

Article

Study on Quality Measurement and Influencing Factors of Russian Wood Forest Products Imported from China under the Background of High-Quality Development

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Abstract: Taking the trade flow of main wood forest products imported from Russia from 2011 to 2021 as the data source, this study measures the quality of the main wood forest products imported from Russia by China through the regression inference method of demand information and describes the changing trend of the quality of the wood forest products within the measurement range. In addition, the study also analyzes the influencing factors from the perspective of the high-quality development of China's foreign trade. The results show that the quality of major wood forest products imported from Russia by China ranks at the top in the measurement range, among which the quality of logs shows a downward trend, while the quality of converted timber and wood pulp shows an upward trend; China's customs convenience, import amount, and economic development level all play a significant positive correlation on the import quality of wood forest products, and the total population of China and the distance between the two countries have a significant negative correlation on the import quality of wood forest products. Some suggestions are put forward for expanding and strengthening the in-depth integration of forestry and economic cooperation between China and Russia, continuously deepening and strengthening the cooperation between the Far East and Siberia, and actively promoting the construction of the Sino-Russia free trade area.



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Keywords: Sino-Russia; wood forest product; import quality; high-quality development

1. Introduction

The European Commission approved the eighth round of sanctions against Russia on 6 October 2022. Since the Russia–Ukraine conflict broke out in early 2022, Russia, as a major producer and trader of wood forest products, has been forced to produce a series of trade diversion effects. China has undoubtedly become Russia's main strategic export to the east. Combined with the multiple impacts of COVID-19, the cooling of the real estate, construction, and decoration industry, and logistics disruptions, the world trade in wood forest products has entered a downward state of reduced supply and demand. WTO trade data shows that the growth of global merchandise trade in 2022 will be lowered from the previous forecast of 4.7 percent to 3.0 percent. In early 2022, the global softwood lumber trade slowed due to lower demand in most of the world's major markets, especially for lumber to China, the United States, and Germany, where imports fell by 6–20% compared with the same period in 2021 [1,2].

In terms of trade scale, both China and Russia play an important role in the world trade of wood forest products. In the long-term deal structure of wood forest products between China and Russia, China has been in the state of “net import” for a long time, and is also the chief export destination country of Russian wood forest products. According to the data of the Ministry of Economic Development and Trade of the Russian Federation, the export of wood and forest products accounted for 8% of the trade between China and

Russia in 2018, 11% in 2017, 7.66% in 2019, 8.85% in 2020, and 7.62% in 2021, ranking second after oil and its products.

However, the economies of scale have been far from meeting the actual development needs of the trade of wood forest products between China and Russia, and the two countries have been locked into the low global value chain of forest products trade for a long time. Against the background of the depth adjustment of global wood forest products supply and demand territory, the trade of wood forest products between China and Russia will also undergo profound changes [3,4].

In recent years, product quality has become a new perspective of international trade development. It is the micro and external expression of the quality of international trade, as well as the comprehensive expression of the comparative advantages between countries. Issues related to product quality are closely bound up with the high-quality development of international trade and the quality of import and export products has become an important symbol of a country's trade development level [5–7]. The quality of imported products is regarded as a necessary dimension to observe that the import trade structure, and the duration, of trade relations correlates positively with the quality of imported goods [8–11].

China first put forward a new expression of high-quality development on 24 October 2017, and the 20th National Congress of the Communist Party of China, which concluded in October 2022, identified high-quality development as a top priority to build China into a great modern socialist country in all respects. The high-quality development of the wood forest products trade between China and Russia is the path the two countries must take to realize the transition of the global wood forest products trade value chain. This paper attempts to measure the quality of main wood forest products imported from Russia by China from 2011 to 2021, describe the quality change map of these wood forest products within the measurement range, and analyze the influencing factors of quality change based on the above. In addition, this paper attempts to explore the high-quality development of wood forest products trade between China and Russia by taking import quality as a breakthrough. The theoretical marginal contribution of this paper may lie in starting from the micro product quality, this paper explores the relationship between the quality of international trade products and the high-quality development of national trade, provides countermeasures and suggestions for the high-quality development of wood forest products between China and Russia, and can provide references for the high-quality development of international trade in other industries.

2. Literature Review and Theoretical Foundation

The quality of economic development is limited by the scarcity of resources, and import trade is seen as the most direct and effective way to make up for this scarcity. China's per capita share of forest resources is low and environmental pressure is high, so the domestic demand for forest products is met mainly through international trade [12].

The import of wood forest products has become an important part of Chinese forestry supply-side reform to ensure the stability of a quality wood supply. While diversifying import sources, it has become an important development strategy for Chinese forestry economic and trade development to ensure the basic supply of raw wood forest products such as logs and converted timber, to expand imports, and to attach importance to the role of imports [13–15].

Russia is the world's biggest timber production and export power, with the unique advantages of forest resources endowment. It can provide different types of high-quality wood forest products, and its timber industry depends on forest resources. However, the export potential of its wood forest products has not been fully tapped due to the domestic forest management system, domestic laws and regulations, the relatively backward mechanical technology, the frequent adjustment of tariff policies, the inconvenient logistics transportation, and other reasons [16–19]. At present, China and Russia have abundant research results on the trade of wood forest products, mainly focusing on the trade structure, trade scale, complementarity, efficiency, and potential of the two countries' wood

forest products trade, as well as related influencing factors [20]. Li Shuang et al. (2018) argued that China and Russia have great differences in explicit comparative advantages of wood forest products. In the export of labor-intensive wood forest products, China is highly complementary to Russia's imports; in the export of resource-intensive wood forest products, Russia is highly complementary to China's imports [21]. Wu Tianbo (2019) proposed that the trade of wood forest products between China and Russia has developed rapidly and has been highly complementary since the 21st century, which was mainly influenced by the economic aggregate, population size, per capita forest resources, and whether the two countries had joined the WTO or not [22]. The trade complementarity between Russia's exports and China's imports of wood forest products is always higher than that between China's exports and Russia's imports of wood forest products, among which logs, converted timber, and wood pulp have obvious complementarity. The trade of wood forest products between China and Russia has great potential and a broad space for expansion [23].

In terms of theories related to product quality and international trade, the relationship between quality and international trade was first discovered by Linder (1961) in the overlapping demand theory. He pointed out that quality plays a certain role in determining the direction of trade. The Linder hypothesis is the first theory to explain the influence of quality differences on trade direction [24]. Melitz (2003) emphasizes the heterogeneity of enterprise productivity [25]. Baldwin and Harrigan (2011) introduced vertically differentiated products into Melitz's (2003) heterogeneous firm trade model [26]. Scholars began to pay attention to the multidimensional heterogeneity of firms based on the new trade theory, among which the heterogeneity of firm product quality was widely mentioned. In terms of the theoretical study on the quality of imported products, Schott (2004) pointed out that the price of imported products is determined by the economic conditions of exporters, and the quality of imported products correlates positively with the price of imported products [10,27]. Bas and Strauss-Kahn (2014) proposed that the quality of imported products gradually improved with the continuous enhancement of the effect of free trade competition [28].

In terms of empirical measurement methods of trade product quality, Shi Bingzhan et al. (2014) measured the export quality of Chinese enterprises by using Shi Bingzhan product quality measurement method (2014) [10]. Shi Bingzhan et al. (2015) calculated the imported products of Chinese enterprises [11]. Tan Jinrong and He Yanting (2019) used the KSW method to measure the quality of agricultural products in China [29]. Li Fangjing (2015) used the unit value method to study the impact of intermediate imports on China's manufacturing exports [30]. Tao Chenlu and Cheng Baodong et al. (2022) measured the quality of export products of the wood processing enterprises in China [31].

In conclusion, the recent research about quality measurement focuses more on export measurement. Scholars tend to pay more attention to the upgrading of export quality and the improvement of export competitiveness. There is little research on import quality measurement. Some works of literature on import quality measurement focus more on the quality of multilateral trade products imported by China as a whole. However, the literature on the quality of bilateral trade products of China's imports of fixed products from a country is rare, and there is no research on the measurement of the quality of Sino-Russian wood forest products [32–35]. In view of this, in the macro context of China's high-quality development, and in view of the dilemma that China and Russia have politically mutual trust, complementary resources, geographical proximity, and other compatible advantages, but the trade potential of forest products has not been fully released, this paper conducts an empirical measurement on the quality of China's main wood forest products imported from Russia, and uses product quality as a breakthrough to break down the negative factors that restrict the development of China–Russia wood forest products trade, and to explore the high-quality development path of bilateral trade of wood forest products between the two countries.

3. Quality Measurement of Wood Forest Products Imported from Russia by China

3.1. Measure Method

Quality has become a new observation point in the field of international trade [36]. Studies on the specific methods of quality measurement have emerged endlessly, including the unit value method, the price index method, the demand information regression estimation method, the supply information regression estimation method, and many other methods, each of which has its own advantages. This study chooses the most widely used KSW method proposed by Khandelwal, Scotchmer, and Wei in 2013, which is typically representative of the demand information regression inference method. Mainly based on the demand function in the field of industrial organization, this method takes into account the consumer's preference for quality from the perspective of demand side, and expresses quality as the information of demand levels such as product sales volume and product price, which is used to estimate the demand function and quality [37]. The basic measurement logic of this method is that if the price of two kinds of products is the same, the product with a larger market share has a higher quality. Based on demand information, this kind of method provides a more accurate and universal measurement paradigm for product quality and can measure the quality of international trade products more accurately [38]. In the actual measurement, based on KSW as the theoretical basis and referring to the specific application of KSW method by Sun Lin (2019) and Wu Tianbo (2020), the main wood forest products imported from Russia by China during 2011 to 2021 were measured [39,40].

First, construct the consumption utility function:

$$U = \left\{ \int_{\omega \in \Omega} [\lambda_{fct}(\omega) q_{fct}(\omega)]^{\frac{\sigma-1}{\sigma}} d\omega \right\}^{\frac{\sigma}{\sigma-1}} \quad (1)$$

In the above formula, $\lambda_{fct}(\omega)$ and $q_{fct}(\omega)$ are the quality and demand of the product ω , respectively, f is the importing country, c is the exporting country, and t is the year. The corresponding price index formula of this function is:

$$P_t = \left\{ \int_{\Omega} [\lambda_{fct}(\omega)]^{\sigma-1} [p_{fct}(\omega)]^{1-\sigma} d\omega \right\}^{\frac{1}{\sigma-1}} \quad (2)$$

Under a given budget constraint $\int_{\Omega} p_{fct}(\omega) q_{fct}(\omega) d\omega = Y_t$, $p_{fct}(\omega)$ is the ω price of the product, Y_t is the total consumption expenditure of the product, and its corresponding demand function is:

$$q_{fct}(\omega) = [\lambda_{fct}(\omega)^{\sigma-1}] [p_{fct}(\omega)]^{\sigma} Y_t P_t^{\sigma-1} \quad (3)$$

Since consumption depends on both price and quality, the logarithm is taken to simplify the above equation as follows:

$$\ln q_{fhct} + \sigma \ln p_{fhct} = \phi_h + \phi_{ct} + \varepsilon_{fhct} \quad (4)$$

In the formula, ϕ_h is product fixed effect, ϕ_{ct} is the time dummy variable, $\varepsilon_{fhct} = (\sigma - 1) \ln \lambda_{fhct}$ is used to measure the quality of product h imported by enterprise f from country c within 1 year. Thus, product quality in international trade can be defined as:

$$r_quality_{fhct} = \ln \hat{\lambda}_{fhct} = \frac{\hat{\varepsilon}_{fhct}}{\sigma - 1} = \frac{\ln q_{fhct} - \ln \hat{q}_{fhct}}{\sigma - 1} \quad (5)$$

The above formula can be used to measure the quality of various wood forest products imported by China from different countries every year. Due to the defects of KSW

measurement method that cannot be compared across time and across countries, this study refers to Wu Tianbo's (2020) [22] approach and standardizes product quality:

$$r_quality_{fhct} = \frac{quality_{fhct} - min_quality_{fhct}}{max_quality_{fhct} - min_quality_{fhct}} \quad (6)$$

In the above formula, $max_quality_{fhct}$ and $min_quality_{fhct}$ are the maximum and minimum value of h quality of a product, and the quality index is between 0 and 1.

3.2. Data Source and Explanation

The wood forest products imported by China from Russia from 2011 to 2021 were selected as the trade data source, and other major wood forest products imported by China during the same period were selected as the comparison sample countries. There are 15 countries including Australia, New Zealand, the United States, Canada, Argentina, Sweden, Indonesia, Germany, Chile, Brazil, Thailand, Gabon, Cameroon, Burma, and Finland. The raw wood forest products imported from Russia by China, namely logs, converted timber and wood pulp, are selected as the research object. The import flow data of wood forest products were obtained from the UNCOMTRADE DATABASE. The customs code of the logs is HS4403; the customs codes of the converted timber include HS4406, HS4407, HS4409; the customs codes of the wood pulp include HS4701, HS4702, HS4703, HS4704, HS4705, and HS4706. Product HS classification is derived from the official website of FAOSTAT.

3.3. Measurement Results and Analysis

In this paper, the KSW quality measurement method is adopted to calculate the overall product quality and product quality of sub-categories of main wood forest products imported from Russia in China during 2011–2021. The overall quality measurement results are shown in Table 1.

(1) Overall measure results and analysis

In terms of the overall measure, the annual average quality of wood forest products imported from Russia by China ranks the first place within the sample measure range, and the overall quality shows a trend of rising in fluctuation. The quality of main wood forest products exported from Russia to China within the measured interval and between the measured samples was higher than the overall average level of main wood forest products imported from China in that year. China's import of raw wood forest products from Russia ranked first in 2012–2013 and 2017–2018, respectively. The Russia–Ukraine crisis that broke out at the end of 2013 made Russia's economy in recovery worse, and the overall deterioration of the economic environment caused the measurement value in 2014 to drop to a trough. In 2017, due to the implementation of China's "all logging of natural forests has been halted" policy, timber demand depended more on imports. In order to meet the demand, China imported about 56 percent of its timber every year, of which Russia accounts for nearly 30 percent of China's imported timber market. In the 10 years after Russia's accession to the WTO in 2012, the comprehensive quality of logs, converted timber, and wood pulp exported by Russia to China showed a steady and improving trend from Russia's accession to 2016, and the overall quality of wood imports improved significantly from 2018 to 2021. By 2021, the quality of Russian raw wood forest products imported by China reached a peak of 0.727.

Table 1. Overall quality of main wood forest products imported from Russia by China from 2011 to 2021.

Ranking	Country	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	National Average Quality
1	Russia	0.718	0.714	0.719	0.683	0.684	0.691	0.718	0.726	0.715	0.721	0.727	0.711
2	America	0.732	0.693	0.706	0.699	0.709	0.656	0.713	0.678	0.715	0.727	0.732	0.706
3	Canada	0.697	0.706	0.695	0.701	0.715	0.699	0.654	0.711	0.672	0.695	0.609	0.687
4	New Zealand	0.649	0.694	0.681	0.678	0.661	0.671	0.538	0.698	0.654	0.68	0.695	0.663
5	Indonesia	0.627	0.600	0.611	0.636	0.650	0.675	0.660	0.688	0.671	0.68	0.703	0.655
6	Cameroon	0.637	0.646	0.642	0.643	0.693	—	0.646	0.658	0.645	0.652	0.658	0.652
7	Germany	0.642	0.619	0.623	0.629	0.633	0.637	0.632	0.650	0.658	0.675	0.710	0.646
8	Chile	0.595	0.598	0.602	0.606	0.624	0.624	0.585	0.660	0.630	0.616	0.657	0.618
9	Brazil	0.549	0.591	0.643	0.607	0.637	0.653	0.651	0.647	0.663	0.674	0.454	0.615
10	Burma	0.623	0.653	0.621	0.639	0.584	0.528	0.569	0.529	0.565	0.672	0.663	0.604
11	Finland	0.648	0.619	0.570	0.633	0.613	0.574	0.593	0.562	0.62	0.649	0.631	0.610
12	Gabon	0.604	0.615	0.583	0.581	0.615	0.565	0.594	0.605	0.605	0.548	0.536	0.586
13	Thailand	0.582	0.544	0.561	0.576	0.545	0.563	0.565	0.578	0.589	0.616	0.657	0.580
14	Sweden	0.538	0.554	0.548	0.575	0.582	0.562	0.595	0.59	0.599	0.600	0.622	0.579
15	Argentina	0.555	0.53	0.528	0.507	0.413	0.526	0.517	0.535	0.585	0.568	0.604	0.534
16	Australia	0.602	0.536	0.624	0.519	0.531	0.383	0.547	0.613	0.606	0.643	0.479	0.553
Annul Average Quality		0.625	0.619	0.622	0.620	0.618	0.604	0.611	0.633	0.637	0.651	0.634	—

Compared with other major importers of Chinese raw wood forest products, the United States, Canada, Indonesia, and New Zealand ranked second to fifth in overall quality. Among them, the measurement result of the United States in 2017 was very close to that of Russia, which topped the measurement list that year, because the volume of hard wood exported from the United States to China in that year exceeded the total export volume of all other markets in the world. The comprehensive quality of logs, converted timber, wood pulp, and wood forest products exported to China ranked first in 2019–2021. In 2022, China still remains the largest export market for American hard wood, even under the influence of multiple factors such as the Russia–Ukraine war, the energy crisis in Europe, and the repeated epidemic. The comprehensive quality of Canada’s three wood forest products exported to China from 2014 to 2016, including logs, converted timber, and wood pulp, ranked first.

Figures 1 and 2, respectively, show the quality change maps of the main wood forest products imported from Russia by China (raw wood forest products: logs, converted timber, and wood pulp) and the quality change trends of the three types of products: logs, converted timber, and wood pulp. As shown in Figure 1, within the measurement range, the quality of main wood forest products imported by China from Russia is relatively stable on the whole, and China has been the main source country of high-quality wood forest products with stable raw materials for a long time. The changing trend of product quality conforms to the "quantity before quality", that is, under the premise of a certain trade scale, the quality of wood forest products steadily improves the changing trend, but there is an incomplete positive correlation between the quality of wood forest products and the trade flow. This relationship is particularly evident in 2020–2021, mainly because the global economic slowdown caused by the COVID-19 pandemic forces the global trade of wood and forest products, including China and Russia, to be in a state of insufficient supply and demand. However, the upgrading of ecological environmental protection awareness worldwide and the improvement of forest certification area and certification ranking in Russia during 2020–2021 will promote the improvement of wood forest product quality. In Figure 2, the quality rankings of three types of wood forest products from high to low are logs, converted timber, and wood pulp. Although the average quality of logs ranks the first, it is also the only product that shows a declining trend in the measurement range, while the quality of converted timber and wood pulp shows a stable and rising trend.

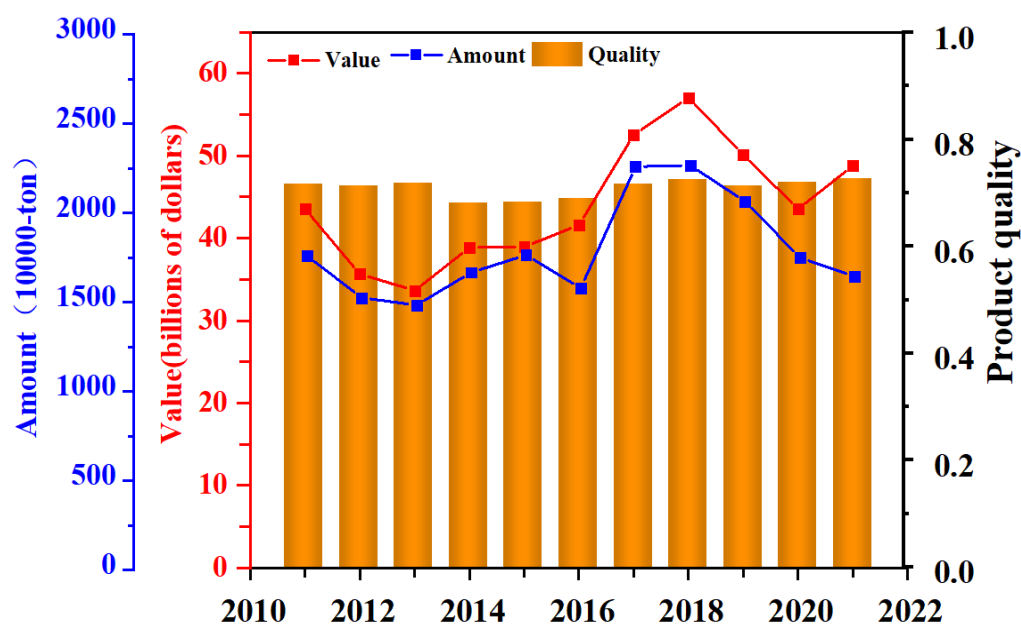


Figure 1. Quality and trade flow trends of main wood forest products imported from Russia by China.

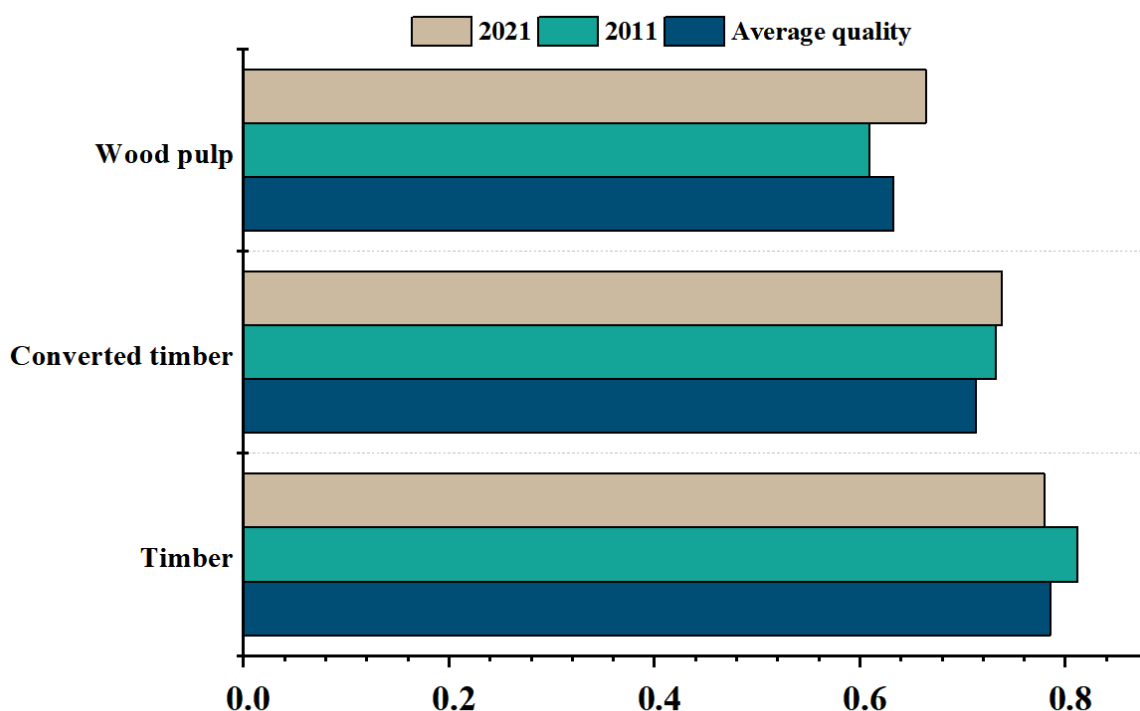


Figure 2. Classification quality measurement of main wood forest products imported from Russia by China.

(2) Category measurement results and analysis

Figure 3a shows the changing trend of log quality of the top 10 countries in terms of log quality exported to China from sample countries within the measurement range. Figure 3b shows that the quality of Russian logs ranks second only to that of New Zealand. As mentioned above, the overall quality of Russian logs shows a downward trend in the measurement range [41]. Curzi (2015) explained the relationship between tariffs and food import quality [42]. As Russia continues to attach greater importance to timber and other strategic resources, as well as its strong intention to vigorously develop and upgrade its domestic wood processing industry, Russia announced in October 2021 that it would

achieve carbon neutrality by 2060. From 2 January to 31 December 2022, Russia increased the export duty rate on individual types of timber with a water content exceeding 22% and a thickness and width exceeding 10 cm, and adjusted the export trade of raw softwood and precious hardwood to only two border crossings (Ryuta on the border of Russia and Finland and Hasan Station on the border of Russia and North Korea). Improvements in the quality of Russian log exports have been curbed by frequently adjusted tariffs. In 2007, Russia announced the implementation of a log tariff adjustment policy. Its underlying logic is that it wants to upgrade the domestic wood processing industry through the policy lever, and promote the deep processing of the wood industry in Russia. Because of the current policy, Russia's strong regulatory stance is very firm, even at the cost of abandoning some external demands, and causing turbulence in some domestic small and medium-sized enterprises to promote the overall upgrading of the Russian timber industry. The goal of this initiative is to fully release the huge potential of Russia's timber industry and make the forestry industry one of the important directions of Russia's economic development. China is the world's second largest timber consumer and the largest timber importing country, and the log gap will be further enlarged. In the long run, Russia's forest area and stock continue to grow, and the amounts of forests allowed to be felled in Russia each year is far greater than the amount cut. Therefore, Russia is still actively pursuing a substantial increase in the scale of the forestry economy under the premise of considerable profits and competent supervision. However, China's high-quality economic development takes coordination, innovation, green development, opening up, and sharing as the core concepts, which makes the quality of imported logs clearer [43].

In terms of other major log export suppliers, the measurement of this paper shows that the quality of exported logs from New Zealand and the United States ranks first and third, respectively, and the quality of German logs ranks seventh. The export quality of New Zealand logs ranked first in the measurement range. Since 2016, New Zealand has surpassed Russia for the first time to become China's largest log import source country. Meanwhile, China is also the primary export destination of New Zealand logs. The main log species exported to China is Monterey pine, which has a straight texture, a beautiful decorative pattern, a uniform texture, easy processing, and it is easy to glue and color. In addition, Chinese imported Monterey pine logs are mainly Grade A [44,45], and New Zealand Monterey pine is also the largest imported timber in China. In January 2021, China and New Zealand signed the Free Trade Agreement between the Government of the People's Republic of China and the Government of New Zealand to upgrade, so that due to New Zealand's trade volume with China of nearly 3 billion Singapore dollars of wood and paper products and 99% of the duty-free access, that year's New Zealand log export share accounted for 20% of the world's, and as of 30 June 2022, 87% of New Zealand logs are shipped to China. Over the past decade, New Zealand's log material has continued to rise, from 20 million cubic meters to 36 million cubic meters per year, an increase of more than 75%. In the short term, the potential export demand and export quality of New Zealand logs will remain relatively stable, but due to the pressure of shipping congestion and a series of supply chain problems caused by the labor shortage, the export of New Zealand logs is under great pressure. According to Forestry New Zealand, log receipts are expected to fall to 2500 cubic meters by 2030. The plan to build more houses in New Zealand will lead to a significant increase in the consumption of local wood. In addition, the equipment in New Zealand is obsolete, the labor cost is high, and the processing capacity is limited. Without greater economic benefits to stimulate, the wood processing capacity in New Zealand will not grow rapidly in the short term, and the room for improving log quality is insufficient. In the long run, it is a fact that New Zealand's log exports will decline. The US log supply quality is high, and the quality is stable within the measured range. However, due to the impact of the trade war between China and the US in 2017, it is difficult for the US to become a stable and reliable timber trading partner. Combined with the strong demand of the US domestic construction industry and the tight supply, the US log export volume may further decrease. Although Germany is a big exporter of logs, its domestic

pests lead to passive logging, which significantly reduces the quality of its overall logs. The supply of logs is nearly capped, and the potential of the log export supply is weak.

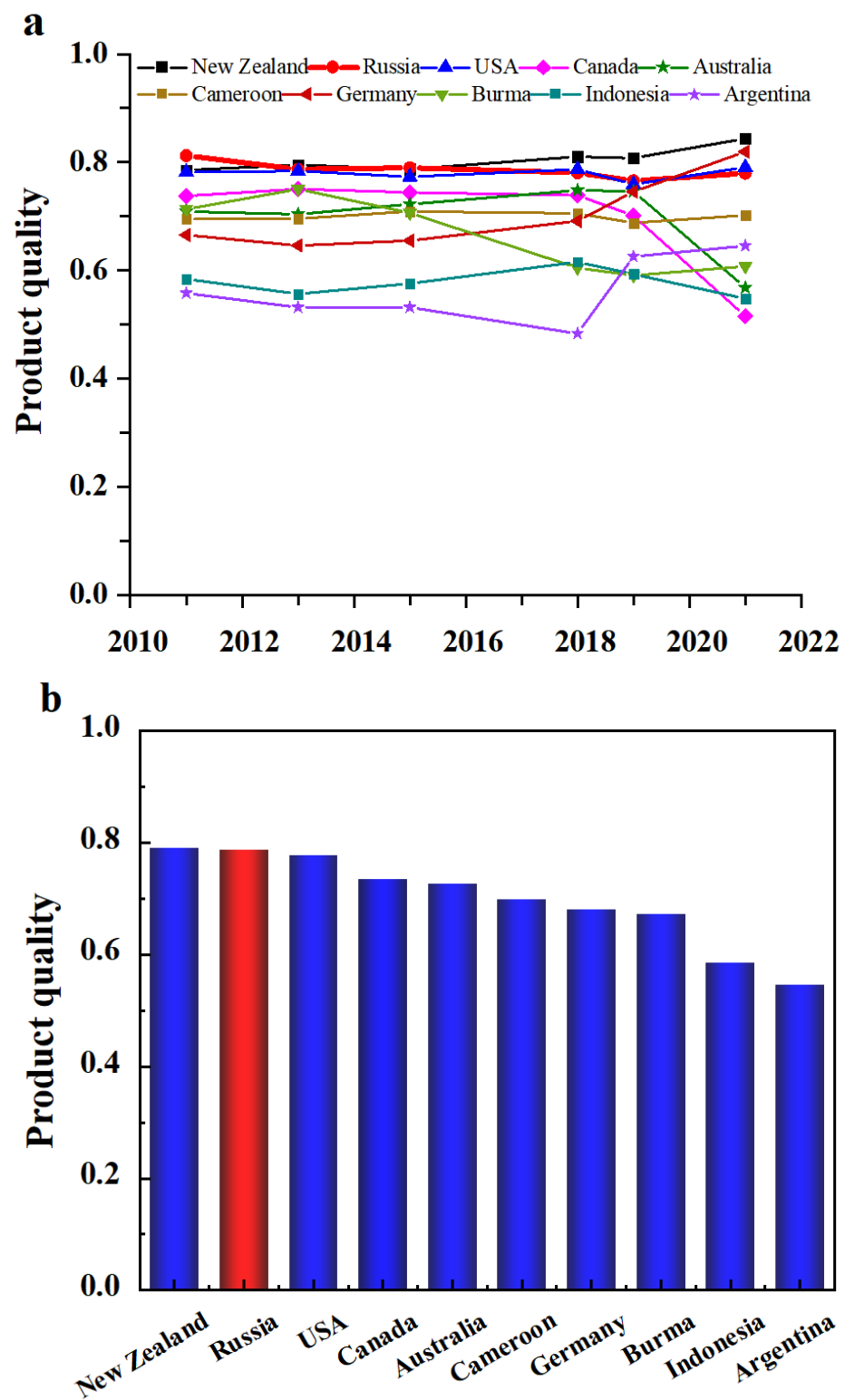


Figure 3. The quality of Russian logs imported from China during 2011–2021. Subfigure (a) shows the log quality change trend of sample countries within the measurement range, and Subfigure (b) shows the log quality ranking of sample countries within the measurement range.

Figure 4 shows the quality change trend of the top 10 countries in terms of the quality of the converted timber exported to China from the sample countries within the measurement range. The Siberian Federal District has 38 percent of the country's annual logging quota. Even though the western economic sanctions against Russia caused by the ongoing Russia–Russia conflict since March 2022 have caused heavy damage to the Russian economy, some Russian experts and scholars believe that the implementation of the log export ban to China may not be idealized in the long run. However, based on the growing voice of global ecological environment protection, China and Russia have put forward the goal of “carbon neutrality”, which makes it inevitable that a large number of Russian converted timber will be exported to China instead of logs. Moreover, there is a strong complementary relationship between Russian converted timber and Russian logs, which promotes the background of imposing a high proportion of log tariffs step by step from Russia. The quality of the converted timber exported from Russia to China has steadily improved, and its rising trend is basically consistent with the declining trend of log quality shown in Figure 3. Russia's far Eastern Siberian region with outstanding forest resources has a developed timber industry, and is leading in timber harvesting, converted timber production, and commercial pulp and wood chemical products, which is a stable premise for improving the quality of Russia's export of converted timber. With the gradual introduction of the import ban of logs, converted timber has replaced logs and become the largest import of raw wood forest products in China. As shown in Figure 3, the improvement of the quality of the converted timber exported to China by Russia, Indonesia, and other countries has boosted the overall quality level of China's imported converted timber, playing a crucial role in realizing the high-quality import of China's raw wood forest products.

China has long held an important position in the Russian wood pulp export market. Although the quality of Russian wood pulp exported to China is lower than the first two kinds of raw wood forest products, logs and converted timber, China, as a major producer of paper products, has had a high demand for wood pulp for a long time. In addition, due to the strong demand of China's wood pulp import market, the growth rate of the import trade volume is much higher than that of Russia's export to China. Against the background of the trade diversion effect caused by the Russia–Ukraine conflict, the supply gap of Russian wood pulp will be further amplified, and the quality of wood pulp will also show a good trend [46].

Based on the above analysis of the overall and sub-category quality change trend of the main wood forest products imported from Russia by China within the measured range, as well as the continuous expansion and deepening of the comprehensive strategic partnership of cooperation between China and Russia in the current new era, combined with the differences in forest resources between China and Russia, the complementarity of the forest products trade and the compound advantages of geographical advantages are demonstrated. Under the requirement of the high-quality development of forestry economic and trade cooperation between China and Russia, it can be predicted that China will remain the most reliable marketing destination for Russian raw wood forest products. Russia will continue to be the most stable source country for China's import of raw wood and forest products for a long time, and the export quality of converted timber and wood pulp has a large room for improvement.

Figure 5 shows the quality change trend of wood pulp exported to China from the top 10 countries in the sample countries within the measurement range. As Russia, Sweden, Finland, and other countries have long exported large amounts of high-quality wood pulp to China, the quality of Chinese wood pulp imports has steadily increased.

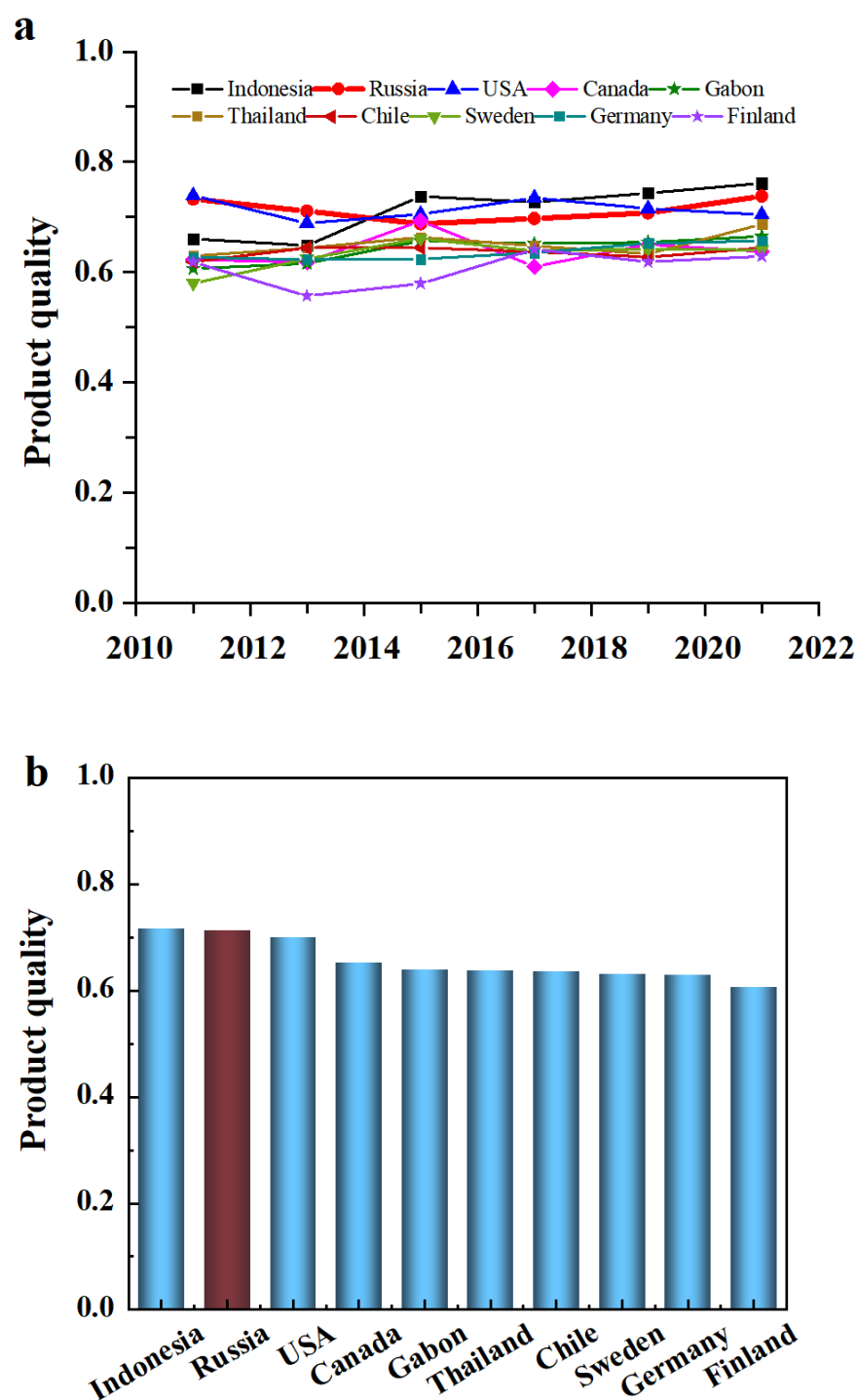


Figure 4. Quality measurement results of Russian converted timber imported from China during 2011–2021. Subfigure (a) shows the quality change trend of converted timber of sample countries within the measurement range, and Subfigure (b) shows the quality ranking of converted timber of sample countries within the measurement range.

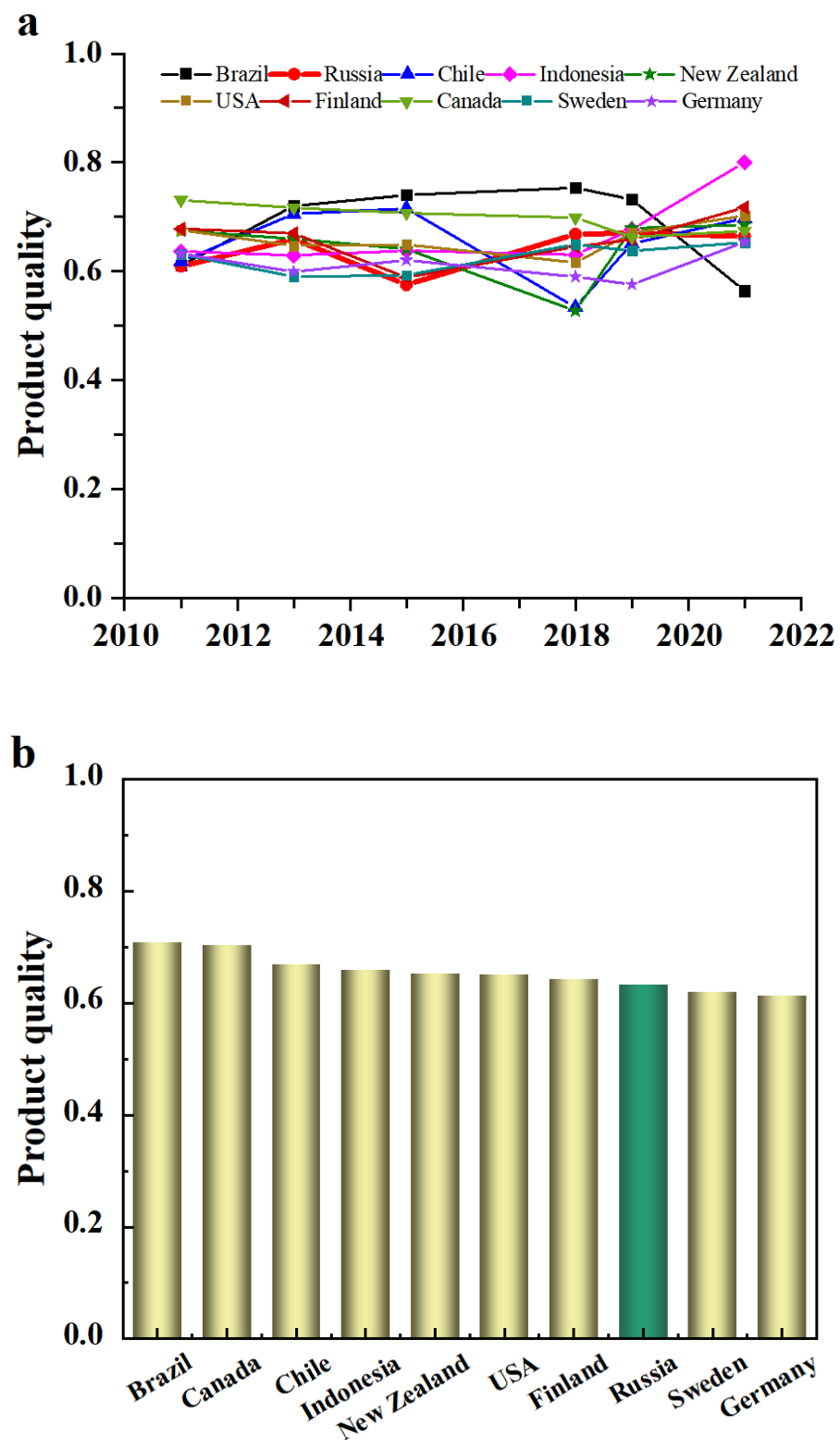


Figure 5. Quality measurement results of Russian wood pulp imported from China during 2011–2021. Subfigure (a) shows the quality change trend of wood pulp of sample countries within the measurement range, and Subfigure (b) shows the quality ranking of wood pulp of sample countries within the measurement range.

4. Analysis of the Influencing Factors of China's Import of Russian Wood Forest Products

4.1. Model Setting and Variable Description

To deeply explore the factors affecting the quality of main wood forest products imported from Russia by China, this paper, referring to the method proposed by Wu Tianbo (2020), builds a multivariate linear regression model to conduct empirical tests on the factors affecting the quality measurement of wood forest products. Specifically, the estimated overall quality level of China's imported wood forest products from Russia was taken as the explained variable of the regression model. From the perspective of coordinated, green, open, developing, and innovative high-quality development of China's economy, the explained variables are as follows: the forest certification area of exporting country, the forest area of the importing and exporting country, the tariff rate level of the importing and exporting country, the customs convenience of the importing and exporting country, the research and development expenditure of the exporting country, the import amount of raw wood and forest products, whether they are countries of the Belt and Road Initiative, whether it has signed a free trade agreement, the economic development level of the importing and exporting country, the total population of the importing and exporting country, and the distance between bilateral countries.

$$\begin{aligned} \ln q_{ijt} = & \beta_0 + \beta_1 \ln FOR_{it} + \beta_2 \ln FOR_{jt} + \beta_3 \ln COC_{it} + \beta_4 \ln COC_{jt} + \beta_5 \ln GDP_{it} + \beta_6 \ln POP_i + \beta_7 \ln DIS_{ij} \\ & + \beta_8 \ln GDP_{ji} + \beta_9 \ln POP_j + \beta_{10} \ln TAR_{ji} + \beta_{11} \ln TAR_{it} + \beta_{12} \ln IMP_{jt} + \beta_{13} \ln CER_{it} + \beta_{14} \ln REA_{it} \\ & + \beta_{15} \ln B\&P_{it} + \beta_{16} \ln FTA_{ij} \end{aligned} \quad (7)$$

In Formula (7), the explained variable q_{ijt} refers to the quality of wood forest product h imported by Country j from Country i in year t ; explanatory variables are selected as follows: GDP_{jt} is the GDP per capita of the importing country; GDP_{it} stands for GDP per capita of exporting country (Data is from the UNCOMTRADE Database); FOR_{it} represents the area of forest in the exporting country; FOR_{jt} represents the area of forest in the importing country (Data is from World Development Indicators); POP_{it} is the total population of the exporting country; POP_{jt} represents the total population of the importing country (Data is from FAOSTAT); COC_{it} stands for customs convenience of exporting country; COC_{jt} stands for customs convenience of importing country (Data is from World Development Indicators); TAR_{jit} means the tariff rate of the importing and exporting country; TAR_{it} means the level of the exporter's tariff rate (Data is from World Development Indicators); REA_{it} stands for research and development investment (Data is from UNESCO); CER_{it} stands for Forest Certified Area (Data is from FSC); FTA_{ij} is a dummy variable, indicating whether a free trade agreement has been signed. The value of a trade agreement with FTA is 1, and that of a trade agreement without FTA is 0 (Data is from FTA). $B\&R_{it}$ is a dummy variable, indicating whether it is a Belt and Road country. If it is a Belt and Road country, the value is 1, and if it is not a Belt and Road country, the value is 0 (Data is from the Belt and Road Website). DIS_{ij} stands for bilateral national space distance (Data is from Google Maps); and IMP_{jt} represents the import amount of raw wood forest products of the importing country (Data is from UN COMTRADE DATABASE).

4.2. Empirical Results and Analysis

In this paper, STATA16.0 software is used for model fitting. After data processing and unit adjustment, the fixed and random effects of imports were tested (Hausman test), and the fixed effects model was selected according to the F. Table 2 shows the overall estimation results of the import quality of wood forest products, and the significant influencing factors are basically consistent with the expectation.

Among them, the customs convenience of importing countries is significantly positive at the level of 1%. With the development of economic globalization, trade facilitation has long become an important direction for the trade development of all countries. The

improvement of customs facilitation will play a positive role in promoting trade quality and bilateral trade development.

Bilateral country distance has a significant negative effect on the quality of wood forest products. The core factor of logistics transportation cost is the distance between the two countries. Strengthening infrastructure construction and enhancing connectivity among trading countries will remain an important direction for the development of the international community in the future.

The population size of the importing country is significantly negative at the level of 5%. The reason for this result is that, with the gradual introduction of the world's two-carbon target, the world's supply of high-quality raw wood forest products is very limited. Therefore, for those importing countries with a large population and a high demand for high-quality raw wood and forest products, it is difficult to achieve the balance in the use of high-quality products, which leads to a negative correlation between population size and product quality.

The import amount of imported raw wood forest products is significantly positive at the level of 1%. Due to the disunity of statistical dimensions related to quantity in the UNCOMTRADE Database, this paper takes import amount as the reflection of trade scale between the two countries. The positive correlation between import amount and product quality means that product quality will gradually improve with the expansion of trade scale. Quality is a dynamic comprehensive concept, including both quantity and quality, and high quality is generally a new dynamic demand based on the development of a scale to a certain extent. Therefore, for bilateral countries with stable trading scales, it is an advanced requirement and there is an inevitable trend to pursue the high-quality development of traded products on the premise of ensuring a stable supply.

The degree of economic development represented by the per capita GDP of the importing country is significantly positive on the basis of 1%. The positive correlation between per capita GDP of importing countries and the product quality means that countries with larger and faster economic development scales have higher requirements for product quality. As the problem of climate change and environmental pollution has gradually become a socialized problem recognized by the global public, consumers have gradually internalized their environmental awareness into the quality requirements of wood forest products. It also proves that product quality is the most micro, the most advanced, and the most direct expression of the development of international trade quality [47,48].

Table 2. Regression model of influencing factors of quality of wood forest products imported by China from Russia.

	In Quality of Import
FORit	−0.0106 (−0.45)
FORjt	10.9981 (1.72)
COCit	0.2046 (1.76)
COCjt	5.0866 *** (3.77)
GDPit	0.0605 (1.39)
POPi	−0.0150 (−0.39)
DISij	−0.0717 *** (−4.23)
GDPjt	1.0308 *** (3.39)
POPj	−39.3714 ** (−2.96)

Table 2. Cont.

	In Quality of Import
TARit	0.0015 (0.11)
TARjt	0.0292 (0.57)
IMPjt	0.0910 *** (7.16)
CERit	0.0001 (0.02)
REAit	−0.0052 (−0.13)
B&Rit	0.0536 (1.20)
FTAij	−0.0122 (−0.16)
_cons	648.0922 *** (3.33)
N	31
Adj. R ²	0.91

Note: The t corresponding to the estimation coefficient in brackets is: **, *** represents statistically significant at the level of 5%, and 1%, respectively, and () internal digit standard error.

5. Conclusions and Policy Implications

5.1. Conclusions

- (1) In terms of the overall import quality, the quality of main wood forest products imported from Russia by China ranks first in the measured range. It shows a steady upward trend even in the changeable macroenvironment of the international form. This result fully proved the basic fact of the diversification of the source of Chinese raw materials and the urgent demand for high-quality wood products. China's trade in wood forest products imported from Russia has entered a stage of high-quality development. The quality of Russian wood forest products ranked the first place in 2012–2013 and 2017–2018. Within the range, the highest comprehensive quality level was 0.727, which dropped to the lowest level of 0.683 in 2014, mainly due to the crisis in Russia and Ukraine at the end of 2013. It took about three years of recovery to reach pre-crisis levels.

The Russia–Ukraine conflict in early 2022 led to a series of economic sanctions against Russia, which reshaped the global forest products trade pattern. However, Russia will continue to be a source of a stable supply of raw material type lignin forest products in China, because our country has become the main strategic export to the east of Russia and because of the inevitable requirements of the high-quality development of China's economy. It will also help change China's trade structure of imported products from "massive imports and massive exports" to "quality imports and quality exports".

- (2) In terms of product quality by category, the quality of logs was the highest during the measurement period, while converted timber and wood pulp were second and third, respectively. The quality of these three kinds of wood forest products all had their own characteristics. Logs were the only products that showed a downward trend in quality, while converted timber and wood pulp both showed an upward trend. The substitution of converted timber for log exports has become a certainty because of Russia's carbon peaking and carbon neutrality goals and the country's desire to push its woodworking industry towards deeper processing. In the future, the quality of Russia's converted timber is expected to further improve, due to its superior forest resources and gradually improved production and processing capacity, and will become the main export category of raw wood forest products in Russia. Although the quality of wood pulp ranks third in the measured range, China, as a

major producer of paper products, still has a long-term high demand for wood pulp. With the further increase of the export share of Russian wood pulp to China, the quality of converted timber and wood will be further improved under the inevitable requirements of the high-quality development of the forestry economic and trade cooperation between China and Russia.

- (3) In terms of influencing factors on the quality of wood forest products imported from Russia by China, the economic aggregate of the exporting country, the customs convenience, the natural resources of the forest in the exporting country, and the total population of the importing country all have a positive impact on the quality of wood forest products imported from Russia by China. However, the tariff level of the exporting country and the distance between the two countries will impact the trade quality of Chinese wood forest products imported from Russia. All the positive correlation factors will play a positive role in promoting the quality of the main wood forest products imported from Russia by China, while the negative correlation factors will play a certain role in hindering the quality.

5.2. Suggestions

The Sino-Russian trade of wood forest products has entered the stage of high-quality development. As the most microscopic embodiment of the trade quality of wood forest products between the two countries, the quality of products will directly affect the stability and future development trend of the Sino-Russian wood forest products trade. Under the macro background of the China-Russia comprehensive strategic partnership of coordination in the new era, China and Russia should take the quality improvement of wood forest products as a breakthrough to promote the high-quality development of trade in wood forest products between the two countries.

(1) For Russia

The Russian side should take the product quality as the breakthrough point and set the export standards of logs, sawn timber, and wood pulp to the demand of the Chinese market.

In view of the resource endowment of the Far East and Siberia, we should strengthen the development and construction of the Far East Siberia region and the construction of logistics infrastructure, so as to improve the overall level of international logistics and transportation. We will continue to increase the area of forest certification in Russia, intensify efforts to crack down on illegal logging, and promote the high-quality development of trade in wood forest products between China and Russia [49].

(2) For China

China should take the quality of the imported wood forest products as the core evaluation factor, ensure the safety, stability, and quality of imported raw wood forest products, and continuously optimize the customs convenience.

In order to improve the trade pattern of “two ends outside, large import and large export” of China’s wood forest products trade, “excellent import” drives “excellent export”. At the same time, customs convenience should continue to be improved to help realize China’s transition in the global value chain of the wood and forest products trade.

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