncratic shocks. Diversification of export requires product variation which requires some fixed costs for information acquisition, technology, and labor acquisition. Besides, trade and customs formalities are also considered fixed costs that the exporters must bear before exporting [58]. These fixed costs bar exporting firms to penetrate new markets and diversify their export [59]. However, the Trade facilitation scheme of the WTO remarkably reduces trade costs [23]. Such initiative significantly lessens exporters' fixed costs and creates new export avenues [60].

Dong [19] argues that trade facilitation also has an intensive and extensive margin effect on trade.

Dutt et al. [21] find that WTO membership improves the extensive margin of exports, meaning WTO membership significantly impacts the extensive margin of export trade.

Gnangnon [22] finds that the Aid for Trade program of WTO is favorable to export diversification, and scaling up this project might aid participating economies to diversify their products and integrate them into the international trade landscape.

Based on these academic shreds of evidence, this study tries to investigate the innovation-export diversification nexus corroborating the role of Russia's acces-

sion to WTO by framing the following hypothesis.

H2: WTO accelerates export diversification in Russian regions through innovation.

2.3. Innovation and Export Diversification: the role of business potential

Export diversification involves frequent product revitalization through innovation which requires firms to take long term projects. Long-term projects require extensive innovations to stay competitive in the export market and to meet this requirement firms require bulk amount of funding [61]. Meanwhile, existing literature documents that businesses encounter shortage of capitals for different problems which functions as a bottleneck in their investment decisions [62].

Petryk et al. [63] propose that ensuring a favorable regional business potential is crucial for assisting the local companies with required capital for their business growth.

Tagoe et al. [28] using six case studies. Its findings, which confirm and extend the conclusions of previous studies, are integrated into a framework that explains the impact of FSL and the factors at work. The main financial challenge facing SMEs is access to affordable credit over a reasonable period. This is determined by the financing needs of SMEs and the action of investors. SME financing needs reflect their operational requirements, while the action of investors depends on their risk perception and the attractiveness of alternative investment (which affects their willingness to investstate that investment climate of the regions relies on the overall economic scenario, public debt management, access to collateral, standard of corporate reporting and investor relations of the companies.

Meanwhile, the classical theories suggest that financial institutions extend funds to companies based on their historical and future financial performances, specifically their risk and transaction cost-adjusted cash flows [64].

Rizkullah et. al. [65] and Gulzar et al. [27] find that banks are intrinsically prejudiced towards investing in low-risk ventures.

Allen & Gale [66] also find that banks grant bulk credits by applying several risk-management tools which includes the scrutiny of the business potential of the projects in question.

King & Levine [67] state that banks contribute to the economic growth and diversity of nations as powerful financiers. However, they are subjected to protect shareholders' interest at the same time. Therefore, they tend to be skeptical about funding long-tern innovation. From this empirical discussion, it is observed that business potential is a vital prerequisite for firms to receive external financing innovation for diversifying export.

This study intends to explore the dynamics of innovation and export diversification of the Russian regions in the context of regional business potential considering the following hypothesis.

H3: Regional business potential influences innovation-export diversification nexus in Russia.

2.4. Innovation and Export Diversification: The role of sanctions

Sanctions become a powerful weapon to win over opponents in geopolitical conflict [68]. Existing literature finds that sanctions limit economic activities and significantly increase the costs of doing business [69]. Due to the increased cost of economic activities, exporting industries under sanction experience revenue slumps which sometimes leads them to go bankrupt [70].

Onderco & van der Veer [71] argues that companies exposed to sanctions encounter turmoil only in the short term. They

conclude that the destiny of the sanctioned businesses, in the long run, relies mostly on their resilience to sanctions. Meanwhile, another strand of literature finds that sanctions create opportunities.

Lektzian & Biglaiser [72] finds that sanctions might open up markets to new rivals or encourage domestic manufacturers to grow through import substitution. Businesses respond to sanctions by shifting their exports to neighboring marketplaces which maintain close economic and political affiliations with the sanctioning nations [38].

Dreger et al. [73] find that countries with strong export diversification hardly get affected by sanctions in the long run.

Portela et al. [74] find that sanctions imposed on Russia in 2014 initially affected the Russian private sector, but the country resisted those embargoes in the long run. Western sanctions curb Russian oil export to European markets, but they diversify their export to alternative destinations such as Central and South Asian markets [75].

Gaur [76] argue that the sanctions of 2014 enforced on Russia after its occupation of Crimea posed a limited impact on the country due to the stringent mitigation policies adopted by the Russian government in response to those embargoes.

Ross [77] state that it is challenging for resource-abundant countries to diversify export during a price surge. However, he finds that countries with economic sanctions, i.e., Iran diversified their economies after the oil price shocks in the 1970s.

Seyfi & Hall [78] propose that sanctions or any geopolitical tension led to export demand uncertainty, and to tackle this unforeseen event, highly concentrated economies should focus on diversifying exports to their allies. From the above empirical works, this study finds mixed evidence about how economies respond to sanctions.

This study developed the following hypothesis to examine the relationship be-tween innovation and export diversification of Russian regions in the post-sanction scenario.

H4: Western Sanctions positively affects innovation-export diversification nexus in Russian regions.

3. Data, model specification, and research method
3.1. Data
This study examines the influence of innovation on the export diversification of the Russian regions. By following Vasilyeva et al. [79], Swathi & Sridharan [80], and Nieminen [81], this study considers both Herfindahl Index and Theil indices as the proxy for Export diversification.

The indices employ annual data on 97 export groups for each region to calculate the Herfindahl and Theil indices that assess the extent of export concentration in Russian regions [82]. The higher value of the index indicates fewer export groups represented in a region, which corresponds to a lower degree of regional export diversification.

Meanwhile, the term innovation incorporates several characteristics ranging from decision-making to framing legal structures of the companies, existing studies extensively discussed about its appropriate measures [83–84].

Zemtsov et al. [7] state that innovation refers to the knowledge that creates new thecnologlies which are measured by the total number of patents. However, Hervas-Oliver et al. [85] argue that innovation conveys new knowledge regarding firms product and process develpoments. The purpose of this study is not to differentiate between different forms of innovation rather to see the impact of innovation as new knowledge measured by patents in promoting export diversification.

Therefore, this study considers total patents as the measure of innovation by fol-

lowing Pradhan et al. [86], Xin et al. [87] and Hsu et al. [88]. Following Shakib et al. [89] and Degles et. al [90], investment potential index for the Russian regions published by the Russian Credit rating agency "Expert RA" is considered for the proxy for Business potential.

Besides, For the proxy of trade globalization and geopolitics, this study considers both WTO membership by following Dong [19], Paul [56], and Tomz et al. [62]. Besides, this study considers Sanctions as dummy for geopolitics by following Besedeš et al. [68], Onderco & van der Veer [71] and Allen [91] to explore their role in innovation-export diversification nexus of the Russian regions.

From the control variable perspective, this study uses Gross Regional Product per capita, natural resources rent, and total number of employments in exploring the role of innovation in promoting export diversification (see for example, Vasilyeva et al. [79], Nieminen [81], and Elhiraika & Mbate [92]).

This study collected Data of 66 Russian regions from the Federal statistical database of Russia and the official website of the Russian Treasury. This study omitted some regions from our dataset due to lack of data for those regions. Besides, we did not consider the data for Moscow city to avoid outlier issue. Regarding time period, this study considered data from 2009 to 2019.

The reason for restricting the period up to 2019 is not to include a kind of structural that happened after the emergence of the Covid-19 pandemic and the subsequent special military operation in Ukraine.

The definition and the sources of data are presented in detail in Table 1.

3.2. Research Method and model specification

This study applies Machado & Silva's [40] the "*Method of Moments Quantile Regression*" (MMQR) to address the heterogeneous and the distributional properties over the quantiles within innovation, export diversification, GDP per capita, employment, trade globalization (WTO), business potential and sanctions in Russian federation.

Koenker & Bassett [93], and Canay [94] suggest that the conventional quantile regression approaches deliver reliable estimates in the presence of outliers. They conclude that these regression methods are suitable when the conditional means of two variables have an insignificant association but conventional quantile regressions for panel data do not consider the possibility of unobserved heterogeneity of the cross-sections [95].

Koenker [96] propose that the MMQR estimates the effect of covariance within the drivers of export diversification and its conforming conditional heterogeneous effect which reveals their explicit relationship. He concludes that the MMQR approach presents the overall characteristics of the dataset unlike the traditional approaches which presents the changed mean only.

Khan et al. [97] state that the MMQR approach tackles potential endogeneity of the descriptive variables. Besides, this method can be applied in conditions where specific effect accommodates the disparities of panel data. Moreover, this method takes into account the asymmetries in locations and generate effective intuition about the non-crossing quantile estimations.

Machado & Silva [40] argue that the MMQR method addresses the heterogeneity Issue unlike the fixed effects which are not capable of tackling it. The presentation of heterogenous coefficients proves the ability of MMQR method in fixing heterogeneity problem of the dataset. Therefore, considers the MMQR estimation method for testing the research hypotheses. The conditional quantiles $Q_y \left(\tau | X \right)$ estimates of the proposed econometric model under

Table 1. **Definition of the variables and sources of data**

Variable	Definition	Source
EHHI	Herfindahl-Hirschman Index (HHI) as a proxy for Export Diversification	Vasilyeva et al. [82]
ETHEIL	Theil Index as a Proxy for Export Diversification	Vasilyeva et al. [82]
ETHEILW	The intensive margin of the Theil Index as a proxy for intra-regional Export Diversification	Vasilyeva et al. [82]
ETHEILW	The extensive margin of the Theil Index as a proxy for inter-regional Export Diversification	Vasilyeva et al. [82]
LINNO	Log of total patents in the Russian region (in units)	https://rosstat.gov.ru/statistics/science
LGRPPC	Log of Gross Regional Product per capita (in million rubles)	https://rosstat.gov.ru/statistics/accounts
LNRR	Log of Mineral Resources Extraction Tax	Official website of the Russian Treasury (roskazna.gov.ru)
LEMPL	Log of the total employment in Russian regions	https://rosstat.gov.ru/labour_force
INPOT	The Annual index of investment potential for the Russian regions	https://www.raexpert.ru/
WTO	Dummy for World Trade Organization membership of the Russian Federation	
SANC	Dummy for Western sanction over Russian Federation	

different locations and scales are presented with the following equation:

$$Y_{it} = \alpha_i + X'_{it}\beta + \left(\delta_i + Z'_{it}\gamma\right)U_{it}. \quad (1)$$

Here, the probability $P\{\delta_i + Z'_{it}\gamma > 0\} = 1$, $(\alpha,\beta',\delta,\gamma')$ are the constraints that need to be estimated. The individual i fixed effects are specified as (α_i,δ_i), $i = 1, \ldots, n$ and k vector of known components of X is represented by Z, which are divergent modifications with constituent l stated below:

$$Z_l = Z_l(X), \ l = 1,...,k. \quad (2)$$

X_{it} is independently and equally distributed for any fixed i and also, over time

t. U_{it} is also independently and equally distributed among individuals i through time t are superfluous to X_{it} and are uniformed to complete the moment conditions. Equation (1) derives the following:

$$Q_y(\tau|X) = \alpha_i + \delta_i(\tau) + X'_{it}\beta + Z'_{it}\gamma q(\tau). \quad (3)$$

Where X_{it} is the vector of independent variables and $Q_y(\tau|X)$ adopts that the quantiles in operations are dispersed to the dependent variable Y_{it} (Export Diversification) depending on the distribution (location) of independent variables X_{it}. The Individual (i) quantile (τ) fixed effect is confirmed by the scalar coefficient signified as $\alpha_i(\tau) = \alpha_i + \delta_i q(\tau)$.

The modification of the intercept does not illustrate the sole effect against the OLS fixed-effects. These limitations do not address the time variance and heterogeneous effect that diverge along the conditional distribution of the endogenous variables. The τ-the sample quantile shown by $q(\tau)$ can be assessed by taking the optimization outcome shown in equation (15):

$$\min_q \sum \sum p\tau \left(R_{it} - Z'_{it}\, \gamma \right) q). \quad (4)$$

Where $p\tau(A) = (\tau - 1)AI\{A \le 0\}TAI\{A > 0\}$ indicates the check function.

By applying the traditional conditional regression method, this study models the main MMQR equations as follows:

$$Q_{ED_{it}}\left(\tau | X_{it} \right) =$$
$$= \left(\alpha_i(\tau) + \delta_i q(\tau) \right) +$$
$$+ \beta_{1i}(\tau) LINNO_{i,t} +$$
$$+ \beta_{2i}(\tau) LGRPPC_{i,t} + \quad (5)$$
$$+ \beta_{3i}(\tau) LNRR_{i,t} +$$
$$+ \beta_{4i}(\tau) LEMPL_{i,t} +$$
$$+ Z'_{it}\, \gamma q(\tau) + \varepsilon.$$

In this equation, this study considers export diversification (*ED*) as the dependent variable, and the log of patents (*LINNO*) as the independent variable. This study further considers the log of Gross Regional Product Per capita (*GRPPC*), log of natural resources rent (*LNRR*), and log of total employment (*LEMPL*) as the control variables. In the model, the "*i*" indicates region, and "*t*" indicates time. Moreover, "α" and "β" refer to intercept and parameters respectively, and "ε" refer to the error term.

This study further explores the role of, Business Potential, Trade globalization, and Sanctions in the innovation-export diversification nexus in regional Russia by modeling the equations (6), (7), and (8) as follows:

$$Q_{ED_{it}}\left(\tau | X_{it} \right) =$$
$$= \left(\alpha_i(\tau) + \delta_i q(\tau) \right) +$$
$$+ \beta_{1i}(\tau) LINNO_{i,t} +$$
$$+ \beta_{2i}(\tau) LGRPPC_{i,t} +$$
$$+ \beta_{3i}(\tau) LNRR_{i,t} + \quad (6)$$
$$+ \beta_{4i}(\tau) LEMPL_{i,t} +$$
$$+ \beta_{5i}(\tau) WTO_t +$$
$$+ Z'_{it}\, \gamma q(\tau) + \varepsilon.$$

$$Q_{ED_{it}}\left(\tau | X_{it} \right) =$$
$$= \left(\alpha_i(\tau) + \delta_i q(\tau) \right) +$$
$$+ \beta_{1i}(\tau) LINNO_{i,t} +$$
$$+ \beta_{2i}(\tau) LGRPPC_{i,t} +$$
$$+ \beta_{3i}(\tau) LNRR_{i,t} + \quad (7)$$
$$+ \beta_{4i}(\tau) LEMPL_{i,t} +$$
$$+ \beta_{5i}(\tau) INPOT_t +$$
$$+ Z'_{it}\, \gamma q(\tau) + \varepsilon.$$

$$Q_{ED_{it}}\left(\tau | X_{it} \right) =$$
$$= \left(\alpha_i(\tau) + \delta_i q(\tau) \right) +$$
$$+ \beta_{1i}(\tau) LINNO_{i,t} +$$
$$+ \beta_{2i}(\tau) LGRPPC_{i,t} +$$
$$+ \beta_{3i}(\tau) LNRR_{i,t} + \quad (8)$$
$$+ \beta_{4i}(\tau) LEMPL_{i,t} +$$
$$+ \beta_{5i}(\tau) SANC_t +$$
$$+ Z'_{it}\, \gamma q(\tau) + \varepsilon.$$

In equation (6), in addition to our main model, this study takes trade Globalization (*WTO*) as the dummy variable to check its role in the relationship between innovation and export diversification in the Russian Region. In Equations (7) and (8), This study uses the investment potential index as a proxy for business potential and Sanctions of 2014 as the dummy variable for sanctions to see their effects in the main model.

4. Analysis of Results
4.1. The Descriptive Statistics

This study commences the empirical investigation with the presentation of descriptive statistics of the dataset used in this research. The standard deviations shown in Table 2 include standard deviation for both spatial (between) and over time (within).

Given the proxies for export diversification, this research detects a higher scale of spatial standard deviation, which favors the higher disparities in the economic indicators among Russian regions, which eventually necessitates the application of the quantile method (MMQR) for the regression analysis. The empirical results approve that regions in Russia are widely dispersed in terms of economic growth, natural resource rent, and employment. The standard deviation for innovation shows low disparities across the regions and over the time.

Therefore, this study presumes that most of the regions experience equal levels of innovation. However, the standard deviation (within) for innovation shows the lower pace of innovation in Russian regions.

4.2. Main Analysis

The quantile regressions differentiate all the quantiles according to the dependent variable (Herfindahl and Theil index). Since the concentration indices are used as proxies for export diversification, the regions with the most diversified exports fall into the lower to the lowest quantiles (Q10–Q30), while the regions with the least diversified exports go into the higher to the highest quantiles (Q70–Q90). This research also separates areas with a medium level of export diversification, which are classified as medium quantiles (Q40-Q60).

In table 3 the distribution of regions according to the quantiles are presented.

4.2.1 Innovation-Export diversification nexus in Russian Regions

Table 4 represents the estimation of the main model (Eq. 9) of this study. The table report that the coefficient of innovation is negative and significant for quantiles 10 through 90 indicating that an increase in the amount of innovation increases the diversification in all regions at all quantiles.

Table 2. **Descriptive statistics**

Variable		Mean	Std. Dev.	Min	Max	Observations
EHHI	overall	0.333519	0.214769	0	0.994489	N = 726
	between		0.191613	0.084722	0.85927	n = 66
	within		0.099582	−0.02791	1.0722	T = 11
ETHEIL	overall	2.797823	0.720686	0	4.55349	N = 726
	between		0.632984	1.404445	4.224461	n = 66
	within		0.352485	1.048311	5.601801	T = 11
ETHEILB	overall	0.529293	0.383747	0	2.089804	N = 726
	between		0.347433	0.036371	1.649738	n = 66
	within		0.167981	−0.1967	1.210217	T = 11
ETHEILW	overall	2.26853	0.672971	0	4.004893	N = 726
	between		0.597709	1.273247	3.665132	n = 66
	within		0.317115	0.974562	4.705683	T = 11

Table 2. **Descriptive statistics (the end)**

Variable		Mean	Std. Dev.	Min	Max	Observations
LINNO	overall	1.537496	0.302614	−0.36651	2.096038	N = 523
	between		0.303299	0.585258	2.038187	n = 66
	within		0.083277	0.585724	1.894176	T = 7.92424
LGRPPC	overall	11.99664	0.48855	10.9588	14.02869	N = 725
	between		0.475935	11.12237	13.88054	n = 66
	within		0.122409	11.62855	12.34721	T = 10.9848
LNRR	overall	18.39713	1.979089	10.51867	23.86452	N = 709
	between		1.926018	11.63906	23.24658	n = 66
	within		0.478695	16.73944	22.02336	T = 10.7424
LEMPL	overall	6.503226	0.73279	4.406719	8.14613	N = 726
	between		0.736873	4.450536	8.106606	n = 66
	within		0.03859	6.294799	6.645087	T = 11
INPOT	overall	1.136329	0.97262	0.164	6.249	N = 726
	between		0.974842	0.190455	5.903727	n = 66
	within		0.093702	0.20942	1.539693	T = 11
WTO	overall	0.727273	0.445669	0	1	N = 726
	between		0	0.727273	0.727273	n = 66
	within		0.445669	0	1	T = 11
SANC	overall	0.545455	0.498273	0	1	N = 726
	between		0	0.545455	0.545455	n = 66
	within		0.498273	0	1	T = 11

Table 3. **Russian regions according to the quantiles**

Q10	Q20	Q30	Q40	Q50
Moscow Smolensk Bryansk Ivanovo Penza Tver	Altai region Nizhny Novgorod Vladimir Tambov Chuvash Omsk Saratov	Voronezh Sverdlovsk Adygea Kabardino- Balkarian Samara Kaluga	Mordovia North Ossetia- Alania Oryol Rostov Tula Stavropol Udmurtia Volgograd	Kursk Novosibirsk Kirov Ryazan Krasnoyarsk Yaroslavskaya Leningrad Chelyabinsk Kaliningrad Pskov

Table 3. **Russian regions according to the quantiles (the end)**

Q60	Q70	Q80	Q90
Altai Republic	Irkutsk	St. Petersburg	Lipetsk
Krasnodar	Amur	Komi	Kemerovo
Bashkortostan	Mari El	Novgorod	Sakha
Ulyanovsk	Belgorod	Tatarstan	Sakhalin
Perm	Vologodskaya	Kostroma	Kamchatka
Karelia	Murmansk	Buryatia	Khanty-Mansi
Orenburg		Khakassia	
Kurgan		Belgorod	
Khabarovsk			

Note: Authors creation

The spatial and time fixed effect for both Herfindal and Theil indices also confirms that innovation contributes to export diversification in Russian regions. Meanwhile, the control variables representing economic development, employment, and natural resource rent are found to be counterproductive for export diversification. Both economic development and employment are found to decrease the diversification in all quantiles in the case of both indices. Though natural resource rent positively but insignificantly contributes to the concentration in all quantiles in the case of the Herfindal index, it negatively and significantly augments export concentration in the case of the Theil index.

However, the magnitude decreases with the increase of the quantile suggesting that for most diversified regions, the increase of the resource rent related to the new exploration affects the regional export concentration.

This study reports a positive and significant effect of innovation on the extensive and intensive margin of export diversification at all quantiles. The result confirms that innovation promotes both inter-regional and intra-regional export diversification in Russia. The natural resource rent is counterproductive to the extensive margin of export diversification confirming that the dependency of the Russian economy on the resources can harm diversification and impose higher risks to the Russian economy in the event of commodity price volatility and geopolitical turmoil.

Besides, this study finds that employment diversifies the inter-regional exports, whereas real GRP per capita significantly promotes inter-regional diversification at the most diversified regions (Q10-Q30) and contributes to intra-region concentration in the middle and highly concentrated regions (Q50-Q90). The 90th quantile comprises the regions, which specialize in hydrocarbon production (Khanty-Mansi Autonomous region) and precious metals and minerals extraction (The Republic of Sakha, Sakhalin region, Kamchatka Krai).

4.2.2 Innovation and export diversification: the role of WTO membership

Table 5 reports that the magnitude of the slope coefficients of innovation slightly decreased compared to the results of the main model. It indicates that Russia's inclusion in the WTO did not influence the innovation-export diversification nexus in the case of both the proxies of export diversification.

Table 4. **Estimation for the Innovation-Export diversification nexus of Russian regions (considering HHI and Theil Index as a proxy for export diversification)**

HHI as ED	location	scale	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
inno	−0.312***	−0.0735**	−0.217***	−0.235***	−0.252***	−0.267***	−0.291***	−0.315***	−0.343***	−0.384***	−0.446***
	(0.0516)	(0.0369)	(0.0397)	(0.0379)	(0.0381)	(0.0399)	(0.0453)	(0.0528)	(0.0633)	(0.0810)	(0.109)
lnempl	0.0804***	0.0201	0.0544***	0.0592***	0.0639***	0.0681***	0.0746***	0.0812***	0.0888***	0.1000***	0.117***
	(0.0181)	(0.0130)	(0.0140)	(0.0133)	(0.0134)	(0.0140)	(0.0159)	(0.0185)	(0.0222)	(0.0284)	(0.0382)
lgrpcreal	0.137***	0.0620***	0.0568***	0.0718***	0.0861***	0.0991***	0.119***	0.139***	0.163***	0.197***	0.249***
	(0.0277)	(0.0198)	(0.0212)	(0.0203)	(0.0204)	(0.0215)	(0.0245)	(0.0285)	(0.0341)	(0.0438)	(0.0584)
lnrr	0.00308	−0.000834	0.00415	0.00395	0.00376	0.00359	0.00332	0.00304	0.00273	0.00226	0.00157
	(0.00527)	(0.00377)	(0.00407)	(0.00388)	(0.00389)	(0.00406)	(0.00460)	(0.00536)	(0.00644)	(0.00822)	(0.0111)
Constant	−1.421***	−0.602***	−0.641***	−0.787***	−0.925***	−1.051***	−1.247***	−1.443***	−1.672***	−2.006***	−2.510***
	(0.284)	(0.203)	(0.217)	(0.208)	(0.209)	(0.221)	(0.251)	(0.293)	(0.350)	(0.449)	(0.599)
Observations	508	508	508	508	508	508	508	508	508	508	508

Table 4. **Estimation for the Innovation-Export diversification nexus of Russian regions (considering HHI and Theil Index as a proxy for export diversification) (the end)**

THEIL as ED	location	scale	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
inno	−1.198***	−0.0384	−1.142***	−1.157***	−1.169***	−1.182***	−1.197***	−1.210***	−1.224***	−1.238***	−1.264***
	(0.147)	(0.0867)	(0.176)	(0.159)	(0.149)	(0.145)	(0.146)	(0.154)	(0.168)	(0.186)	(0.227)
lnempl	0.303***	0.00517	0.295***	0.297***	0.299***	0.301***	0.303***	0.305***	0.306***	0.308***	0.312***
	(0.0569)	(0.0336)	(0.0681)	(0.0617)	(0.0579)	(0.0561)	(0.0567)	(0.0597)	(0.0651)	(0.0721)	(0.0879)
lgrpcreal	0.280***	0.236***	−0.0670	0.0241	0.102	0.177**	0.271***	0.352***	0.441***	0.526***	0.684***
	(0.0893)	(0.0527)	(0.107)	(0.0962)	(0.0911)	(0.0891)	(0.0906)	(0.0948)	(0.103)	(0.114)	(0.141)
lnrr	0.0581***	−0.0267**	0.0973***	0.0870***	0.0782***	0.0697***	0.0592***	0.0500**	0.0400*	0.0303	0.0126
	(0.0190)	(0.0112)	(0.0228)	(0.0206)	(0.0194)	(0.0188)	(0.0190)	(0.0200)	(0.0218)	(0.0241)	(0.0295)
Constant	−1.794**	−1.848***	0.918	0.206	−0.404	−0.989	−1.721*	−2.357**	−3.051***	−3.718***	−4.949***
	(0.898)	(0.530)	(1.077)	(0.968)	(0.915)	(0.892)	(0.905)	(0.949)	(1.030)	(1.141)	(1.404)
Observations	508	508	508	508	508	508	508	508	508	508	508

Note: Standard errors in parentheses; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 5. **Estimation for the Innovation-Export diversification-WTO nexus of Russian regions (considering HHI and Theil Index as a proxy for export diversification)**

HHI as ED	location	scale	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
inno	−0.309***	−0.0717**	−0.215***	−0.232***	−0.251***	−0.264***	−0.288***	−0.311***	−0.341***	−0.377***	−0.439***
	(0.0517)	(0.0365)	(0.0405)	(0.0386)	(0.0388)	(0.0404)	(0.0456)	(0.0526)	(0.0640)	(0.0797)	(0.108)
lnempl	0.0775***	0.0187	0.0531***	0.0575***	0.0623***	0.0660***	0.0721***	0.0780***	0.0858***	0.0955***	0.112***
	(0.0180)	(0.0128)	(0.0142)	(0.0135)	(0.0135)	(0.0141)	(0.0159)	(0.0183)	(0.0223)	(0.0278)	(0.0377)
lgrpcreal	0.143***	0.0654***	0.0582***	0.0736***	0.0904***	0.103***	0.124***	0.145***	0.172***	0.206***	0.262***
	(0.0282)	(0.0199)	(0.0220)	(0.0210)	(0.0211)	(0.0222)	(0.0251)	(0.0289)	(0.0352)	(0.0438)	(0.0594)
lnrr	0.00347	−0.000637	0.00430	0.00415	0.00398	0.00386	0.00365	0.00345	0.00319	0.00286	0.00231
	(0.00523)	(0.00370)	(0.00412)	(0.00392)	(0.00393)	(0.00408)	(0.00459)	(0.00530)	(0.00645)	(0.00805)	(0.0109)
wtod	−0.0636**	−0.0312	−0.0229	−0.0303	−0.0383*	−0.0443**	−0.0545**	−0.0644**	−0.0774***	−0.0933***	−0.120**
	(0.0275)	(0.0195)	(0.0216)	(0.0206)	(0.0207)	(0.0215)	(0.0242)	(0.0280)	(0.0340)	(0.0425)	(0.0577)
Constant	−1.435***	−0.614***	−0.635***	−0.780***	−0.937***	−1.056***	−1.257***	−1.452***	−1.708***	−2.024***	−2.550***
	(0.286)	(0.202)	(0.223)	(0.213)	(0.215)	(0.225)	(0.255)	(0.293)	(0.357)	(0.444)	(0.603)
Observations	508	508	508	508	508	508	508	508	508	508	508

Table 5. **Estimation for the Innovation-Export diversification-WTO nexus of Russian regions (considering HHI and Theil Index as a proxy for export diversification) (the end)**

THEIL as ED	location	scale	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
inno	-1.189***	-0.0414	-1.128***	-1.144***	-1.157***	-1.171***	-1.186***	-1.202***	-1.215***	-1.231***	-1.258***
	(0.149)	(0.0876)	(0.183)	(0.166)	(0.155)	(0.148)	(0.148)	(0.155)	(0.166)	(0.184)	(0.223)
lnempl	0.296***	0.00258	0.292***	0.293***	0.294***	0.295***	0.295***	0.296***	0.297***	0.298***	0.300***
	(0.0572)	(0.0336)	(0.0703)	(0.0636)	(0.0594)	(0.0570)	(0.0569)	(0.0596)	(0.0637)	(0.0708)	(0.0856)
lgrpcreal	0.296***	0.249***	-0.0688	0.0242	0.108	0.192**	0.278***	0.375***	0.453***	0.553***	0.712***
	(0.0917)	(0.0540)	(0.113)	(0.101)	(0.0954)	(0.0930)	(0.0933)	(0.0968)	(0.103)	(0.114)	(0.140)
lnrr	0.0591***	-0.0264**	0.0977***	0.0879***	0.0790***	0.0701***	0.0610***	0.0508**	0.0424**	0.0319	0.0150
	(0.0190)	(0.0112)	(0.0234)	(0.0211)	(0.0198)	(0.0191)	(0.0191)	(0.0199)	(0.0212)	(0.0236)	(0.0287)
wtod	-0.160*	-0.102*	-0.0104	-0.0486	-0.0828	-0.118	-0.153*	-0.192**	-0.225**	-0.266**	-0.331**
	(0.0908)	(0.0534)	(0.112)	(0.101)	(0.0942)	(0.0907)	(0.0906)	(0.0947)	(0.101)	(0.112)	(0.136)
Constant	-1.830**	-1.895***	0.948	0.240	-0.396	-1.040	-1.696*	-2.429**	-3.029***	-3.786***	-5.002***
	(0.913)	(0.538)	(1.124)	(1.011)	(0.949)	(0.921)	(0.922)	(0.959)	(1.021)	(1.132)	(1.386)
Observations	508	508	508	508	508	508	508	508	508	508	508

Note: Standard errors in parentheses; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Nevertheless, innovation promotes export diversification in all quantiles. In general, WTO membership drive export diversification in less diversified regions. It shows the negative and significant result at medium and highest quantiles which are confirmed both by estimation results for Herfindahl and Theil indices. Moreover, the magnitude of the slope coefficients by the WTO dummy aggravates to the highest quantiles, confirming that membership in the World Trade Organization stimulates export diversity in the most concentrated entities of the Russian Federation.

Meanwhile, according to the estimation results for the intensive and extensive margin of the Theil index, the most diversified and moderately diversified regions (Q10–Q60) enjoyed the membership of Russia in WTO as it significantly promoted inter-regional export diversity. The results for the within component indicate that intra-regional diversity was not significantly spurred by the WTO membership in all the quantiles. However, innovation in general promoted inter-regional and intra-regional export diversification of the Russian Federation in the event of trade globalization.

4.2.3 Innovation and Export Diversification: the role of Business Potential

In Table 6, this study presents the result for the innovation-export diversification-business potential nexus with the Herfindahl index as proxy for export diversification. The table reports that the impact of innovation on export diversification is positive and significant in the Russian regions (from Q10–Q90) where the business potential is higher. Besides, we see that the real GRP per capita and employment contribute to the export concentration, while natural resource rent significantly promotes export concentration in the lower quantiles (Q10–Q30) only. On

the contrary, the role of innovation is more pronounced in the most diversified regions (Q10–Q40) with lower business potential However, the magnitude of the coefficients of innovation in the low business potential regions is much lower compared to the regions with high business potential.

Meanwhile, in the case of the Theil index as a proxy for export diversification, this study confirms the results of the Herfindahl index.

In Table 7, this study reports that innovation influences regional export diversification at all the quantiles (Q10–Q90) where the business potential is high. Besides, we observe that the real GRP per capita and employment contribute to the export concentration, while natural resource rent indicates a significant contribution to export concentration in the lower and middle quantiles only. On the other hand, in the regions with low investment potential, the effect of innovation on export diversity is pivotal only in lower and middle quantiles (Q10–Q50). Moreover, the sign of the slope coefficients is changed to positive in Q90 suggesting a possible contribution to export concentration.

Besides, considering the extensive and intensive margin of the Theil index, this study reports that innovation promotes inter-regional export diversification in regions with both high and low business potential but innovation augments intra-regional export diversification only in the regions with high business potential. We see that innovation influences inter-regional export diversification in all quantiles (Q10–Q90) in regions with both high and low business potential. However, we observe that the coefficients of innovation are negative and significant in all quantiles (Q10–Q90) in the case of regions with high business potential, indicating the significance of business potential for intra-regional export diversification in Russia.

Table 6. **Estimation for the Innovation-Export Diversification-Business potential nexus of Russian regions (considering the HHI Index as a proxy for export diversification)**

HHI — low potential	location	scale	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
inno	−0.0662	0.0529*	−0.150***	−0.122***	−0.104**	−0.0924**	−0.0701	−0.0546	−0.0353	−0.0142	0.0259
	(0.0461)	(0.0284)	(0.0526)	(0.0460)	(0.0438)	(0.0436)	(0.0457)	(0.0489)	(0.0548)	(0.0623)	(0.0791)
lnempl	0.0837***	−0.0185	0.113***	0.103***	0.0968***	0.0929***	0.0851***	0.0797***	0.0729***	0.0656**	0.0516
	(0.0205)	(0.0127)	(0.0233)	(0.0204)	(0.0195)	(0.0194)	(0.0203)	(0.0217)	(0.0243)	(0.0276)	(0.0351)
lgrpcreal	0.274***	−0.0357**	0.330***	0.311***	0.299***	0.291***	0.276***	0.266***	0.253***	0.238***	0.211***
	(0.0276)	(0.0170)	(0.0317)	(0.0277)	(0.0263)	(0.0262)	(0.0274)	(0.0294)	(0.0330)	(0.0375)	(0.0475)
lnrr	−0.0233**	0.0102	−0.0393***	−0.0341***	−0.0305***	−0.0284***	−0.0241**	−0.0211**	−0.0174	−0.0133	−0.00567
	(0.0100)	(0.00617)	(0.0114)	(0.00999)	(0.00951)	(0.00947)	(0.00991)	(0.0106)	(0.0119)	(0.0135)	(0.0172)
Constant	−2.919***	0.411**	−3.567***	−3.354***	−3.210***	−3.123***	−2.949***	−2.829***	−2.679***	−2.515***	−2.204***
	(0.289)	(0.178)	(0.331)	(0.290)	(0.275)	(0.274)	(0.287)	(0.307)	(0.346)	(0.392)	(0.497)
Observations	138	138	138	138	138	138	138	138	138	138	138

Table 6. **Estimation for the Innovation-Export Diversification-Business potential nexus of Russian regions (considering the HHI Index as a proxy for export diversification) (the end)**

HHI — high potential	location	scale	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
inno	−0.384***	−0.121**	−0.230***	−0.253***	−0.282***	−0.310***	−0.339***	−0.376***	−0.420***	−0.491***	−0.614***
	(0.0616)	(0.0515)	(0.0403)	(0.0382)	(0.0385)	(0.0419)	(0.0486)	(0.0598)	(0.0751)	(0.104)	(0.156)
lnempl	0.0616***	0.0344*	0.0180	0.0244*	0.0329**	0.0407***	0.0490***	0.0594***	0.0720***	0.0922**	0.127**
	(0.0221)	(0.0185)	(0.0146)	(0.0137)	(0.0137)	(0.0150)	(0.0174)	(0.0213)	(0.0269)	(0.0369)	(0.0552)
lgrpcreal	0.123***	0.0960***	0.00116	0.0191	0.0426*	0.0644**	0.0874***	0.117***	0.152***	0.208***	0.305***
	(0.0399)	(0.0333)	(0.0256)	(0.0247)	(0.0251)	(0.0272)	(0.0317)	(0.0390)	(0.0489)	(0.0678)	(0.103)
lnrr	0.00184	−0.00706	0.0108**	0.00946**	0.00773*	0.00613	0.00444	0.00230	−0.000284	−0.00442	−0.0115
	(0.00736)	(0.00615)	(0.00487)	(0.00457)	(0.00456)	(0.00497)	(0.00576)	(0.00708)	(0.00892)	(0.0122)	(0.0182)
Constant	−1.005**	−0.920***	0.161	−0.0112	−0.237	−0.446	−0.666**	−0.945**	−1.282**	−1.821***	−2.748***
	(0.410)	(0.342)	(0.264)	(0.254)	(0.257)	(0.279)	(0.325)	(0.400)	(0.501)	(0.695)	(1.053)
Observations	370	370	370	370	370	370	370	370	370	370	370

Note: Standard errors in parentheses; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 7. Estimation for the Innovation-Export Diversification-Business potential nexus of Russian regions (considering Theil Index as a proxy for export diversification)

THEIL-low potential	location	scale	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
inno	-0.279*	0.220**	-0.660***	-0.500***	-0.407**	-0.356**	-0.303*	-0.230	-0.174	-0.0532	0.145
	(0.162)	(0.102)	(0.235)	(0.188)	(0.168)	(0.163)	(0.161)	(0.167)	(0.175)	(0.207)	(0.268)
lnempl	0.250***	-0.102**	0.427***	0.353***	0.309***	0.285***	0.261***	0.227***	0.201***	0.145	0.0526
	(0.0691)	(0.0435)	(0.101)	(0.0810)	(0.0718)	(0.0698)	(0.0687)	(0.0713)	(0.0750)	(0.0895)	(0.115)
lgrpcreal	0.696***	-0.0705	0.818***	0.767***	0.737***	0.720***	0.704***	0.680***	0.662***	0.624***	0.560***
	(0.0864)	(0.0544)	(0.123)	(0.0989)	(0.0895)	(0.0869)	(0.0860)	(0.0886)	(0.0928)	(0.108)	(0.142)
lnrr	-0.00418	-0.0186	0.0281	0.0145	0.00660	0.00229	-0.00216	-0.00834	-0.0131	-0.0233	-0.0400
	(0.0254)	(0.0160)	(0.0362)	(0.0291)	(0.0263)	(0.0256)	(0.0253)	(0.0260)	(0.0273)	(0.0319)	(0.0418)
Constant	-6.517***	1.916***	-9.832***	-8.440***	-7.626***	-7.182***	-6.724***	-6.088***	-5.600***	-4.549***	-2.826*
	(1.005)	(0.632)	(1.498)	(1.198)	(1.048)	(1.019)	(0.998)	(1.042)	(1.099)	(1.332)	(1.679)
Observations	138	138	138	138	138	138	138	138	138	138	138

Table 7. **Estimation for the Innovation-Export Diversification–Business potential nexus of Russian regions (considering Theil Index as a proxy for export diversification) (the end)**

THEIL high potential	location	scale	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
inno	−1.524***	−0.186*	−1.249***	−1.324***	−1.377***	−1.437***	−1.495***	−1.552***	−1.630***	−1.706***	−1.831***
	(0.174)	(0.113)	(0.185)	(0.166)	(0.160)	(0.160)	(0.168)	(0.182)	(0.209)	(0.242)	(0.305)
lnempl	0.278***	0.0801*	0.159**	0.192***	0.214***	0.240***	0.265***	0.289***	0.323***	0.356***	0.410***
	(0.0728)	(0.0474)	(0.0776)	(0.0696)	(0.0669)	(0.0670)	(0.0703)	(0.0762)	(0.0874)	(0.101)	(0.128)
lgrpcreal	0.232*	0.322***	−0.244*	−0.114	−0.0230	0.0802	0.181	0.279**	0.414***	0.547***	0.762***
	(0.126)	(0.0820)	(0.135)	(0.120)	(0.116)	(0.117)	(0.123)	(0.134)	(0.152)	(0.176)	(0.230)
lnrr	0.0482*	−0.0346**	0.0994***	0.0854***	0.0757***	0.0645***	0.0538**	0.0432	0.0287	0.0144	−0.00874
	(0.0259)	(0.0169)	(0.0276)	(0.0247)	(0.0238)	(0.0239)	(0.0251)	(0.0272)	(0.0312)	(0.0361)	(0.0458)
Constant	−0.404	−3.002***	4.028***	2.820**	1.972*	1.010	0.0754	−0.840	−2.097	−3.334*	−5.342**
	(1.267)	(0.825)	(1.354)	(1.205)	(1.168)	(1.178)	(1.239)	(1.343)	(1.529)	(1.770)	(2.303)
Observations	370	370	370	370	370	370	370	370	370	370	370

Note: Standard errors in parentheses; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

4.2.4 Innovation and export diversification: The role of sanction

In Table 8 we observe that, in the case of both the proxies of export diversification, the magnitude of the slope coefficients of innovation in all quantiles (Q10–Q90) decreased to some extent compared to the results of the main model (innovation-export diversification). It indicates that sanctions imposed on Russia in 2014 did not affect Russian innovation and export diversification spree.

Nevertheless, innovation promotes export diversification in all quantiles. Moreover, the coefficients of the sanctions dummy are significant and negative, which means that sanctions imposed on the Russian Federation enforce the regional export diversity. This study reports that the regression results with the Herfindahl index as a proxy for export diversification reveal no significant effect of sanctions in the most diversified region (Q10) and the case of the Theil index as proxy regions in the lower quantiles (Q10–Q30) report no significant effect of sanctions.

However, the effect of the sanction dummy is significant at medium and higher quantiles (Q20–Q90) in the case of the Herfindahl index but in the case of the Theil index, regions within Q30–Q90 show a significant impact of sanction on export diversification in Russian regions. The magnitude of the coefficient increases to the highest quantiles, which reflects that most concentrated regions, specializing in natural resource extraction, may diversify their regional export.

Table 9 reports the results for the intensive and extensive margin of the Theil index.

The slope coefficients of the sanctions dummy are significant in all quantiles (Q10–Q90) contributing to the inter-regional export diversification. However,

the sanctions have no significant impact on the intra-regional export diversity of the Russian regions. Nevertheless, innovation in general augments inter-regional and intra-regional export diversification in Russian regions during the time of sanctions of 2014.

5. Discussion

This study empirically shows a tangible relationship between innovation and export diversification within the Russian regions. The result also shows that innovation promotes both inter-regional and intra-regional export diversification in Russia. Besides, this study discloses that membership in the World Trade Organization stimulates export diversity in the most concentrated regions of Russia.

This also study finds that the impact of innovation on export diversification is positive and significant in the Russian regions where the business potential is higher. Moreover, this study shows that sanctions imposed on Russia in 2014 did not affect the positive relationship between innovation and export diversification in the Russian region. Nevertheless, sanctions imposed on the Russian Federation are found to enforce regional export diversity. Meanwhile, the control variables representing economic development, employment, and natural resource rent are found to be counterproductive for export diversification.

The main result supports the research hypothesis *H1* that assumed a positive relationship between innovation and export diversification in Russian regions. The result supports prior literature like Mariev et al. [2], Sarin et al. [9], Carrasco & Tovar-García [10], Cirera et al. 2015 [11] and Dong & Zhou [46] who claim that innovation is one of the key drivers for fostering export diversification in resource based economies.

Table 8. **Estimation for the Innovation-Export Diversification-Sanction nexus of Russian regions (considering HHI and Theil Index as a proxy for export diversification)**

HI as ED	location	scale	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
inno	-0.312***	-0.0721*	-0.215***	-0.235***	-0.252***	-0.267***	-0.290***	-0.316***	-0.344***	-0.382***	-0.436***
	(0.0516)	(0.0370)	(0.0412)	(0.0385)	(0.0385)	(0.0402)	(0.0451)	(0.0531)	(0.0641)	(0.0806)	(0.106)
lnempl	0.0778***	0.0185	0.0529***	0.0581***	0.0625***	0.0663***	0.0721***	0.0787***	0.0861***	0.0958***	0.110***
	(0.0180)	(0.0129)	(0.0143)	(0.0134)	(0.0134)	(0.0140)	(0.0156)	(0.0184)	(0.0223)	(0.0280)	(0.0368)
lgrpcreal	0.143***	0.0654***	0.0546**	0.0728***	0.0886***	0.102***	0.123***	0.146***	0.172***	0.206***	0.255***
	(0.0281)	(0.0202)	(0.0224)	(0.0209)	(0.0210)	(0.0221)	(0.0248)	(0.0291)	(0.0351)	(0.0441)	(0.0587)
lnrr	0.00347	-0.000715	0.00444	0.00424	0.00406	0.00392	0.00369	0.00344	0.00315	0.00278	0.00225
	(0.00522)	(0.00374)	(0.00417)	(0.00391)	(0.00390)	(0.00405)	(0.00453)	(0.00535)	(0.00646)	(0.00812)	(0.0107)
sancd	-0.0609***	-0.0320**	-0.0177	-0.0266*	-0.0344**	-0.0409**	-0.0510***	-0.0625***	-0.0751***	-0.0921***	-0.116***
	(0.0207)	(0.0149)	(0.0165)	(0.0155)	(0.0155)	(0.0162)	(0.0181)	(0.0213)	(0.0257)	(0.0324)	(0.0427)
Constant	-1.434***	-0.616***	-0.604***	-0.776***	-0.925***	-1.051***	-1.244***	-1.465***	-1.709***	-2.034***	-2.492***
	(0.286)	(0.205)	(0.228)	(0.213)	(0.214)	(0.225)	(0.253)	(0.296)	(0.357)	(0.449)	(0.596)
Observations	508	508	508	508	508	508	508	508	508	508	508

Table 8. **Estimation for the Innovation-Export Diversification-Sanction nexus of Russian regions (considering HHI and Theil Index as a proxy for export diversification) (the end)**

THEIL as ED	location	scale	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
inno	−1.197***	−0.0495	−1.124***	−1.142***	−1.158***	−1.176***	−1.193***	−1.212***	−1.228***	−1.246***	−1.276***
	(0.149)	(0.0889)	(0.181)	(0.163)	(0.153)	(0.147)	(0.148)	(0.157)	(0.169)	(0.187)	(0.223)
lnempl	0.296***	0.00108	0.294***	0.294***	0.295***	0.295***	0.295***	0.296***	0.296***	0.297***	0.297***
	(0.0568)	(0.0338)	(0.0688)	(0.0622)	(0.0583)	(0.0561)	(0.0564)	(0.0596)	(0.0643)	(0.0710)	(0.0850)
lgrpcreal	0.296***	0.249***	−0.0708	0.0239	0.103	0.194**	0.277***	0.374***	0.456***	0.546***	0.694***
	(0.0914)	(0.0544)	(0.111)	(0.0994)	(0.0945)	(0.0916)	(0.0926)	(0.0972)	(0.103)	(0.114)	(0.139)
lnrr	0.0592***	−0.0268**	0.0988***	0.0886***	0.0801***	0.0702***	0.0613***	0.0508**	0.0420**	0.0324	0.0164
	(0.0189)	(0.0113)	(0.0230)	(0.0207)	(0.0195)	(0.0188)	(0.0189)	(0.0199)	(0.0214)	(0.0237)	(0.0285)
sancd	−0.174***	−0.0908**	−0.0397	−0.0742	−0.103	−0.136**	−0.166*	−0.202***	−0.232***	−0.265***	−0.319***
	(0.0670)	(0.0399)	(0.0812)	(0.0732)	(0.0689)	(0.0664)	(0.0668)	(0.0705)	(0.0758)	(0.0837)	(0.101)
Constant	−1.833**	−1.891***	0.955	0.236	−0.364	−1.058	−1.686*	−2.427**	−3.049***	−3.729***	−4.857***
	(0.914)	(0.544)	(1.109)	(0.996)	(0.942)	(0.911)	(0.919)	(0.967)	(1.033)	(1.142)	(1.384)
Observations	508	508	508	508	508	508	508	508	508	508	508

Note: Standard errors in parentheses; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 9. **Estimation for the Innovation-Export Diversification-Sanction nexus of Russian regions (considering Theil Between and Theil Within Index as a proxy for export diversification)**

THEILB as ED	location	scale	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
inno	−0.579***	−0.228**	−0.263**	−0.342***	−0.394***	−0.463***	−0.533***	−0.617***	−0.708***	−0.816***	−1.012***
	(0.125)	(0.0946)	(0.103)	(0.0924)	(0.0925)	(0.0994)	(0.113)	(0.135)	(0.164)	(0.204)	(0.278)
lnempl	−0.093***	−0.0141	−0.0733**	−0.0782***	−0.0814***	−0.0856***	−0.0900***	−0.0952**	−0.101**	−0.107*	−0.120
	(0.0348)	(0.0264)	(0.0288)	(0.0260)	(0.0258)	(0.0276)	(0.0314)	(0.0379)	(0.0462)	(0.0570)	(0.0779)
lgrpcreal	−0.0167	0.0751*	−0.120***	−0.0946**	−0.0774**	−0.0548	−0.0319	−0.00407	0.0259	0.0613	0.126
	(0.0527)	(0.0400)	(0.0437)	(0.0392)	(0.0391)	(0.0420)	(0.0478)	(0.0574)	(0.0697)	(0.0862)	(0.118)
lnrr	0.0205**	0.0139**	0.00138	0.00615	0.00933	0.0135**	0.0177**	0.0229***	0.0284***	0.0349***	0.0468***
	(0.00802)	(0.00609)	(0.00667)	(0.00599)	(0.00596)	(0.00639)	(0.00728)	(0.00876)	(0.0107)	(0.0132)	(0.0180)
sancd	−0.142***	−0.0326	−0.0971***	−0.108***	−0.116***	−0.126***	−0.136***	−0.148***	−0.161***	−0.176***	−0.204**
	(0.0369)	(0.0280)	(0.0306)	(0.0276)	(0.0274)	(0.0293)	(0.0334)	(0.0402)	(0.0490)	(0.0605)	(0.0827)
Constant	1.927***	−0.469	2.574***	2.413***	2.305***	2.164***	2.021***	1.848***	1.661**	1.440	1.037
	(0.557)	(0.423)	(0.461)	(0.415)	(0.413)	(0.442)	(0.503)	(0.606)	(0.738)	(0.911)	(1.245)
Observations	508	508	508	508	508	508	508	508	508	508	508

Table 9. **Estimation for the Innovation-Export Diversification-Sanction nexus of Russian regions (considering Theil Between and Theil Within Index as a proxy for export diversification) (the end)**

THEILW as ED	location	scale	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
inno	−0.618***	−0.0812	−0.493***	−0.528***	−0.552***	−0.581***	−0.614***	−0.641***	−0.665***	−0.696***	−0.753***
	(0.147)	(0.0892)	(0.174)	(0.155)	(0.147)	(0.142)	(0.146)	(0.156)	(0.168)	(0.188)	(0.234)
lnempl	0.388***	0.00655	0.378***	0.381***	0.383***	0.385***	0.388***	0.390***	0.392***	0.395***	0.399***
	(0.0559)	(0.0339)	(0.0662)	(0.0589)	(0.0557)	(0.0541)	(0.0555)	(0.0591)	(0.0638)	(0.0714)	(0.0889)
lgrpcreal	0.313***	0.195***	0.0124	0.0968	0.155*	0.225***	0.303***	0.370***	0.427***	0.500***	0.639***
	(0.0855)	(0.0519)	(0.101)	(0.0898)	(0.0857)	(0.0840)	(0.0857)	(0.0908)	(0.0975)	(0.109)	(0.140)
lnrr	0.0387**	−0.0267**	0.0798***	0.0683***	0.0603***	0.0507***	0.0400**	0.0309	0.0231	0.0131	−0.00588
	(0.0180)	(0.0109)	(0.0213)	(0.0190)	(0.0180)	(0.0176)	(0.0180)	(0.0191)	(0.0206)	(0.0231)	(0.0291)
sancd	−0.0313	−0.0788**	0.0899	0.0559	0.0323	0.00407	−0.0274	−0.0543	−0.0773	−0.107	−0.163
	(0.0653)	(0.0396)	(0.0773)	(0.0688)	(0.0652)	(0.0635)	(0.0650)	(0.0692)	(0.0746)	(0.0835)	(0.105)
Constant	−3.759***	−1.255**	−1.829*	−2.371***	−2.747***	−3.196***	−3.698***	−4.126***	−4.491***	−4.964***	−5.854***
	(0.860)	(0.522)	(1.016)	(0.905)	(0.860)	(0.839)	(0.857)	(0.912)	(0.981)	(1.099)	(1.387)
Observations	508	508	508	508	508	508	508	508	508	508	508

Note: Standard errors in parentheses; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

The finding also supports hypothesis *H2* of this study showing that Russia's entrance into the WTO platform promoted their export diversification through innovation. Previous studies of Dong [19], Beverelli et al. [20], Paul [56], Dutt et al. [21], and Felbermayr & Kohler [57] also support this finding arguing that the accession to WTO platform can help countries diversify their export. However, Rose [53] disagree with the finding claiming that WTO has no significant role in promoting trade diversification. The finding also contradicts Subramanian & Wei [54] who argue that WTO membership benefits only developed nations in export diversification, not the developing ones.

This study proved the research hypothesis *H3* revealing that the role of business potential in promoting export diversification positive and significant in case of Russian regions. The finding is supported by Leitner & Stehrer [62], and Petryk et al. [63], who also claim that a healthy business environment encourages diversification through innovation. This study reveals that Russian regions having low business potential experience insignificant innovations for export diversification which is validated by King & Levine [67], Gulzar et al. [27], and Alexandrov et al. [29] who argue that exporting firms struggle with finances for export diversification through innovation because of their low and uncertain business potential.

Finally, the result about the effect of sanctions on innovation- export diversification nexus supports hypothesis *H4* of this study showing that sanctions enforce export diversification through innovation in Regional Russia. This finding coincides with the propositions of Lektzian & Biglaiser [72], Dreger et al. [73], Portela et al. [74], and Gaur [76] who state that sanctions, though hinders export performance in the short run, creates opportunities for export diversification in the long run.

However, the finding diverges from the findings of Besedeš et al. [68], and Seyfi & Hall [78] who claim that sanctions deter economic activities by contributing to currency devaluation, inflation, and cross-border trade crises.

Meanwhile, the result of this study has some shortcomings that need to be addressed.

Firstly, the findings of the study may not reflect the most recent status of the innovation-export diversification nexus of the Russian regions because, the most recent data could not be collected during the time of study.

Secondly, Russian economy has taken a different dimension thanks to the sanctions of 2022. The result of this study does not reflect that dimension. Future research can be done taking the new data covering the sanctions of 2022 to further explore impact of innovation on trade diversification considering the mediating role of geopolitical issues like sanctions.

Third, the western sanctions of February 2022 affected the country's financial sector significantly. This study did not consider the role of financial sector in augmenting export diversification through innovation amidst this transformative landscape.

Future studies can be carried considering this research gap. In summary, this study argues that innovation plays pivotal role in accelerating trade diversification in Russian regions.

This study also claims that trade globalization and business potential are two crucial stimulants for spurring export diversification in a transition economy like the Russian federation.

Finally, this study concludes that geopolitical tension like sanctions can create opportunities for diversifying trade into newer destinations and reduce future economic shocks.

6. Conclusion and policy implications

The contemporary market economic paradigm, financial turmoil, and geopolitical tensions require countries to significantly diversify their economies to stay competitive. Innovation, in this regard, can perform as a key stimulator for this economic modernization. Russia is an emerging economy and relies heavily on hydrocarbon earnings. Being a resource-rich economy, the country remains exposed to several external economic consequences. Therefore, establishing a non-resource-dependent and modernized economic environment by augmenting private sector is a prime development agenda.

In this connection, this study deals with investigating the role of innovation on export diversification under different macroeconomic scenarios of the Russian Federation that has been uninvestigated by the prior studies.

This study further considers exploring the impact of trade globalization, business potential, and Western sanctions in proliferating export diversification through innovation in Russia. This study analyzes the data for export diversification and the total patents (as a proxy for innovation) of the 66 Russian regions from 2009 to 2019 Quantiles via moments (MMQR) taking into account the issues of regional heterogeneity and potential endogeneity within the dataset.

This study provides some fresh empirical insights relating to the impact of innovation on export diversification in widely disparate Russian regions.

First, this study finds that innovation in the Russian region tangibly accelerated the export diversification of the country. The result also shows that innovation promotes both inter-regional and intra-regional export diversification in Russia.

Second, this study finds that Russia's accession to the WTO network profoundly contributed to local export diversification through increasing market competition and creating niches for the incumbent exporters.

Third, this study reveals that Russian business entities located in regions with high potential for doing business engaged in more innovative activities for export diversification than their peers located in regions having low business potential.

Fourth, this study finds that the Western sanctions of 2014 did not affect Russian export diversification of Russian regions. Moreover, this study shows that the magnitude of the relationship between innovation and export diversification in the post-sanction scenario is significantly favourable in almost all quantiles.

Fifth, the findings of this study shows that Gross Regional Product per capita, employment, and natural resource rent adversely affect Russian export diversification.

The findings of this research provide some significant policy implications concerning the promotion of innovation to support regional export diversification.

First, to propel export diversification, the Russian government and the Russian financial sector may undertake policies to adjust deposit and lending interest rates. With this initiative, the policymakers can encourage savings to mobilize more debt capital for the exporting businesses.

Second, the concerned authorities may decrease the lending rates to keep the demand for and supply of loan capital at equilibrium.

Third, loan policies need to be formulated in a way that industries that take part in export diversification and make a transition towards semi-finished and manufacturing goods export receive sufficient credit facilities.

Fourth, policy experts should make coordinated efforts to establish a favorable investment climate in the Russian region to ensure enough supply of bank credit to the innovative sectors to augment export diversification.

References

1. Makarov, A.A. (2020). Technological Progress Opportunities in the Energy Sector of Russia. *Studies on Russian Economic Development,* Vol. 31, Issue 1, 52–63. https://doi.org/10.1134/S1075700720010086

2. Mariev, O., Davidson, N., Nagieva, K., Pushkarev, A. (2023). Innovations and their complementarities: which types of innovations drive export performance? *Post-Communist Economies,* Vol. 35, Issue 7, 708–743. https://doi.org/10.1080/14631377.2023.2215022

3. Davidson, N., Mariev, O., Pushkarev, A. (2018). The Impact of Externalities on the Innovation Activity of Russian Firms. *Foresight and STI Governance,* Vol. 12, No. 3, 62–72. https://doi.org/10.17323/2500-2597.2018.3.62.72

4. Tajoli, L. (2022). Too much of a good thing? Russia-EU international trade relations at times of war. *Journal of Industrial and Business Economics,* Vol. 49, Issue 4, 807–834. http://dx.doi.org/10.1007/s40812-022-00232-2

5. Alexeev, M., Kurlyandskaya, G. (2013). Russian Fiscal Federalism: Impact of Political and Fiscal (De)Centralization. *Journal of Comparative Economics,* Vol. 31, Issue 1, 20–33. https://doi.org/10.1016/S0147-5967(02)00011-2

6. Rozhkova, A.V., Karaseva, M.V. (2020). Regional structural export diversification. *IOP Conference Series: Earth and Environmental Science,* Vol. 421, Issue 3, 032015. https://doi.org/10.1088/1755-1315/421/3/032015

7. Zemtsov, S., Muradov, A., Wade, I., Barinova, V. (2016). Determinants of regional innovation in Russia: Are people or capital more important? *Foresight and STI Governance,* Vol. 10, No. 2, 29–42. https://doi.org/10.17323/1995-459x.2016.2.29.42

8. Abbas, S., Shtun, V., Sapogova, V., Gleb, V. (2023). Russian global export flow and potential: evidence from augmented gravity model. *International Journal of Emerging Markets,* ahead-of-print(ahead-of-print). https://doi.org/10.1108/IJOEM-02-2022-0285

9. Sarin, V., Mahapatra, S.K., Sood, N. (2022). Export diversification and economic growth: A review and future research agenda. *Journal of Public Affairs,* Vol. 22, Issue 3, e2524. https://doi.org/10.1002/pa.2524

10. Carrasco, C.A., Tovar-García, E.D. (2021). Trade and growth in developing countries: the role of export composition, import composition and export diversification. *Economic Change and Restructuring,* Vol. 54, Issue 4, 919–941. https://doi.org/10.1007/s10644-020-09291-8

11. Cirera, X., Marin, A., Markwald, R. (2015). Explaining export diversification through firm innovation decisions: The case of Brazil. *Resources. Policy,* Vol. 44, Issue 10, 1962–1973. https://doi.org/10.1016/j.respol.2015.06.004

12. Balavac, M., Pugh, G. (2016). The link between trade openness, export diversification, institutions and output volatility in transition countries. *Economic Systems,* Vol. 40, Issue 2, 273–287. https://doi.org/10.1016/j.ecosys.2016.02.001

13. Ngassam, S.B. (2023). Exports Diversification in Africa: The Role of Infrastructures. *Journal of the Knowledge Economy,* 1–33. https://doi.org/10.1007/s13132-023-01408-4

14. Barinova, V., Zemtsov, S., Zinov, V., Kidyaeva, V. Krasnoselskikh, A.N, Kurakova, N.G, Semenova, R.I, Fedotov, I.V, Halimova, S.R, Khafisov, R.R, Tsareva, Yu.V. (2019). *National Report "High-Tech Business in the Russian Regions".* Issue 2. Moscow, RANEPA, AIRR. Available at: https://ssrn.com/abstract=3062324

15. Lopez, C., Haddoud, M.Y., Kasturiratne, D. (2022). Revisiting the innovation–export entry link through a configuration approach. *Journal of Business Research,* Vol. 149, 927–937. https://doi.org/10.1016/j.jbusres.2022.05.018

16. Autor, D., Dorn, D., Hanson, G.H., Pisano, G., Shu, P. (2020). Foreign Competition and Domestic Innovation: Evidence from US Patents. *American Economic Review: Insights,* Vol. 2, No. 3, 357–374. https://doi.org/10.1257/aeri.20180481

17. Gokhberg, L.M., Gracheva, G.A., Ditkovskiy, K.A., Evnevich, E.I., Kuznetsova, I.A., Martynova, S.V. (2021). *Indicators of Innovation in the Russian Federation Data Book.* Moscow,

Higher School of Economics, 280 p. Available at: https://www.hse.ru/data/2022/04/01/1798049748/Indicators_of_Innovation_2021.pdf

18. Dutta, S., Lanvin, B., Wunsch-Vincent, S. (2021). *The Global Innovation Index 2021.* World Intellectual Property Organization. Available at: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021.pdf

19. Dong, H. (2022). The impact of trade facilitation on the networks of value-added trade-based on social network analysis. *Emerging Markets Finance and Trade,* Vol. 58, Issue 8, 2290–2299. https://doi.org/10.1080/1540496X.2021.1974393

20. Beverelli, C., Neumueller, S., Teh, R. (2015). Export diversification effects of the WTO trade facilitation agreement. *World Development,* Vol. 76, 293–310. https://doi.org/10.1016/j.worlddev.2015.07.009

21. Dutt, P., Mihov, I., Van Zandt, T. (2013). The effect of WTO on the extensive and the intensive margins of trade. *Journal of International Economics,* Vol. 91, Issue 2, 204–219. https://doi.org/10.1016/j.jinteco.2013.08.001

22. Gnangnon, S.K. (2019). Aid for trade and export diversification in recipient-countries. *The World Economy,* Vol. 42, Issue 2, 396–418. https://doi.org/10.1111/twec.12711

23. UN.ESCAP. (2022). *Digital and Sustainable Trade Facilitation: Global Report 2021.* United Nations. Available at: https://hdl.handle.net/20.500.12870/4216

24. Connolly, R. (2015). Economic modernisation in Russia: the role of the world trade organization. *European Politics and Society,* Vol. 16, Issue 1, 27–44, https://doi.org/10.1080/15705854.2014.965891

25. Freeman, S., Vissak, T., Nummela, N., Trudgen, R. (2023). Do technology-focused fast internationalizers' performance measures change as they mature?. International *Business Review,* Vol. 32, Issue 5, 102168. https://doi.org/10.1016/j.ibusrev.2023.102168

26. Chor, D., Manova, K. (2012). Off the cliff and back? Credit conditions and international trade during the global financial crisis. *Journal of International Economics,* Vol. 87, Issue 1, 117–133. https://doi.org/10.1016/j.jinteco.2011.04.001

27. Gulzar, I., Bisati, A.I., Haque, S.M.I. (2023). Endogeneity and the Dynamics of Corporate Governance and Innovation in India's Manufacturing Sector. *Business Perspectives and Research.* https://doi.org/10.1177/22785337221148580

28. Tagoe, N., Nyarko, E., Anuwa-Amarh, E. (2005). Financial challenges facing urban SMEs under financial sector liberalization in Ghana. *Journal of Small Business Management,* Vol. 43, Issue 3, 331–343. https://doi.org/10.1111/J.1540-627x.2005.00140.x

29. Alexandrov, G., Vyakina, I., Skvortsova, G. (2021). Assessment of the Factors of Investment Attractiveness of the Business Environment in Terms of Sustainable Development of the Region. *E3S Web of Conferences,* Vol. 295, 01043. https://doi.org/10.1051/e3sconf/202129501043

30. Lektzian, D., Mkrtchian, G. (2021). The effect of sanctions on economic freedom. *Social Science Quarterly,* Vol. 102, Issue 6, 2776–2794. https://doi.org/10.1111/ssqu.13067

31. Vatansever, A. (2020). Put over a barrel? "Smart" sanctions, petroleum and statecraft in Russia. *Energy Research & Social Science,* Vol. 69, 101607. https://doi.org/10.1016/J.ERSS.2020.101607

32. Tuzova, Y., Qayum, F. (2016). Global oil glut and sanctions: The impact on Putin's Russia. *Energy Policy,* Vol. 90, 140–151. https://doi.org/10.1016/j.enpol.2015.12.008

33. Chortane, S.G., Pandey, D.K. (2022). Does the Russia-Ukraine war lead to currency asymmetries? A US dollar tale. *Journal of Economic Asymmetries,* Vol. 26, e00265. https://doi.org/10.1016/j.jeca.2022.e00265

34. Kholodilin, K.A., Netšunajev, A. (2019). Crimea and punishment: the impact of sanctions on Russian economy and economies of the euro area. *Baltic Journal of Economics,* Vol. 19, Issue 1, 39–51. https://doi.org/10.1080/1406099x.2018.1547566

35. Gould-Davies, N. (2018). Economic effects and political impacts: Assessing Western sanctions on Russia, *BOFIT Policy Brief,* No. 8/2018. Helsinki, Bank of Finland, Institute for Economies in Transition (BOFIT). Available at: https://www.econstor.eu/handle/10419/251680

36. Davis, C.M. (2016). The Ukraine conflict, economic-military power balances and economic sanctions. *Post-Communist Economies,* Vol. 28, Issue 2, 167–198. https://doi.org/10.1080/14631377.2016.1139301

37. Sahling, C. (2024). Central Banking in Russia, Ukraine, and Belarus in the Face of Pandemic, War, and Sanctions. *In: Central Banking in a Post-Pandemic World.* Edited by M. Yağcı. Routledge, 145–166. Available at: https://www.taylorfrancis.com/chapters/edit/10.4324/9781003323280-10/central-banking-russia-ukraine-belarus-face-pandemic-war-sanctions-cornelia-sahling

38. Early, B., Peksen, D. (2019). Searching in the Shadows: The Impact of Economic Sanctions on Informal Economies. *Political Research Quarterly,* Vol. 72, Issue 4, 821–834. https://doi.org/10.1177/1065912918806412

39. Shakib, M., Sohag, K., Kabir Hassan, M., Vasilyeva, R. (2023). Finance and export diversifications Nexus in Russian regions: Role of trade globalization and regional potential. *Emerging Markets Review,* Vol. 57, 101059. https://doi.org/10.1016/j.ememar.2023.101059

40. Machado, J.A., Silva, J.S. (2019). Quantiles via moments. *Journal of Econometrics,* Vol. 213, Issue 1, 145–173. https://doi.org/10.1016/j.jeconom.2019.04.009

41. Valliere, D., Peterson, R. (2009). Entrepreneurship and economic growth: Evidence from emerging and developed countries. *Entrepreneurship & Regional Development,* Vol. 21, Issue 5–6, 459–480. https://doi.org/10.1080/08985620802332723

42. Halpern, L., Muraközy, B. (2012). Innovation, productivity and exports: The case of Hungary. *Economics of Innovation & New Technology,* Vol. 21, Issue 2, 151–173. https://doi.org/10.1080/10438599.2011.561995

43. Markakkaran, S., Sridharan, P. (2022). Impact of export diversification on economic growth: a system GMM approach. *International Journal of Development Issues,* Vol. 21, Issue 2, 309–320. https://doi.org/10.1108/ijdi-10-2021-0210

44. Herzer, D., Nowak-Lehnmann, D.F. (2006). What does export diversification do for growth? An econometric analysis. *Applied Economics,* Vol. 38, Issue 15, 1825–1838. https://doi.org/10.1080/00036840500426983

45. Alaya, M. (2012). The determinants of MENA export diversification: An empirical analysis. *Economic Research Forum.* Working Paper 709. Available at: https://erf.org.eg/app/uploads/2014/08/709.pdf

46. Dong, G., Kokko, A., Zhou, H. (2022). Innovation and export performance of emerging market enterprises: The roles of state and foreign ownership in China. *International Business Review,* Vol. 31, Issue 6. 102025. https://doi.org/10.1016/j.ibusrev.2022.102025

47. Melitz, M.J. (2003). The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica,* Vol. 71, Issue 6, 1695–1725. https://doi.org/10.1111/1468-0262.00467

48. Bernard, A.B., Jensen, J.B., Redding, S.J., Schott, P.K. (2012). The empirics of firm heterogeneity and international trade. *Annual Review of Economics,* Vol. 4, Issue 1, 283–313. https://doi.org/10.1146/annurev-economics-080511-110928

49. Faiazova, S.I. (2020). Innovation influence on export activities: Empirical analysis of Russian companies. *Strategic Decisions and Risk Management,* Vol. 11, No. 1, 56–69. https://doi.org/10.17747/2618-947x-2020-1-56-69

50. Song, Y., Hao, X., Zheng, L. (2022). Intermediate import, independent innovation and export sophistication of Chinese manufacturing enterprises. *Structural Change and Economic Dynamics,* Vol. 60, 126–140. https://doi.org/10.1016/j.strueco.2021.11.012

51. Monreal-Pérez, J., Aragón-Sánchez, A., Sánchez-Marín, G. (2012). A longitudinal study of the relationship between export activity and innovation in the Spanish firm: The moderating role of productivity. *International Business Review,* Vol. 21, Issue 5, 862–877. https://doi.org/10.1016/j.ibusrev.2011.09.010

52. Lawton, T. C. McGuire, S.M. (2021). Supranational governance and corporate strategy: the emerging role of the World Trade Organization. *International Business Review,* Vol. 10, Issue 2, 217–233. https://doi.org/10.1016/S0969-5931(00)00047-0

53. Rose, A.K. (2004). Do We Really Know That the WTO Increases Trade? *American Economic Review,* Vol. 94, No. 1, 98–114. https://doi.org/10.1257/000282804322970724

54. Subramanian, A., Wei, S.-J. (2007). The WTO promotes trade, strongly but unevenly. *Journal of International Economics,* Vol. 72, Issue 1, 151–175. https://doi.org/10.1016/j.jinteco.2006.07.007

55. Tomz, M., Goldstein, J.L., Rivers, D. (2005). Do We Really Know That the WTO Increases Trade? Comment. *American Economic Review,* Vol. 97, No. 5, 2005–2018. https://doi.org/10.1257/aer.97.5.2005

56. Paul, J. (2015). Does the WTO increase trade and cause convergence? *International Trade Journal,* Vol. 29, Issue 4, 291–308. https://doi.org/10.1080/08853908.2015.1053632

57. Felbermayr, G., Kohler, W. (2010). Does WTO membership make a difference at the extensive margin of world trade? *In: Is the World Trade Organization Attractive Enough for Emerging Economies? Critical Essays on the Multilateral Trading System.* Edited by Z. Drabek. London, Palgrave Macmillan UK, 217–246. https://doi.org/10.1057/9780230250826_9

58. Castellani, D., Serti, F., Tomasi, C. (2010). Firms in International Trade: Importers' and Exporters' Heterogeneity in Italian Manufacturing Industry. *World Economy,* Vol. 33, Issue 3, 424–457. https://doi.org/10.1111/j.1467-9701.2010.01262.x

59. Cali, M., Ghose, D., Montfaucon, A.F., Ruta, M. (2022). *Trade Policy and Exporters' Resilience: Evidence from Indonesia.* The World Bank. https://dx.doi.org/10.2139/ssrn.4295056

60. Juárez Allende, H.H. (2022). Procedures and Facilitation. *In: The World Customs Organization. Law for Professionals.* Springer, Cham, 177–231. https://doi.org/10.1007/978-3-030-85296-2_10

61. Ireland, R.D., Webb, J.W. (2007). Strategic entrepreneurship: Creating competitive advantage through streams of innovation. *Business Horizons,* Vol. 50, Issue 1, 49–59. https://doi.org/10.1016/j.bushor.2006.06.002

62. Leitner, S.M., Stehrer, R. (2013). Access to finance and funding composition during the crisis: A firm-level analysis of Latin American countries. *Latin American Journal of Economics,* Vol. 50, No. 1, 1–47. https://doi.org/10.7764/laje.50.1.1

63. Petryk, O., Semenov, A., Hnatenko, I., Samiilenko, A., Rubezhanska, V., Patsarniuk, O. (2020). Conceptual model for assessing the investment attractiveness of innovative projects of industrial enterprises. *Accounting,* Vol. 6, No. 7, 1345–1350. https://doi.org/10.5267/j.ac.2020.8.015

64. Rehman, Z.U., Muhammad, N., Sarwar, B., Raz, M.A. (2019). Impact of risk management strategies on the credit risk faced by commercial banks of Balochistan. *Financial Innovation,* Vol. 5, Issue 1, 1–13. https://doi.org/10.1186/s40854-019-0159-8

65. Rizkullah, A.R., Suhel, Andaiyani, S. (2023). Determinants of Credit Growth: An Empirical Study of Commercial Banks in Indonesia. *Journal of Applied Economic Research,* Vol. 22, No. 2, 404–424. https://doi.org/10.15826/vestnik.2023.22.2.017

66. Allen, F., Gale, D. (1999). Innovations in financial services, relationships, and risk sharing. *Management Science,* Vol. 45, No. 9, 1239–1253. https://doi.org/10.1287/mnsc.45.9.1239

67. King, R.G., Levine, R. (1993). Finance and growth: Schumpeter might be right. *The Quarterly Journal of Economics,* Vol. 108, Issue 3, 717–737. https://doi.org/10.2307/2118406

68. Besedeš, T., Goldbach, S., Nitsch, V. (2021). Cheap talk? Financial sanctions and non-financial firms. *European Economic Review,* Vol. 134, 103688. https://doi.org/10.1016/j.euroecorev.2021.103688

69. Mirkina, I. (2018). FDI and sanctions: An empirical analysis of short-and long-run effects. *European Journal of Political Economy,* Vol. 54, 198–225. https://doi.org/10.1016/j.ejpoleco.2018.05.008

70. Nikiforakis, N. (2008). Punishment and counter-punishment in public good games: Can we really govern ourselves? *Journal of Public Economics,* Vol. 92, Issue 1–2, 91–112. https://doi.org/10.1016/j.jpubeco.2007.04.008

71. Onderco, M., van der Veer, R. A. (2021). No More Gouda in Moscow? Distributive Effects of the Imposition of Sanctions. *JCMS: Journal of Common Market Studies,* Vol. 59, Issue 6, 1345–1363. https://doi.org/10.1111/jcms.13185

72. Lektzian, D., Biglaiser, G. (2013). Investment, opportunity, and risk: Do US sanctions deter or encourage global investment? *International Studies Quarterly,* Vol. 57, Issue 1, 65–78. https://doi.org/10.1111/j.1468-2478.2012.00761.x

73. Dreger, C., Kholodilin, K.A., Ulbricht, D., Fidrmuc, J. (2016). Between the hammer and the anvil: The impact of economic sanctions and oil prices on Russia's ruble. *Journal of Comparative Economics,* Vol. 44, Issue 2, 295–308. https://doi.org/10.1016/j.jce.2015.12.010

74. Portela, C., Pospieszna, P., Skrzypczyńska, J., Walentek, D. (2021). Consensus against all odds: explaining the persistence of EU sanctions on Russia. *Journal of European Integration,* Vol. 43, Issue 6, 683–699. https://doi.org/10.1080/07036337.2020.1803854

75. Silvan, K., Kaczmarski, M. (2023). Russia's Approach to Connectivity in Asia: From Cooperation to Coercion. *East Asia,* Vol. 40, 317–334. https://doi.org/10.1007/s12140-023-09404-w

76. Gaur, A., Settles, A., Väätänen, J. (2023). Do Economic Sanctions Work? Evidence from the Russia-Ukraine Conflict. *Journal of Management Studies,* Vol. 60, Issue 6, 1391–1414. https://doi.org/10.1111/joms.12933

77. Ross, M.L. (2019). What do we know about export diversification in oil-producing countries? *The Extractive Industries and Society,* Vol. 6, Issue 3, 792–806. https://doi.org/10.1016/j.exis.2019.06.004

78. Seyfi, S., Hall, C.M. (2020). Sanctions and tourism: Effects, complexities and research. *Tourism Geographies,* Vol. 22, Issue 4–5, 749–767. https://doi.org/10.1080/14616688.2019.1663911

79. Vasilyeva, R.I., Voitenkov, V.A., Urazbaeva, A.R. (2022). Modelling of the Influence of Regional Determinants on Export Diversification in Russia. *Journal of Applied Economic Research,* Vol. 21, No. 1, 79–100. https://doi.org/10.15826/vestnik.2022.21.1.004

80. Swathi, M., Sridharan, P. (2022). Determinants of Export Diversification: Evidence from Fractional Logit Estimation Model. *Foreign Trade Review,* Vol. 57, Issue 2, 160–177. https://doi.org/10.1177/00157325211072922

81. Nieminen, M. (2020). Multidimensional financial development, exporter behavior and export diversification. *Economic Modelling,* Vol. 93, 1–12. https://doi.org/10.1016/j.econmod.2020.07.021

82. Vasilyeva, R.I., Mariev, O.S., Voytenkov, V.A., Urazbaeva, A.R. (2022). Factors of Export Diversification: Empirical Analysis of Russian Industrial Regions. *Economy of Regions,* Vol. 18, No. 3, 895–909. https://doi.org/10.17059/ekon.reg.2022-3-19

83. Corrente, S., Garcia-Bernabeu, A., Greco, S., Makkonen, T. (2023). Robust measurement of innovation performances in Europe with a hierarchy of interacting composite indicators. *Economics of Innovation and New Technology,* Vol. 32, Issue 2, 305–322. https://doi.org/10.1080/10438599.2021.1910815

84. Yurevich, M.A. (2022). Factors of Growth in Income from Research Activities in Universities of the Russian Federation. *Journal of Applied Economic Research,* Vol. 21, No. 4, 795–817. https://doi.org/10.15826/vestnik.2022.21.4.028

85. Hervás-Oliver, J.L., Parrilli, M.D., Rodríguez-Pose, A., Sempere-Ripoll, F. (2021). The drivers of SME innovation in the regions of the EU. *Research Policy,* Vol. 50, Issue 9, 104316. https://doi.org/10.1016/j.respol.2021.104316

86. Pradhan, R.P., Arvin, M.B., Bahmani, S. (2018). Are innovation and financial development causative factors in economic growth? Evidence from a panel granger causality test. *Technological Forecasting and Social Change,* Vol. 132, 130–142. https://doi.org/10.1016/j.techfore.2018.01.024

87. Xin, F., Zhang, J., Zheng, W. (2017). Does credit market impede innovation? Based on the banking structure analysis. *International Review of Economics & Finance,* Vol. 52, 268–288. https://doi.org/10.1016/j.iref.2017.01.014

88. Hsu, P.H., Tian, X., Xu, Y. (2014). Financial development and innovation: Cross-country evidence. Journal of Financial Economics, Vol. 112, Issue 1, 116–135. https://doi.org/10.1016/j.jfineco.2013.12.002

89. Shakib, M., Sohag, K., Mariev, O., Samargandi, N., Ferraris, A. (2023). Innovation and credit market deepening: Evidence from Russian region. *Journal of Innovation & Knowledge,* Vol. 8, Issue 3, 100391. https://doi.org/10.1016/j.jik.2023.100391

90. Degles, H.S.M., Kelchevskaya N. R. (2021). The Impact of Intellectual Capital on Performance and Investment Attractiveness of Russian Companies. *Journal of Applied Economic Research,* Vol. 20, No. 1, 110–132. https://doi.org/10.15826/vestnik.2021.20.1.005

91. Allen, S.H. (2008). The domestic political costs of economic sanctions. *Journal of Conflict Resolution,* Vol. 52, Issue 6, 916–944. https://doi.org/10.1177/0022002708325044

92. Mosley, P. (2018). Why has export diversification been so hard to achieve in Africa? *The World Economy,* Vol. 41, Issue 4, 1025–1044. https://doi.org/10.1111/twec.12620

93. Koenker, R., Bassett Jr., G. (1978). Regression quantiles. *Econometrica,* Vol. 46, No. 1, 33–50. https://doi.org/10.2307/1913643

94. Canay, I.A. (2011). A simple approach to quantile regression for panel data. *Econometrics Journal,* Vol. 14, Issue 3, 368–386. https://doi.org/10.1111/j.1368-423x.2011.00349.x

95. Awan, A., Abbasi, K. R., Rej, S., Bandyopadhyay, A., Lv, K. (2022). The impact of renewable energy, internet use and foreign direct investment on carbon dioxide emissions: A method of moments quantile analysis. *Renewable Energy,* Vol. 189, 454–466. https://doi.org/10.1016/j.renene.2022.03.017

96. Koenker, R. (2004). Quantile regression for longitudinal data. *Journal of Multivariate Analysis,* Vol. 91, Issue 1, 74–89. https://doi.org/10.1016/j.jmva.2004.05.006

97. Khan, S.A.R., Ponce, P., Yu, Z., Ponce, K. (2022). Investigating economic growth and natural resource dependence: An asymmetric approach in developed and developing economies. *Resources Policy,* Vol. 77, 102672. https://doi.org/10.1016/j.resourpol.2022.102672

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Взаимосвязь инноваций и диверсификации экспорта в российских регионах: имеют ли значение глобализация торговли, бизнес-потенциал и геополитика?

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Аннотация. Российские регионы демонстрируют ограниченную степень диверсификации экспорта в основном из-за подавляющего доминирования экспорта углеводородов и их последующего влияния на государственные доходы внутри регионов. Тем не менее в свете текущей геополитической напряженности и экономической неопределенности Россия вынуждена уделять приоритетное внимание диверсификации своего экспорта. На этом фоне в данной статье мы эмпирически исследуем, могут ли инновации в какой-то степени увеличить диверсификацию экспорта российских регионов, обосновывая значимость таких факторов, как глобализация торговли благодаря вступлению России в ВТО, бизнес-потенциал на региональном уровне и экономические последствия санкций 2014 г. Данные были собраны по 66 регионам России в период с 2009 по 2019 г. Учитывая значительную неоднородность данных по регионам и за длительный период времени, в данном исследовании применялась квантильная регрессия методом моментов (Method of Moments Quantile Regression, MMQR) на панельных данных. Основные результаты исследования показывают, что инновации стимулируют диверсификацию экспорта в российских регионах при различных макроэкономических сценариях, где роль инноваций является ключевой в среднем и высшем квантилях. В статье также обосновывается, что вступление России в ВТО способствовало диверсификации экспорта страны, стимулируемого инновациями. Кроме того, в данном исследовании отмечается сильная динамика стимулируемой инновациями экспортной диверсификации в регионах России с высоким бизнес-потенциалом. Исследование также показало, что экономические санкции, введенные в 2014 г., обеспечили диверсификацию экспорта за счет инноваций в российских регионах. Полученные результаты исследования могут быть полезны при разработке практических подходов к стимулированию инноваций в частном секторе и диверсификации экспорта в российских регионах.

Ключевые слова: инновации; диверсификация экспорта; глобализация торговли; ВТО; геополитика; санкции; бизнес-потенциал; MMQR; Россия.

Список использованных источников

1. *Makarov A. A.* Technological Progress Opportunities in the Energy Sector of Russia // Studies on Russian Economic Development. 2020. Vol. 31, Issue 1. Pp. 52–63. https://doi.org/10.1134/S1075700720010086

2. *Mariev O., Davidson N., Nagieva K., Pushkarev A.* Innovations and their complementarities: which types of innovations drive export performance? // Post-Communist Economies. 2023. Vol. 35, Issue 7. Pp. 708–743. https://doi.org/10.1080/14631377.2023.2215022

3. *Davidson N., Mariev O., Pushkarev A.* The Impact of Externalities on the Innovation Activity of Russian Firms // Foresight and STI Governance. 2018. Vol. 12, No. 3. Pp. 62–72. https://doi.org/10.17323/2500-2597.2018.3.62.72

4. *Tajoli L.* Too much of a good thing? Russia-EU international trade relations at times of war // Journal of Industrial and Business Economics. 2022. Vol. 49, Issue 4. Pp. 807–834. http://dx-.doi.org/10.1007/s40812-022-00232-2

5. *Alexeev M., Kurlyandskaya G.* Russian Fiscal Federalism: Impact of Political and Fiscal (De)Centralization // Journal of Comparative Economics. 2013. Vol. 31, Issue 1. Pp. 20–33. https://doi.org/10.1016/S0147-5967(02)00011-2

6. *Rozhkova A. V., Karaseva M. V.* Regional structural export diversification // IOP Conference Series: Earth and Environmental Science. 2020. Vol. 421, Issue 3. 032015. https://doi.org/10.1088/1755-1315/421/3/032015

7. *Zemtsov S., Muradov A., Wade I., Barinova V.* Determinants of regional innovation in Russia: Are people or capital more important? // Foresight and STI Governance. 2016. Vol. 10, No. 2. Pp. 29–42. https://doi.org/10.17323/1995-459x.2016.2.29.42

8. *Abbas S., Shtun V., Sapogova V., Gleb V.* Russian global export flow and potential: evidence from augmented gravity model // International Journal of Emerging Markets, ahead-of-print (ahead-of-print). 2023. https://doi.org/10.1108/IJOEM-02-2022-0285

9. *Sarin V., Mahapatra S. K., Sood N.* Export diversification and economic growth: A review and future research agenda // Journal of Public Affairs. 2022. Vol. 22, Issue 3. e2524. https://doi.org/10.1002/pa.2524

10. *Carrasco C. A., Tovar-García E. D.* Trade and growth in developing countries: the role of export composition, import composition and export diversification // Economic Change and Restructuring. 2021. Vol. 54, Issue 4. Pp. 919–941. https://doi.org/10.1007/s10644-020-09291-8

11. *Cirera X., Marin A., Markwald R.* Explaining export diversification through firm innovation decisions: The case of Brazil // Resources. Policy. 2015. Vol. 44, Issue 10. Pp. 1962–1973. https://doi.org/10.1016/j.respol.2015.06.004

12. *Balavac M., Pugh G.* The link between trade openness, export diversification, institutions and output volatility in transition countries // Economic Systems. 2016. Vol. 40, Issue 2. Pp. 273–287. https://doi.org/10.1016/j.ecosys.2016.02.001

13. *Ngassam S. B.* Exports Diversification in Africa: The Role of Infrastructures // Journal of the Knowledge Economy. 2023. Pp. 1–33. https://doi.org/10.1007/s13132-023-01408-4

14. *Barinova V., Zemtsov S., Zinov V., Kidyaeva V., Krasnoselskikh A.N., Kurakova N.G., Semenova R.I., Fedotov I.V., Halimova S.R., Khafisov R.R., Tsareva Yu. V.* National Report "High-Tech Business in the Russian Regions". Issue 2. Moscow: RANEPA, AIRR. 2019. URL: https://ss-rn.com/abstract=3062324

15. *Lopez C., Haddoud M. Y., Kasturiratne D.* Revisiting the innovation–export entry link through a configuration approach // Journal of Business Research. 2022. Vol. 149. Pp. 927–937. https://doi.org/10.1016/j.jbusres.2022.05.018

16. *Autor D., Dorn D., Hanson G. H., Pisano G., Shu P.* Foreign Competition and Domestic Innovation: Evidence from US Patents // American Economic Review: Insights. 2020. Vol. 2, No. 3. Pp. 357–374. https://doi.org/10.1257/aeri.20180481

17. *Gokhberg L. M., Gracheva G. A., Ditkovskiy K. A., Evnevich E. I., Kuznetsova I. A., Martynova S. V.* Indicators of Innovation in the Russian Federation Data Book. Moscow: Higher School of Economics, 2021. 280 p. https://www.hse.ru/data/2022/04/01/1798049748/Indicators_of_Innovation_2021.pdf

18. *Dutta S., Lanvin B., Wunsch-Vincent S.* The Global Innovation Index 2021. World Intellectual Property Organization, 2021. URL: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021.pdf

19. *Dong H.* The impact of trade facilitation on the networks of value-added trade-based on social network analysis // Emerging Markets Finance and Trade. 2022. Vol. 58, Issue 8. Pp. 2290–2299. https://doi.org/10.1080/1540496X.2021.1974393

20. *Beverelli C., Neumueller S., Teh R.* Export diversification effects of the WTO trade facilitation agreement // World Development. 2015. Vol. 76. Pp. 293–310. https://doi.org/10.1016/j.worlddev.2015.07.009

21. *Dutt P., Mihov I., Van Zandt T.* The effect of WTO on the extensive and the intensive margins of trade // Journal of International Economics. 2013. Vol. 91, Issue 2. Pp. 204–219. https://doi.org/10.1016/j.jinteco.2013.08.001

22. *Gnangnon S.K.* Aid for trade and export diversification in recipient-countries // The World Economy. 2019. Vol. 42, Issue 2. Pp. 396–418. https://doi.org/10.1111/twec.12711

23. UN.ESCAP. Digital and Sustainable Trade Facilitation: Global Report 2021. United Nations, 2022. URL: https://hdl.handle.net/20.500.12870/4216

24. *Connolly R.* Economic modernisation in Russia: the role of the world trade organization // European Politics and Society. 2015. Vol. 16, Issue 1. Pp. 27–44, https://doi.org/10.1080/15705854.2014.965891

25. *Freeman S., Vissak T., Nummela N., Trudgen R.* Do technology-focused fast internationalizers' performance measures change as they mature? // International Business Review. 2023. Vol. 32, Issue 5. 102168. https://doi.org/10.1016/j.ibusrev.2023.102168

26. *Chor D., Manova K.* Off the cliff and back? Credit conditions and international trade during the global financial crisis // Journal of International Economics. 2012. Vol. 87, Issue 1. Pp. 117–133. https://doi.org/10.1016/j.jinteco.2011.04.001

27. *Gulzar I., Bisati A.I., Haque S.M.I.* Endogeneity and the Dynamics of Corporate Governance and Innovation in India's Manufacturing Sector // Business Perspectives and Research. 2023. https://doi.org/10.1177/22785337221148580

28. *Tagoe N., Nyarko E., Anuwa-Amarh E.* Financial challenges facing urban SMEs under financial sector liberalization in Ghana // Journal of Small Business Management. 2005. Vol. 43, Issue 3. Pp. 331–343. https://doi.org/10.1111/J.1540-627x.2005.00140.x

29. *Alexandrov G., Vyakina I., Skvortsova G.* Assessment of the Factors of Investment Attractiveness of the Business Environment in Terms of Sustainable Development of the Region // E3S Web of Conferences. 2021. Vol. 295. 01043. https://doi.org/10.1051/e3sconf/202129501043

30. *Lektzian D., Mkrtchian G.* The effect of sanctions on economic freedom // Social Science Quarterly. 2021. Vol. 102, Issue 6. Pp. 2776–2794. https://doi.org/10.1111/ssqu.13067

31. *Vatansever A.* Put over a barrel? "Smart" sanctions, petroleum and statecraft in Russia // Energy Research & Social Science. 2020. Vol. 69. 101607. https://doi.org/10.1016/J.ERSS.2020.101607

32. *Tuzova Y., Qayum F.* Global oil glut and sanctions: The impact on Putin's Russia // Energy Policy. 2016. Vol. 90. Pp. 140–151. https://doi.org/10.1016/J.ENPOL.2015.12.008

33. *Chortane S.G., Pandey D.K.* Does the Russia-Ukraine war lead to currency asymmetries? A US dollar tale // Journal of Economic Asymmetries. 2022. Vol. 26. e00265. https://doi.org/10.1016/j.jeca.2022.e00265

34. *Kholodilin K.A., Netšunajev A.* Crimea and punishment: the impact of sanctions on Russian economy and economies of the euro area // Baltic Journal of Economics. 2019. Vol. 19, Issue 1. Pp. 39–51. https://doi.org/10.1080/1406099x.2018.1547566

35. *Gould-Davies N.* Economic effects and political impacts: Assessing Western sanctions on Russia // BOFIT Policy Brief. No. 8/2018. Helsinki: Bank of Finland, Institute for Economies in Transition (BOFIT), 2018. URL: https://www.econstor.eu/handle/10419/251680

36. *Davis C.M.* The Ukraine conflict, economic–military power balances and economic sanctions // Post-Communist Economies. 2016. Vol. 28, Issue 2. Pp. 167–198. https://doi.org/10.1080/14631377.2016.1139301

37. *Sahling C.* Central Banking in Russia, Ukraine, and Belarus in the Face of Pandemic, War, and Sanctions // In: Central Banking in a Post-Pandemic World. Edited by M. Yağcı. Routledge, 2023. Pp. 145–166. URL: https://www.taylorfrancis.com/chapters/edit/10.4324/9781003323280-10/central-banking-russia-ukraine-belarus-face-pandemic-war-sanctions-cornelia-sahling

38. *Early B., Peksen D.* Searching in the Shadows: The Impact of Economic Sanctions on Informal Economies // Political Research Quarterly. 2019. Vol. 72, Issue 4. Pp. 821–834. https://doi.org/10.1177/1065912918806412

39. *Shakib M., Sohag K., Kabir Hassan M., Vasilyeva R.* Finance and export diversifications Nexus in Russian regions: Role of trade globalization and regional potential // Emerging Markets Review. 2023. Vol. 57. 101059. https://doi.org/10.1016/j.ememar.2023.101059

40. *Machado J. A., Silva J. S.* Quantiles via moments // Journal of Econometrics. 2019. Vol. 213, Issue 1. Pp. 145–173. https://doi.org/10.1016/j.jeconom.2019.04.009

41. *Valliere D., Peterson R.* Entrepreneurship and economic growth: Evidence from emerging and developed countries // Entrepreneurship & Regional Development. 2009. Vol. 21, Issue 5–6. Pp. 459–480. https://doi.org/10.1080/08985620802332723

42. *Halpern L., Muraközy B.* Innovation, productivity and exports: The case of Hungary // Economics of Innovation & New Technology. 2012. Vol. 21, Issue 2. Pp. 151–173. https://doi.org/10.1080/10438599.2011.561995

43. *Markakkaran S., Sridharan P.* Impact of export diversification on economic growth: a system GMM approach // International Journal of Development Issues. 2022. Vol. 21, Issue 2. Pp. 309–320. https://doi.org/10.1108/ijdi-10-2021-0210

44. *Herzer D., Nowak-Lehnmann D. F.* What does export diversification do for growth? An econometric analysis // Applied Economics. 2006. Vol. 38, Issue 15. Pp. 1825–1838. https://doi.org/10.1080/00036840500426983

45. *Alaya M.* The determinants of MENA export diversification: An empirical analysis // Economic Research Forum. Working Paper 709. 2012. URL: https://erf.org.eg/app/uploads/2014/08/709.pdf

46. *Dong G., Kokko A., Zhou H.* Innovation and export performance of emerging market enterprises: The roles of state and foreign ownership in China // International Business Review. 2022. Vol. 31, Issue 6. 102025. https://doi.org/10.1016/j.ibusrev.2022.102025

47. *Melitz M. J.* The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity // Econometrica. 2003. Vol. 71, Issue 6. Pp. 1695–1725. https://doi.org/10.1111/1468-0262.00467

48. *Bernard A. B., Jensen J. B., Redding S. J., Schott P. K.* The empirics of firm heterogeneity and international trade // Annual Review of Economics. 2012. Vol. 4, Issue 1. Pp. 283–313. https://doi.org/10.1146/annurev-economics-080511-110928

49. *Faiazova S. I.* Innovation influence on export activities: Empirical analysis of Russian companies // Strategic Decisions and Risk Management. 2020. Vol. 11, No. 1. Pp. 56–69. https://doi.org/10.17747/2618-947x-2020-1-56-69

50. *Song Y., Hao X., Zheng L.* Intermediate import, independent innovation and export sophistication of Chinese manufacturing enterprises // Structural Change and Economic Dynamics. 2022. Vol. 60. Pp. 126–140. https://doi.org/10.1016/j.strueco.2021.11.012

51. *Monreal-Pérez J., Aragón-Sánchez A., Sánchez-Marín G.* A longitudinal study of the relationship between export activity and innovation in the Spanish firm: The moderating role of productivity // International Business Review. 2012. Vol. 21, Issue 5. Pp. 862–877. https://doi.org/10.1016/j.ibusrev.2011.09.010

52. *Lawton T. C., McGuire S. M.* Supranational governance and corporate strategy: the emerging role of the World Trade Organization // International Business Review. 2021. Vol. 10, Issue 2. Pp. 217–233. https://doi.org/10.1016/S0969-5931(00)00047-0

53. *Rose A. K.* Do We Really Know That the WTO Increases Trade? // American Economic Review. 2004. Vol. 94, No. 1. Pp. 98–114. https://doi.org/10.1257/000282804322970724

54. *Subramanian A., Wei S.-J.* The WTO promotes trade, strongly but unevenly // Journal of International Economics. 2007. Vol. 72, Issue 1. Pp. 151–175. https://doi.org/10.1016/j.jinteco.2006.07.007

55. *Tomz M., Goldstein J. L., Rivers D.* Do We Really Know That the WTO Increases Trade? Comment // American Economic Review. 2005. Vol. 97, No. 5. Pp. 2005–2018. https://doi.org/10.1257/aer.97.5.2005

56. *Paul J.* Does the WTO increase trade and cause convergence? // International Trade Journal. 2015. Vol. 29, Issue 4. Pp. 291–308. https://doi.org/10.1080/08853908.2015.1053632

57. *Felbermayr G., Kohler W.* Does WTO membership make a difference at the extensive margin of world trade? // In: Is the World Trade Organization Attractive Enough for Emerging Economies? Critical Essays on the Multilateral Trading System. Edited by Z. Drabek London: Palgrave Macmillan UK, 2010. Pp. 217–246. https://doi.org/10.1057/9780230250826_9

58. *Castellani D., Serti F., Tomasi C.* Firms in International Trade: Importers' and Exporters' Heterogeneity in Italian Manufacturing Industry // World Economy. 2010. Vol. 33, Issue 3. Pp. 424–457. https://doi.org/10.1111/j.1467-9701.2010.01262.x

59. *Cali M., Ghose D., Montfaucon A. F., Ruta M.* Trade Policy and Exporters' Resilience: Evidence from Indonesia. The World Bank, 2022. https://dx.doi.org/10.2139/ssrn.4295056

60. *Juárez Allende H. H.* Procedures and Facilitation. *In: The World Customs Organization. Law for Professionals.* Springer, Cham, 2022. Pp. 177–231. https://doi.org/10.1007/978-3-030-85296-2_10

61. *Ireland R. D., Webb J. W.* Strategic entrepreneurship: Creating competitive advantage through streams of innovation // Business Horizons. 2007. Vol. 50, Issue 1. Pp. 49–59. https://doi.org/10.1016/j.bushor.2006.06.002

62. *Leitner S. M., Stehrer R.* Access to finance and funding composition during the crisis: A firm-level analysis of Latin American countries // Latin American Journal of Economics. 2013. Vol. 50, No. 1. Pp. 1–47. https://doi.org/10.7764/laje.50.1.1

63. *Petryk O., Semenov A., Hnatenko I., Samiilenko A., Rubezhanska V., Patsarniuk O.* Conceptual model for assessing the investment attractiveness of innovative projects of industrial enterprises // Accounting. 2020. Vol. 6, No. 7. Pp. 1345–1350. https://doi.org/10.5267/j.ac.2020.8.015

64. *Rehman Z. U., Muhammad N., Sarwar B., Raz M. A.* Impact of risk management strategies on the credit risk faced by commercial banks of Balochistan // Financial Innovation. 2019. Vol. 5, Issue 1. Pp. 1–13. https://doi.org/10.1186/s40854-019-0159-8

65. *Rizkullah A. R., Suhel, Andaiyani S.* Determinants of Credit Growth: An Empirical Study of Commercial Banks in Indonesia // Journal of Applied Economic Research. 2023. Vol. 22, No. 2, 404–424. https://doi.org/10.15826/vestnik.2023.22.2.017

66. *Allen F., Gale D.* Innovations in financial services, relationships, and risk sharing // Management Science. 1999. Vol. 45, No. 9. Pp. 1239–1253. https://doi.org/10.1287/mnsc.45.9.1239

67. *King R. G., Levine R.* Finance and growth: Schumpeter might be right // Quarterly Journal of Economics. 1993. Vol. 108, Issue 3. Pp. 717–737. https://doi.org/10.2307/2118406

68. *Besedeš T., Goldbach S., Nitsch V.* Cheap talk? Financial sanctions and non-financial firms // European Economic Review. 2021. Vol. 134. 103688. https://doi.org/10.1016/j.euroecorev.2021.103688

69. *Mirkina I.* FDI and sanctions: An empirical analysis of short-and long-run effects // European Journal of Political Economy. 2018. Vol. 54. Pp. 198–225. https://doi.org/10.1016/j.ejpoleco.2018.05.008

70. *Nikiforakis N.* Punishment and counter-punishment in public good games: Can we really govern ourselves? // Journal of Public Economics. 2008. Vol. 92, Issue 1–2. Pp. 91–112. https://doi.org/10.1016/j.jpubeco.2007.04.008

71. *Onderco M., van der Veer R. A.* No More Gouda in Moscow? Distributive Effects of the Imposition of Sanctions // JCMS: Journal of Common Market Studies. 2021. Vol. 59, Issue 6. Pp. 1345–1363. https://doi.org/10.1111/jcms.13185

72. *Lektzian D., Biglaiser G.* Investment, opportunity, and risk: Do US sanctions deter or encourage global investment? // International Studies Quarterly. 2013. Vol. 57, Issue 1. Pp. 65–78. https://doi.org/10.1111/j.1468-2478.2012.00761.x

73. *Dreger C., Kholodilin K. A., Ulbricht D., Fidrmuc J.* Between the hammer and the anvil: The impact of economic sanctions and oil prices on Russia's ruble // Journal of Comparative Economics. 2016. Vol. 44, Issue 2. Pp. 295–308. https://doi.org/10.1016/j.jce.2015.12.010

74. *Portela C., Pospieszna P., Skrzypczyńska J., Walentek D.* Consensus against all odds: explaining the persistence of EU sanctions on Russia // Journal of European Integration. 2021. Vol. 43, Issue 6. Pp. 683–699. https://doi.org/10.1080/07036337.2020.1803854

75. *Silvan K., Kaczmarski M.* Russia's Approach to Connectivity in Asia: From Cooperation to Coercion // East Asia. 2023. Vol. 40. Pp. 317–334. https://doi.org/10.1007/s12140-023-09404-w

76. *Gaur A., Settles A., Väätänen J.* Do Economic Sanctions Work? Evidence from the Russia-Ukraine Conflict // Journal of Management Studies. 2023. Vol. 60, Issue 6. Pp. 1391–1414. https://doi.org/10.1111/joms.12933

77. *Ross M. L.* What do we know about export diversification in oil-producing countries? // Extractive Industries and Society. 2019. Vol. 6, Issue 3. Pp. 792–806. https://doi.org/10.1016/j.exis.2019.06.004

78. *Seyfi S., Hall C. M.* Sanctions and tourism: Effects, complexities and research // Tourism Geographies. 2020. Vol. 22, Issue 4–5. Pp. 749–767. https://doi.org/10.1080/14616688.2019.1663911

79. *Vasilyeva R. I., Voitenkov V. A., Urazbaeva A. R.* Modelling of the Influence of Regional Determinants on Export Diversification in Russia // Journal of Applied Economic Research. 2022. Vol. 21, No. 1. Pp. 79–100. https://doi.org/10.15826/vestnik.2022.21.1.004

80. *Swathi M, Sridharan P.* Determinants of Export Diversification: Evidence from Fractional Logit Estimation Model // Foreign Trade Review. 2022. Vol. 57, Issue 2. Pp. 160–177. https://doi.org/10.1177/00157325211072922

81. *Nieminen M.* Multidimensional financial development, exporter behavior and export diversification // Economic Modelling. 2020. Vol. 93. Pp. 1–12. https://doi.org/10.1016/j.econmod.2020.07.021

82. *Vasilyeva R. I., Mariev O. S., Voytenkov V. A., Urazbaeva A. R.* Factors of Export Diversification: Empirical Analysis of Russian Industrial Regions // Economy of Regions. 2022. Vol. 18, No. 3. Pp. 895–909. https://doi.org/10.17059/ekon.reg.2022-3-19

83. *Corrente S., Garcia-Bernabeu A., Greco S., Makkonen T.* Robust measurement of innovation performances in Europe with a hierarchy of interacting composite indicators // Economics of Innovation and New Technology. 2023. Vol. 32, Issue 2. Pp. 305–322. https://doi.org/10.1080/10438599.2021.1910815

84. *Yurevich M. A.* Factors of Growth in Income from Research Activities in Universities of the Russian Federation // Journal of Applied Economic Research. 2022. Vol. 21, No. 4. Pp. 795–817. https://doi.org/10.15826/vestnik.2022.21.4.028

85. *Hervás-Oliver J. L., Parrilli M. D., Rodríguez-Pose A., Sempere-Ripoll F.* The drivers of SME innovation in the regions of the EU // Research Policy. 2021. Vol. 50, Issue 9. 104316. https://doi.org/10.1016/j.respol.2021.104316

86. *Pradhan R. P., Arvin M. B., Bahmani S.* Are innovation and financial development causative factors in economic growth? Evidence from a panel granger causality test // Technological Forecasting and Social Change. 2018. Vol. 132. Pp. 130–142. https://doi.org/10.1016/j.techfore.2018.01.024

87. *Xin F., Zhang J., Zheng W.* Does credit market impede innovation? Based on the banking structure analysis // International Review of Economics & Finance. 2017. Vol. 52. Pp. 268–288. https://doi.org/10.1016/j.iref.2017.01.014

88. *Hsu P. H., Tian X., Xu Y.* Financial development and innovation: Cross-country evidence // Journal of Financial Economics. 2014. Vol. 112, Issue 1. Pp. 116–135. https://doi.org/10.1016/j.jfineco.2013.12.002

89. *Shakib M., Sohag K., Mariev O., Samargandi N., Ferraris A.* Innovation and credit market deepening: Evidence from Russian region // Journal of Innovation & Knowledge. 2023. Vol. 8, Issue 3. 100391. https://doi.org/10.1016/j.jik.2023.100391

90. *Degles H. S.M., Kelchevskaya N. R.* The Impact of Intellectual Capital on Performance and Investment Attractiveness of Russian Companies // Journal of Applied Economic Research. 2021. Vol. 20, No. 1. Pp. 110–132. https://doi.org/10.15826/vestnik.2021.20.1.005

91. *Allen S. H.* The domestic political costs of economic sanctions // Journal of Conflict Resolution. 2008. Vol. 52, Issue 6. Pp. 916–944. https://doi.org/10.1177/0022002708325044

92. *Mosley P.* Why has export diversification been so hard to achieve in Africa? // The World Economy. 2018. Vol. 41, Issue 4. Pp. 1025–1044. https://doi.org/10.1111/twec.12620

93. *Koenker R., Bassett Jr. G.* Regression quantiles // Econometrica. 1978. Vol. 46, No. 1. Pp. 33–50. https://doi.org/10.2307/1913643

94. *Canay I. A.* A simple approach to quantile regression for panel data // Econometrics Journal. 2011. Vol. 14, Issue 3. Pp. 368–386. https://doi.org/10.1111/j.1368-423x.2011.00349.x

95. *Awan A., Abbasi K. R., Rej S., Bandyopadhyay A., Lv K.* The impact of renewable energy, internet use and foreign direct investment on carbon dioxide emissions: A method of moments quantile analysis // Renewable Energy. 2022. Vol. 189. Pp. 454–466. https://doi.org/10.1016/j.renene.2022.03.017

96. *Koenker R.* Quantile regression for longitudinal data // Journal of Multivariate Analysis. 2004. Vol. 91, Issue 1. Pp. 74–89. https://doi.org/10.1016/j.jmva.2004.05.006

97. *Khan S. A.R., Ponce P., Yu Z., Ponce K.* Investigating economic growth and natural resource dependence: An asymmetric approach in developed and developing economies // Resources Policy. 2022. Vol. 77. 102672. https://doi.org/10.1016/j.resourpol.2022.102672

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ДЛЯ ЦИТИРОВАНИЯ

ИНФОРМАЦИЯ О СТАТЬЕ