**The Potential and Efficiency of Russia's Trade with China**

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Over the past decade, China and Russia have demonstrated an increasingly closer economic relationship that has taken various forms. The gravity model of trade would predict that two large economies sharing a long land border, enjoying good transportation links, exhibiting complementarities in their industrial structure, and fostering close ties have the prerequisites for achieving a flourishing trade relationship. In fact, bilateral trade between China and Russia has been expanding rapidly since the early 2000s with pre-pandemic predictions of 2019 levels doubling by 2024. Russia has specialized in the supply of natural resources needed by China's massive manufacturing sector, while receiving mostly apparel and machinery in return.

However, Russia is not among China's major trading partner, claiming a share of just 1.95% of Chinese exports in 2020, which is considerably less than the US (17%) or Japan (5%) but also India (2.6%) and Vietnam (4.4%), two neighboring economies that are not strategic partners of China. Russia's share in China's imports at 2.8% is also not impressive relative to Japan's 8.5%, Brazil's 4.1%, or Vietnam's 3.8%. These numbers signal the presence of major obstacles preventing trade between China and Russia from reaching an optimal level.

This study explores the Sino-Russian trade relationship in a comparative context with the goal of assessing the inefficiency responsible for keeping the bilateral exchange of goods at modest levels. In particular, we measure the potential level of trade between the two countries employing China's trade with its top partners as a benchmark. The actual trade flows are then evaluated relative to this benchmark with the gap serving as an indicator of inefficiency. Lastly, we identify the factors driving this inefficiency using a statistical framework. The findings allow us to derive specific policy recommendations aimed at lowering trade barriers and boosting Sino-Russian economic cooperation.

This paper makes three key contributions to the literature. First, we employ trade data at various levels of aggregation to study the patterns of trade between China and Russia over the entire period 1992-2020. Detailed statistics from Chinese customs enable us to describe not only exports and imports by goods category but also the firms involved, the mode of transportation, the customs regime, and the location of the customs processing the goods. This sheds light on many specific aspects of Sino-Russian trade that have not been addressed in previous studies. Second, we conduct a comprehensive empirical analysis of the trade potential and trade inefficiency using a sophisticated version of the gravity model that estimates the maximum possible trade levels accounting for differences in economic size, bilateral distance, contiguity, etc. The resulting frontier represents the potential for trade among all major trade partners of China and can be used to gauge how far Russia's trade levels are from this benchmark. This approach is more advantageous for our purposes than the widely-used

standard gravity model, which measures the average response of trade to marginal changes in its determinants. Third, we employ a regression framework to determine the factors that contribute to the inefficiency in Sino-Russian trade relations. In particular, we explore the effects of free trade agreements, customs, infrastructure, and the extent of participation in global value chains.

The empirical framework employed in this study combines two distinct models that are particularly suitable for comparative analysis of trade flows. The first of these is the gravity model, a standard approach in international economics introduced by Tinbergen (1962) and later given a theoretical foundation by Anderson (1979). The second model is the Stochastic Frontier Analysis (SFA), which was introduced by Aigner, Lovell, and Schmidt (1977) and Meeusen and Van den Broeck (1977) and is widely used in the literature on productivity and efficiency. Its main objective is to assess the performance of a unit relative to others by estimating a frontier that serves as the benchmark for comparisons. The distance of each unit from the frontier is decomposed into 1) a random error that contains all factors not taken into account in the model, and 2) an inefficiency term. The focus is on the latter since the distance to the frontier can be defined as a measure of efficiency. The best-performing units are on the frontier, while those below it are considered relatively less efficient. The longer the distance to the frontier for a given unit, the lower its efficiency level. We apply the SFA approach to the trade relationship defined by the gravity model, producing an empirical specification that can measure trade potential and trade efficiency.

Our results indicate that Russian exports to China reach only 43% of their potential, while Chinese exports to Russia achieve 69%. In both cases, the levels are below the sample average and lower than for most other developed or emerging economies. The most surprising finding is that efficiency levels in bilateral trade, and Russian exports in particular, suffered a dramatic decline since the early 2000s and remained low even during the recent period of expanding trade flows and closer economic ties.

This evidence points to the presence of major impediments that stifle Sino- Russian trade. We employ a regression model to identify some of these factors. A broad measure of bilateral trade costs with China suggests that Russia ranks in the middle with many countries enjoying lower costs, and thus higher trade efficiency. FTAs are found to have a positive effect on trade efficiency, implying that the lack of such an agreement between China and Russia puts the latter at a disadvantage relative to other trade partners of China. A larger export share of natural resources, and mineral fuels in particular, also contributes to Russia's unfavorable efficiency ranking. At the same time, our findings indicate that Western sanctions on Russia may have boosted its export efficiency with China after 2014. Lastly, Russia's weak involvement in backward GVCs has also widened the gap between actual and potential trade levels.

Reducing inefficiencies in Sino-Russian trade is likely to face major challenges. The heavy reliance on the extraction and export of natural resources has exacerbated the structural problems of the Russian economy as the industrial sector suffers from a lack of competitiveness, efficiency, and innovation, reinforcing the government's reluctance to enter into trade agreements with a global manufacturing powerhouse such as China. The FTA signed

by the Russian-led Eurasian Economic Union and China in 2018 is non-preferential, leaving potential reductions of tariffs to future negotiations, although planned simplifications of trade procedures might help bring down trade costs. Improvements in cross-border transportation links such as the recent completion of two bridges across the Amur river will lower trade costs between border regions in Heilongjiang and the Russian Far East but will have a limited effect at the national level.