# Country Risk and Wooden Furniture Export Trade: Evidence from China

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**Abstract**

Wooden furniture is the main product of the forest products trade, and activities associated with its international trade currently face many risks, representing a degree of uncertainty in the wooden furniture export trade. To explore the impact of country risk on China's wooden furniture export trade, panel data from 1995 to 2020 are used as a basis for this study, in which the impact of the country risk of trading partners on China's wooden furniture export trade is empirically analyzed using a stochastic frontier gravity model. The research shows that the economic scale and population scale of the trading partners and China, forest resource endowment, and exchange rate fluctuation all have a significant impact on the export trade of Chinese wooden furniture. The economic and financial risks of trading partners have a notable negative influence on China's wooden furniture export trade, but political risk has a positive effect. The export efficiency of China's wooden furniture is at a moderate level, and there is a huge imbalance between different trading partners.

China is a leading exporter of forest products and one of the world's major producers of forest products and thus is an important node in the international forest products trade network (Chen et al. 2021). At the same time, international trade has also become one of the main factors that determine the direction of China's economy and industrial development. The wooden furniture industry, as an important part of China's forest products trade (Cao et al. 2018), has experienced rapid development in the process of global economic integration. This rapid development makes China not only the largest player in the global timber market but also a major player in the wooden furniture market (Barbu and Tudor 2021). Since 2004, China has become the world's largest producer and exporter of wooden furniture (Lin et al. 2019), and wooden furniture has gradually become the main export foreign exchange–earning product among Chinese forest products. According to UN Comtrade data, the export volume of Chinese wooden furniture shows an obvious growth trend from 1995 to 2020. The export volume of wooden furniture increased from $598 million in 1995 to $20.011 billion in 2020, corresponding to an increase of 32.46 times. The rapid development of export trade in the wooden furniture industry not only resolves problems of employment in addition to an increase of forest farmer income (Dai et al. 2012) but also plays an important role in promoting the development of industrial chains, such as the primary and finishing processing of forest products in the forestry industry.

At present, unilateralism and trade protectionism are parallel, and with the COVID-19 pandemic sweeping the world, the pattern of world economic development is undergoing profound changes. In the face of a complex international environment, some wooden furniture–trading countries or regions are threatened by economic and financial risks caused by exchange rate fluctuations, economic downturn, high inflation, and other problems (Shen 2016, Liu et al. 2019), and the occurrence of political events such as terrorism, national conflicts, and wars in some regions leads to the increase of political risk (Cavusgil et al. 2020, Qazi and Khan 2021); cross-border trade activities are threatened as never before. For example, the

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European sovereign debt crisis has seriously increased the economic risks of some European countries, such as Portugal, Greece, and Ireland, and the trade volume of agricultural products of these countries has declined to varying degrees (Sun et al. 2022). Country risk was first studied as equal to political risk, and it was believed that the country risk of emerging countries was caused by the wave of nationalization and unstable political factors during the independence movement (Usher 1965). The study of country risk then spread from politics to economics. Nagy (1978) proposed that country risk is the possibility of transnational credit facing losses due to changes in international situations and other factors. With the gradual deepening of research, country risk has expanded from the political field to economic, financial, cultural, and other fields (Meldrum 1999, Li et al. 2012, Asgary et al. 2020). From the existing research, it can be discerned that the occurrence of country risk not only has a negative impact on project financing and corporate investment (Wang and Qi 2011, Shen 2016) but also has a significant inhibitory effect on export trade (Wang et al. 2021, Zhang et al. 2021). The high correlation between various markets exacerbates the spread of country risk (Dirk 2012) and adversely affects the flow of commodities and capital in the international market (Moser et al. 2008). Then, with the acceleration of economic globalization, does the country risk of trading partners affect China's wooden furniture export trade? Answering this question will not only help to clarify the main influencing factors of China's wooden furniture export trade but also provide a theoretical basis for further improving the efficiency of wooden furniture export trade.

Research on the influencing factors of wooden furniture export trade has achieved fruitful results, but there are few studies on the influence of the country risk of importing countries or regions on wooden furniture export trade. Specifically, on the one hand, some scholars examined export tax rebate policy (Hou and An 2009), technical barriers (Tang and Song 2013), the Lacey Act (Patrick and Eastin 2014), antidumping (Luo et al. 2015), environmental regulations (Zhang et al. 2019), and other single factors to analyze the influencing factors of wooden furniture export trade; on the other hand, some scholars conducted comprehensive studies on the influencing factors of wooden furniture export using multiple regression models, gray correlation methods, trade gravity models, and other research methods. It was found that the export of wooden furniture is positively correlated with the economic development level of the trading partners, the scale of market demand, the endowment of forest resources, the convenience of shipping, and having perfect port infrastructure (Bonnefoi and Buongiorno 1990, Yu and Nie 2009, Wang et al. 2019); the appreciation of RMB exchange rate, trade cost, labor cost, green trade barriers, geographical distance, and other factors are negatively correlated with the export of wooden furniture (Liu 2009, Parhizkar et al. 2010, Koebel et al. 2016, Wang et al. 2019, Morland et al. 2020, Muhammad et al. 2020).

The gravity model is an important model for explaining bilateral trade flows and analyzing trade-influencing factors (Zhang and Li 2009). This model, however, summarizes some objective factors that hinder trade into random error terms, which greatly affects the accuracy of empirical results (Anderson and van Wincoop 2003). Meeusen and Broeck (1977) and Aigner et al. (1977) introduced the stochastic frontier method, which used the gravity model as a basis for improvement. The stochastic frontier gravity model classifies the human factors that hinder or promote the development of trade in terms of trade inefficiency and solves the problem of trade resistance. For our study, we select China and its 37 trading partners from 1995 to 2020 as research samples and use the stochastic frontier gravity model to explore the influence of country risk of trading partners on China's wooden furniture export trade so as to provide empirical reference for optimizing the layout of wooden furniture export market and tapping export potential.

The possible contributions of this article are as follows. On the one hand, few existing studies have incorporated country risk into the empirical analysis framework of influencing factors in the export trade of wooden furniture. This article incorporates country risk into the nonefficiency items of China's wooden furniture export trade, enriches the choice of nonefficiency items, and provides empirical experience for enhancing the export trade potential of China's wooden furniture. On the other hand, because country risk is multidimensional, only a single indicator cannot fully reflect the actual situation of the country risk. Therefore, the political risk, economic risk, and financial risk in the country risk are incorporated into the research framework, and then the role of different risks on the export trade of wooden furniture is clarified. In addition, the research on country risk focuses mainly on international investment and credit. Studying the impact of country risk on export trade is a useful supplement to the research on country risk and international trade, and it is also rich in factors affecting forest product trade.

## Theoretical Analysis and Research Hypothesis

Country risk is a collection of multidimensional risks caused by internal and external factors in a particular country or region (Asgary et al. 2020, Zhang et al. 2021), which is usually conceptualized as a composite index of economic risk, financial risk, and political risk (Suleman et al. 2017, Qazi and Khan 2021). Specifically, political risk is used to evaluate the social governance and political stability of a country (Lee et al. 2020), economic risk is closely related to a country's macroeconomic situation (Qazi and Khan 2021), and financial risk is used to assess the ability to finance government, commercial, and trade debt (Chiu and Lee 2019). Wooden furniture is an important part of China's forest products trade and faces many internal and external risks. Although wooden furniture enterprises can effectively control most internal risks through risk management or preventive measures, they are more easily affected by external risks that often beyond their control (Asgary et al. 2020). With the integration of the international market, the country risk of trading partners has become an important factor in the export of wooden furniture. It follows that the three aspects of political risk, economic risk, and financial risk should be examined to explore the country risk of trade partners to the Chinese wooden furniture export trade and its influencing mechanisms.

The increasing political risk of importing countries or regions has had a significant impact on the wooden furniture trade. The occurrence of national conflicts, wars, terrorist activities, and other events will directly increase the political risk threat in the country (Cavusgil et al. 2020). Excessive political risk will restrict enterprises from

exporting to the affected country (Agarwal and Feils 2007). Taking terrorist incidents as an example, when trade activities are threatened by a third party (terrorists), trading activities of both sides of the trade will be limited in scale or even completely hindered (Blomberg and Hess 2006). Blomberg and Hess (2006) pointed out that when a country has terrorist attacks or other violent incidents, the cost of trade with other countries will increase, and they need to pay 30 percent more tariffs. Similarly, Ruiz Estrada et al. (2018) showed that the economic costs of terrorist activities include the diversion of foreign direct investment, a loss of capital, and reductions in international trade in addition to the increased opportunity cost of commerce and trade. For small and medium-sized enterprises, it also increases their insurance, transaction, transport, and security costs (Asgary et al. 2020). It is not difficult to find that the escalation of political risk caused by terrorist activities will lead to the reduction of trade volume (Shahbaz 2013). Therefore, when the political risk of trading partners rises, taking into account factors such as political stability, trade security, and trade costs, it can be concluded that Chinese wooden furniture companies will reduce their exports to that country.

Economic risk caused by changes in the economic environment of importing countries or regions or unstable economic development will restrain China's wooden furniture export trade. According to transaction cost theory, transaction costs need to be paid to complete a transaction activity. The lower the transaction cost, the easier it is for the transaction activity to be concluded (Coase 1960). In international trade, when the economic development of trading countries is unstable or there is an economic crisis, economic risk will exert a rapid domino effect on the subjects of international trade due to the close connection between the international market and transnational enterprises (Chowdhury 2011, Cavusgil et al. 2020). In an environment of high economic risks, such as low economic growth, high inflation, and high budget deficits, due to unpredictability and various changes, both sides of the trade have incorporated future uncertainty and complexity into their contracts, which will increase the cost of bargaining. At the same time, higher economic risks will increase the supervision cost of safeguarding trade between trading enterprises. Considering these factors, some trading companies choose to trade with countries or regions with low economic risk in order to reduce their own business risks (Liu and Huang 2020). Therefore, when the economic risk of the importing country or region rises, the transaction costs of the two countries will increase, and the export trade of Chinese wooden furniture to the country or region will also be hindered. That is, the export of Chinese wooden furniture to the trading partner country or region will be restrained due to the increase in transaction costs caused by the rising economic risk of that country.

Financial risk caused by exchange rate fluctuations in importing countries or regions and changes in financial policies can easily lead to losses in China's wooden furniture export trade. According to traditional trade theory, exchange rate fluctuation will affect trade value and volume under the condition that other conditions remain unchanged (Berbenni 2021); that is, currency depreciation of a country will reduce the price of its commodities, thereby increasing the export of commodities and improving the competitiveness of its export commodities. Taking the RMB as an example, when the RMB exchange rate appreciates relative to developed countries, China's export trade will be inhibited by RMB exchange rate appreciation (Zhang and Li 2009), and China's export of processed goods and substitutes will be significantly negatively affected (Ahmed 2009). Therefore, to avoid further economic losses caused by exchange rate fluctuations, many countries will implement corresponding financial policies to stabilize the exchange rate and prefer a fixed exchange rate system (Wang and Wang 2021). However, whether it is the real economy or the financial market, the global financial shock will cause stronger spillover effects on the countries adopting the fixed exchange rate system (Joshua et al. 2016, Maurice et al. 2019), which in turn will have a dramatic impact on the country's international trade. It can be seen that financial instability has increased due to the increased risk of exchange rate fluctuations and other factors that affect trade between trading countries. Therefore, when the financial risk of importing countries or regions increases, the export trade of Chinese wooden furniture is bound to be affected to some extent in the short term. Based on the above analysis, this article proposes the following research hypotheses:

H1: The increase in political risk in importing countries or regions is not conducive to China's wooden furniture export trade.
H2: The increase in economic risk in importing countries or regions will hinder the Chinese wooden furniture export trade.
H3: The increase in financial risk in importing countries or regions has a restraining effect on the export trade of Chinese wooden furniture.

## Methods and Data

### Theoretical model

Referring to the methods used by Wang et al. (2019), Abdullahi et al. (2021), and Wu et al. (2021), this article uses the stochastic frontier gravity model proposed by Aigner et al. (1977) Meeusen and Broeck (1977) and to explore the impact of country risk on China's wooden furniture export trade. The basic theoretical models are as follows:

$$T^*_{ijt} = f(X_{ijt}, \alpha)\exp(v_{ijt}) \tag{1}$$

$$T_{ijt} = f(X_{ijt}, \alpha)\exp(v_{ijt})\exp(-u_{ijt}), u_{ijt} \geq 0 \tag{2}$$

$$TE_{ijt} = T_{ijt}/T^*_{ijt} = \exp(-u_{ijt}) \tag{3}$$

$T^*_{ijt}$ in Equation 1 is the frontier trade level between country $i$ and country $j$ in period $t$, $T_{ijt}$ in Equation 2 is the actual level of trade between country $i$ and country $j$ in the period $t$, and $TE_{ijt}$ in Equation 3 is trade efficiency and is the ratio of the actual trade level to the frontier trade level. $X_{ijt}$ represents explanatory variables that affect bilateral trade, such as economic development level, population size, geographical distance, and so on; $\alpha$ is the parameter vector to be estimated; and $v_{ijt}$ is a random disturbance term that represents the unobservable factors affecting trade between the two countries and follows a normal distribution with a mean value of zero. $u_{ijt}$ is the trade inefficiency term, which is used to represent artificial trade resistance factors that cannot be included in the equation, such as government-related policies, emergencies, international relations, and so on, and the trade inefficiency term $u_{ijt}$ is independent of $v_{ijt}$. When $u_{ijt} = 0$, the

trade level is at the frontier level; that is, the trade reaches the optimal level. When $u_{ijt} > 0$, it means that the trade level is below the frontier level; there is trade efficiency loss, and $TE_{ijt} < 1$. In addition, it is a time-invariant model if the inefficiency term $u_{ijt}$ does not change over time. If the research has a large time dimension, a time-varying model can be set to test the trend of trade efficiency (Battese and Coelli 1992):

$$u_{ijt} = \{\exp[-\eta(t - T)]\}u_{ij} \quad (4)$$

In Equation 4, $\exp[-\eta(t - T)] \geq 0$, $u_{ijt}$ follows truncated normal distribution, and $\eta$ is the parameter to be estimated. If $\eta > 0$, $u_{ijt}$ decreases with time. If $\eta = 0$, it indicates that time change has no effect on $u_{ijt}$. If $\eta < 0$, it indicates that $u_{ijt}$ increases with time.

However, due to the contradiction between $u_{ijt}$ calculated by the stochastic frontier gravity model and $u_{ijt}$ in the trade inefficiency model, Battese and Coelli (1995) further constructed a trade inefficiency model to estimate the influencing factors of trade inefficiency. The factors affecting the trade inefficiency term will be regression together with other factors in the stochastic frontier gravity model. Equation 5 is as follows:

$$u_{ijt} = \beta z_{ijt} + \varepsilon_{ijt} \quad (5)$$

where $z_{ijt}$ represents the explanatory variable affecting trade inefficiency, $\beta$ is the parameter to be estimated, and $\varepsilon_{ijt}$ is the random error term. In order to further study the influencing factors of trade inefficiency, the one-step method was used to analyze the influencing factors of trade, and Equation 5 was substituted into Equation 2 to obtain

$$T_{ijt} = f(X_{ijt}, \alpha)\exp(v_{ijt})\exp\left[-(\beta z_{ijt} + \varepsilon_{ijt})\right] \quad (6)$$

$$\ln T_{ijt} = \ln f(X_{ijt}, \alpha) + v_{ijt} - (\beta z_{ijt} + \varepsilon_{ijt}) \quad (7)$$

## Model construction and variable selection

Based on the theoretical model, the stochastic frontier gravity model was used to measure the main influencing factors of China's wooden furniture export trade. Referring to relevant research (Wang et al. 2019, Muhammad et al. 2020, Vu et al. 2020, Abdullahi et al. 2021, Wu and Sun 2021), the economic size of importing and exporting countries, population size, geographical distance of trading countries, exchange rate, endowment of forest resources, and common boundary were selected as explanatory variables, and a specific equation was established as follows:

$$\begin{aligned}\ln \mathrm{EXP}_{ijt} = {} & \alpha_0 + \alpha_1 \ln \mathrm{PGDP}_{jt} + \alpha_2 \ln \mathrm{PGDP}_{it} + \alpha_3 \ln \mathrm{POP}_{jt} \\ & + \alpha_4 \ln \mathrm{POP}_{it} + \alpha_5 \ln \mathrm{PFA}_{jt} + \alpha_6 \ln \mathrm{RER}_{jt} \\ & + \alpha_7 \ln \mathrm{DIS}_{ijt} + \alpha_8 \ln X_{ij} + v_{ijt} - u_{ijt}\end{aligned} \quad (8)$$

$$\begin{aligned}u_{ijt} = {} & \beta_0 + \beta_1 \mathrm{PRI}_{jt} + \beta_2 \mathrm{ERI}_{jt} + \beta_3 \mathrm{FRI}_{jt} + \beta_4 \mathrm{TEL}_{jt} \\ & + \beta_5 \mathrm{FTA}_{ijt} + \beta_6 \mathrm{WTO}_{ijt} + \varepsilon_{ijt}\end{aligned} \quad (9)$$

Equation 8 is a stochastic frontier gravity model, where $i$ and $j$ represent China and its trading partners, respectively; $t$ represents time; and $\mathrm{EXP}_{ijt}$ represents the total trade volume of wooden furniture exported from China to country or region $j$ in the period of t (measured in current dollars). The following explanatory variables were included (Table 1): $\mathrm{PGDP}_{jt}$ and $\mathrm{PGDP}_{it}$ represent the per capita gross domestic product (GDP) of country or region $j$ and China in period $t$, $\mathrm{POP}_{jt}$ and $\mathrm{POP}_{it}$ represent the population of country or region $j$ and China in period $t$, $\mathrm{PFA}_{jt}$ represents the forest resource endowment of country or region $j$ in period $t$, $\mathrm{DIS}_{ijt}$ represents the actual distance between China and country or region $j$, $\mathrm{RER}_{jt}$ represents the real effective exchange rate of country or region $j$ in period $t$, and $X_{ij}$ represents other factors. $\alpha$ is the unknown parameter to be estimated. $v_{ijt}$ is a random error term and follows a normal distribution with a mean value of 0, and $u_{ijt}$ is the trade inefficiency term used to measure the unobtainable data that hinder export.

Equation 9 is the trade inefficiency model, and $u_{ijt}$ is the trade inefficiency item of China's wooden furniture export trade. $\mathrm{PRI}_{jt}$, $\mathrm{ERI}_{jt}$, and $\mathrm{FRI}_{jt}$ are used to represent, respectively, the political risk, economic risk, and financial risk of wooden furniture–importing countries or regions in period $t$. $\mathrm{TEL}_{jt}$ represents the proportion of fixed telephones used in wooden furniture–importing countries or regions, $\mathrm{FTA}_{ijt}$ indicates whether the wooden furniture–importing countries or regions signed a free trade agreement with China in period $t$, and $\mathrm{WTO}_{ijt}$ indicates whether China and wooden furniture–importing countries or regions are World Trade Organization (WTO) members in period $t$. $\beta$ is the unknown parameter to be estimated, and $\varepsilon_{ijt}$ is a random error term.

*Table 1.—Variable explanation and expected effect direction.*[a]

| Variable | Variable explanation | Expected direction |
|---|---|---|
| Main | | |
| $\mathrm{PGDP}_{jt}$ | GDP per capita of trading partners (constant 2010 U.S. dollars) | + |
| $\mathrm{PGDP}_{it}$ | GDP per capita in China (constant 2010 U.S. dollars) | + |
| $\mathrm{POP}_{jt}$ | Actual population in trading partners (person) | + |
| $\mathrm{POP}_{it}$ | Actual population of China (person) | − |
| $\mathrm{PFA}_{jt}$ | Forest area per capita of trading partners ($hm^2$/person) | − |
| $\mathrm{RER}_{jt}$ | Trading partner's real effective exchange rate (%) | − |
| $\mathrm{DIS}_{ijt}$ | Actual distance between China and trading partners (km) | |
| $\mathrm{Contig}_{ijt}$ | Does China have a common border with its trading partners? (yes = 1, no = 0) | + |
| $\mathrm{Comlang}_{ijt}$ | Does China have a common language with its trading partners? (yes = 1, no = 0) | + |
| $\mu$ | | |
| $\mathrm{PRI}_{jt}$ | Political risk indices for trading partners (the greater the value, the lower the risk) | − |
| $\mathrm{FRI}_{jt}$ | Economic risk indices for trading partners (the greater the value, the lower the risk) | − |
| $\mathrm{ERI}_{jt}$ | Financial risk indices for trading partners (the greater the value, the lower the risk) | − |
| $\mathrm{TEL}_{jt}$ | Fixed-line telephone usage of trading partners (%) | − |
| $\mathrm{FTA}_{ijt}$ | Whether China has signed free trade agreements with its trading partners (yes = 1, no = 0) | − |
| $\mathrm{WTO}_{ijt}$ | Whether China and its trading partners are both WTO members (yes = 1, no = 0) | − |

[a] GDP = gross domestic product; WTO = World Trade Organization.

## Data sources

Considering the availability of data, representativeness, and breadth of samples, 37 countries or regions that continued to trade with China in wooden furniture from 1995 to 2020 were selected as research samples. Trading partners included the United States, Belgium, Hong Kong, Japan, Britain, Australia, Canada, South Korea, Germany, Singapore, France, the Netherlands, Russia, Saudi Arabia, Malaysia, Morocco, Austria, Brazil, Switzerland, Chile, Denmark, Spain, Finland, Greece, Hungary, Ireland, Italy, India, Indonesia, Mexico, Norway, New Zealand, the Philippines, Poland, Portugal, Sweden, and Turkey, representing the 37 countries or regions. According to the Harmonized Commodity Description and Coding System (HS), the wooden furniture counted in this article is divided mainly into six categories, and the corresponding HS codes are 940330, 940340, 940350, 940360, 940161, and 940169. The trade value of wooden furniture comes from the UN Comtrade database. The bilateral economic scale ($PGDP_{it}$, $PGDP_{jt}$), population size ($POP_{it}$, $POP_{jt}$), endowment level of forest resources ($PFA_{jt}$), exchange rate change ($RER_{jt}$), and the proportion of fixed telephone usage ($TEL_{jt}$) are all from the World Bank World Development Indicators database. Geographical distance ($DIS_{ijt}$), neighboring countries ($Contig_{ijt}$), and common language ($Comlang_{ijt}$) came from the GeoDist database of CEPII. The data for the political risk index, economic risk index, and financial risk index come from the international Country Risk Guide. The signing data for free trade agreements come from the official website of the Ministry of Commerce of China. The data regarding whether it is a WTO member at the same time are from the official WTO website. In addition, only a few missing data were supplemented by interpolation method.

# Results and Discussion

## Adaptability test of models

The applicability of the stochastic frontier model of gravity and the correctness of the model set were tested using the likelihood ratio test for discriminant models. The test set in this article is whether trade inefficiency exists and whether trade inefficiency has time-varying characteristics. The test results are shown in Table 2. According to the test results, trade inefficiency exists and has time-varying characteristics, so it is reasonable to use the time-varying stochastic frontier gravity model for estimation.

## Analysis of the time-varying stochastic frontier gravity model

On the premise of passing the hypothesis test of the model, this article used the software Frontier4.1 and the time-varying stochastic frontier gravity model to conduct an empirical analysis of China's wooden furniture export volume from 1995 to 2020. The estimated results are shown in Table 3. Among them, the value of $\gamma$ is 0.744, which is significant at the 1 percent level, indicating that there is a big gap between the actual trade volume and the frontier trade volume and that the inefficiency factor is the main cause of low efficiency of export trade; $\mu$ is significantly positive, indicating that China's wooden furniture export trade has the effect of inefficiency; and $\eta$ is significantly positive, indicating that the inefficiency of China's wooden furniture export trade decreases with time. Consequently, the time-varying stochastic frontier gravity model is scientific and reasonable, and the trade inefficiency factor is an important factor affecting the export of Chinese wooden furniture.

The regression results of the model show that the economic development level and population size of trading partners and China's economic development level have significant positive impacts on China's export trade of wooden furniture; China's population size, the per capita forest area of trading partners, and the fluctuation of the currency value of trading partners have significant inhibitory effects on China's export trade of wooden furniture. Specifically, the economic development level and population size of trading partner countries or regions have an indigenous influence on China's wooden furniture export trade. The regression coefficients are all significantly positive at the level of 1 percent, and the regression results are consistent with those of Vu et al. (2020). This shows that the improvement of the economic level of trading partners and the expansion of residents' consumption ability and population size are conducive to improving the potential purchasing ability of wooden furniture consumers and increasing the purchasing demand for Chinese wooden furniture (Tang and Song 2013, Wang et al. 2019, Liu and

*Table 3.—Regression results of the time-varying stochastic frontier gravity model.*[a]

| Variable name | Coefficient | Standard error | *t* ratio |
|---|---|---|---|
| ln $PGDP_{jt}$ | 1.815*** | 0.207 | 10.764 |
| ln $PGDP_{it}$ | 2.672*** | 0.094 | 22.056 |
| ln $POP_{jt}$ | 1.609*** | 0.134 | 13.204 |
| ln $POP_{it}$ | −2.259*** | 0.258 | −7.407 |
| ln $PFA_{jt}$ | −0.299** | 0.120 | −2.328 |
| ln $RER_{jt}$ | −0.465** | 0.032 | −2.550 |
| ln $DIS_{ijt}$ | 0.260 | 0.292 | 0.535 |
| $Contig_{ijt}$ | 0.426 | 0.602 | 0.513 |
| $Comlang_{ijt}$ | 1.367 | 1.024 | 1.510 |
| Constant | −8.717*** | 0.999 | −8.716 |
| $\sigma^2$ | 2.607*** | 0.360 | 5.337 |
| $\gamma$ | 0.744*** | 0.027 | 18.824 |
| $\mu$ | 2.786*** | 0.387 | 5.595 |
| $\eta$ | 0.007*** | 0.002 | 3.098 |
| Log likelihood | | −1,253.262 | |
| Likelihood ratio | | 771.559 | |
| Observations | | 962 | |

[a] ***, **, and *, represent significance at the 1%, 5%, and 10% levels, respectively.

*Table 2.—Hypothesis test results of stochastic frontier gravity model.*

| Null hypothesis | Constraint model | Nonconstrained model | Likelihood ratio[a] | 1% threshold | Results |
|---|---|---|---|---|---|
| There is no trade inefficiency | −1,258.977 | −1,639.041 | 760.128 | 11.345 | Reject |
| Trade inefficiencies remain constant | −1,255.388 | −1,639.041 | 767.306 | 6.635 | Reject |

[a] The likelihood ratio obeys the chi-square distribution.

Huang 2020, Wu and Sun 2021). China's economic scale has a significant promotion effect on the export of wooden furniture, indicating that the improvement of China's economic development level is conducive to increasing the export of wooden furniture (Wu and Sun 2021), which is consistent with the expected sign. China's population scale has a significant hindering effect on the export of wooden furniture, indicating that the expansion of China's population scale increases the domestic demand for wooden furniture and has a certain negative effect on the export of wooden furniture. The forest resource endowment of trading partners was found to have a significant negative impact on China's wooden furniture export, which is consistent with the expected trend. The richer a country's forest resources, the more likely it is to use them for economic development, thus reducing the import demand for wood products (Zhang and Li 2009, Vu et al. 2020), consistent with the Heckscher–Ohlin model. In addition, the real exchange rate of trading partners has a significant negative effect on China's wooden furniture export; that is, the currency appreciation of trading partners makes China's wooden furniture relatively more expensive (Zhang and Li 2009, Berbenni 2021). The geographical distance, common border, and common language of the two sides have no significant impact on China's wooden furniture export trade, which differs from the traditional view. Generally, longer geographical distance will have a negative impact on the export of Chinese wooden furniture (Zhang and Li 2009, Wang et al. 2019, Muhammad et al. 2020). Having a common border and common language has no significant impact on China's wooden furniture export trade, suggesting that there is no significant ''border effect'' in China's wooden furniture export trade (Wang et al. 2019, Wu and Sun 2021) and that the language barrier is not the main factor affecting China's wooden furniture export trade at the present stage (Atif et al. 2017).

## Analysis of trade inefficiency model estimation results

In order to explore the impact of country risk on China's wooden furniture export trade, a one-step trade inefficiency model was adopted for regression analysis of the export trade data of China's wooden furniture from 1995 to 2020. Equation 9 was imported into Equation 8 to perform regression estimation. The regression results are shown in Table 4. Among them, the value of $\gamma$ is significantly positive, indicating that trade inefficiency is an important factor hindering China's wooden furniture export trade at present.

According to the estimation results in Table 4, it was found that national economic risk index and financial risk index have a significant negative impact on the inefficiency of China's wooden furniture export trade and that the political risk index has a significant positive impact on the inefficiency of China's wood furniture export trade. Specifically, the political risk index has a significant positive impact on the inefficiency of China's wooden furniture export trade; that is, the rise of political risk in importing countries has a positive effect on China's wooden furniture export trade, contrary to the expected sign. Generally, political risk is multidimensional (Ding et al. 2022), with rising political risk arising from unexpected political events, political instability, and ineffective government decisions (Qazi and Khan 2021, Wang et al. 2021); rising political risk may lead to a decline in bilateral trade (Oh and Reuveny 2010). Studies have shown that political risk has a significant negative impact on export trade in energy commodity trade such as crude oil (Chen et al. 2016, Lee et al. 2019). However, since China's exports of wooden furniture are mainly low- and medium-grade products with low added value and tend to be necessities of life (Bergstrand 1989, Yu and Nie 2009), when the political risk in the importing country or region increases, the instability of the regional political environment may directly lead to the chaos of forest product processing–related industries (Sun et al. 2022) so as to meet people's living needs by increasing imports.

*Table 4.—Regression results of inefficient model.*

| Variable name | Results |
|---|---|
| Main | |
| ln $PGDP_{jt}$ | 1.212*** (20.112) |
| ln $PGDP_{it}$ | 2.499*** (31.947) |
| ln $POP_{jt}$ | 1.031*** (26.240) |
| ln $POP_{it}$ | −0.994*** (−9.021) |
| ln $PFA_{jt}$ | −0.082** (−1.962) |
| ln $RER_{jt}$ | −0.379** (−2.104) |
| ln $DIS_{ijt}$ | −0.637*** (−8.468) |
| $Contig_{ijt}$ | −0.845*** (−4.521) |
| $Comlang_{ijt}$ | 2.264*** (11.535) |
| Constant | −7.461*** (−7.470) |
| $\mu$ | |
| $PRI_{jt}$ | 0.048*** (6.444) |
| $FRI_{jt}$ | −0.013 (−2.021) |
| $ERI_{jt}$ | −0.084*** (−7.717) |
| $TEL_{jt}$ | 0.025*** (5.452) |
| $FTA_{ijt}$ | 0.144 (1.526) |
| $WTO_{ijt}$ | 0.430*** (5.869) |
| Constant | 1.184*** (5.782) |
| $\sigma^2$ | 1.703*** (25.294) |
| $\gamma$ | 0.038*** (5.044) |
| Log likelihood | −1,605.360 |
| Likelihood ratio | 67.363 |
| Observations | 962 |

[a] The values in brackets are *t* statistics. ***, **, and *, represent significance at the 1%, 5%, and 10% levels, respectively.

The economic risk index has a significant negative impact on the inefficiency of China's wooden furniture export trade, which is consistent with the expected sign, namely, that economic risk has a restraining effect on the efficiency improvement of China's wooden furniture export trade (Wang et al. 2021). On the one hand, rising economic risks will affect the economic development of wooden furniture–importing countries, and the unstable economic environment under economic risks seriously hinders the country's forestry production and trade (Sun et al. 2022). On the other hand, in the case of high inflation and economic downturn, the people of importing countries will have negative sentiments about their income, investment, savings, and jobs (Burns et al. 2012, Michael and Matthew 2019), and the accompanying falling demand for wooden furniture products leads to lower imports (Sun et al. 2022).

Similarly, financial risks are a significant impediment to the efficiency of China's wooden furniture export trade, which is consistent with theoretical expectations, which means that financial risks in importing countries or regions

are not conducive to exporting wooden furniture. Empirical data show that financial crises can negatively affect trade flows by impacting corporate and banking risks (Del Prete and Federico 2020) and that countries adopt tighter monetary policies that lead to lower demand for imports and that are also detrimental to commodity exports (Cao et al. 2018). Taking the global financial crisis that broke out in 2008 as an example, under the influence of the financial crisis, the growth rate of China's wooden furniture exports in 2008 dropped by 18.52 percent compared with 2007. In 2009, the trade volume of wooden furniture exported from China to the United States decreased by 6.15 percent compared with 2008. It can be seen that economic and financial risks pose a major threat to a country's development and trade activities (Qazi and Simsekler 2022), and reducing economic and financial risks can effectively promote foreign trade (Wang et al. 2021).

In addition, the signing of free trade agreements, the communication facilities of trading partners, and whether both are WTO members have a significant positive impact on the inefficiency of China's wooden furniture export trade. First, the signing of a free trade agreement with China by a trading partner country or region is a significant impediment to China's wooden furniture export trade, contrary to the expected sign. Second, the proportion of landline telephone use in trading partner countries or regions is significantly negatively correlated with trade inefficiency, indicating that the level of infrastructure construction, such as communications in trading partner countries or regions represented by the proportion of landline telephone use, has no effect on the import of Chinese wooden furniture. In addition, whether both parties are WTO members has a significant positive impact on the inefficiency of China's wooden furniture export trade, which is opposite to the expected sign. This shows that in the current international environment, becoming a member of the WTO cannot promote China's wooden furniture export trade (Zhang and Li 2009, Vu et al. 2020), and international political and economic agreements are being fragmented by bilateral, regional, and local and short-term interests (Asgary and Ozdemir 2020, Wu and Sun 2021).

## Analysis of export trade efficiency calculated results

According to Equation 3, the export trade efficiency value can be obtained by dividing the actual level of wooden furniture export trade with the random frontier level. Considering the influence of country risk on trade efficiency, the one-step trade inefficiency model is used to estimate the trade efficiency of wooden furniture exported by China to 37 major trading partners from 1995 to 2020, as shown in Table 5. When there is an inefficiency effect, the higher the export efficiency value, the lower the trade potential and the lower the trade resistance. On the contrary, the greater the trade potential, the greater the trade resistance.

China's wooden furniture export efficiency is at a moderate level, and the export efficiency of different countries or regions obviously differs. As can be seen from Table 5, under the influence of country risk and other factors, the average efficiency of wooden furniture export trade between China and 37 trading partners countries or regions is 0.601. This shows that China's wooden furniture export trade efficiency is in the middle level at the present stage, and the export scale has a large space to expand. The 37 major trading partners were divided into three groups: a high-efficiency group (TE $\geq$ 0.7), an average-efficiency group (0.7 $>$ TE $\geq$ 0.6), and a low-efficiency group (TE $<$ 0.6). Specifically, there are 19 trading partners in the high-efficiency group: India, Saudi Arabia, Indonesia, the Philippines, Russia, Morocco, Mexico, Malaysia, Brazil, Turkey, Chile, Norway, Poland, Singapore, Japan, Italy, South Korea, Spain, and Hungary. Meanwhile, Belgium, Denmark, Hong Kong, Austria, and Switzerland are in the average-efficiency group. In addition, there are 13 trading partners in the low-efficiency group: Finland, France, Portugal, the Netherlands, Germany, Ireland, Canada, the United Kingdom, Sweden, Greece, the United States, Australia, and New Zealand. The larger the efficiency value of export trade, the smaller the trade potential or, in other words, the smaller the trade expansion space of both sides. Therefore, there is much room for China to improve its export to trade partners in the low-efficiency group, while there is little room for China to expand its export scale to trade partners in the high-efficiency group. It can be seen that the imbalance in export efficiency between countries or regions is obvious, and the United States and some EU

*Table 5.—Calculation results of export efficiency.*

| Ranking | Country | Mean value |
|---|---|---|
| 1 | India | 0.969 |
| 2 | Saudi Arabia | 0.962 |
| 3 | Indonesia | 0.960 |
| 4 | Philippines | 0.959 |
| 5 | Russia | 0.957 |
| 6 | Morocco | 0.949 |
| 7 | Mexico | 0.939 |
| 8 | Malaysia | 0.930 |
| 9 | Brazil | 0.922 |
| 10 | Turkey | 0.915 |
| 11 | Chile | 0.874 |
| 12 | Norway | 0.854 |
| 13 | Poland | 0.850 |
| 14 | Singapore | 0.830 |
| 15 | Japan | 0.791 |
| 16 | Italy | 0.747 |
| 17 | South Korea | 0.710 |
| 18 | Spain | 0.708 |
| 19 | Hungary | 0.708 |
| 20 | Belgium | 0.662 |
| 21 | Denmark | 0.657 |
| 22 | Hong Kong | 0.657 |
| 23 | Austria | 0.654 |
| 24 | Switzerland | 0.603 |
| 25 | Finland | 0.572 |
| 26 | France | 0.563 |
| 27 | Portugal | 0.541 |
| 28 | Netherlands | 0.540 |
| 29 | Germany | 0.529 |
| 30 | Ireland | 0.515 |
| 31 | Canada | 0.490 |
| 32 | United Kingdom | 0.486 |
| 33 | Sweden | 0.475 |
| 34 | Greece | 0.471 |
| 35 | United States | 0.395 |
| 36 | Australia | 0.370 |
| 37 | New Zealand | 0.365 |
| | Mean | 0.601 |

countries in the low-efficiency group are greatly affected by economic and financial risks and will be the focus of China's wooden furniture export market for a period of time in the future.

According to the calculation results of China's export efficiency of wooden furniture to various countries or regions from 1995 to 2020, it can be found that China's export efficiency to high-income countries or regions is generally lower than non–high-income countries or regions. To explore whether the phenomenon may be long term, according to the World Bank's classification of different income countries designated as a result, China's main trading partners in wooden furniture can be divided into high-income countries, medium- to high-income countries, and medium- to low-income countries. Among them, there are 28 high-income countries, five medium-income countries, and four low-income countries. By averaging the export efficiency of countries with different income types each year, the differences in the export efficiency of Chinese wooden furniture in countries with different income types are examined.

The efficiency of China's export trade to importing countries or regions with higher economic development levels is lower than that of backward importing countries or regions. As can be seen from Figure 1, the export efficiency of wooden furniture from China to high-income countries has always been lower than that from upper- to middle-income and lower- to middle-income countries due to inefficiency factors such as country risk. Moreover, China's export trade efficiency to high-income countries or regions is consistent with the average trend of wooden furniture export efficiency. Furthermore, there is little change in the efficiency of export trade to upper- to middle-income countries and lower- to middle-income countries. On the one hand, China's main export partners of wooden furniture are mainly high-income countries; on the other hand, economic and financial risks have a greater impact on countries with a higher level of economic development. It can be seen that in the long run, the efficiency of China's wooden furniture export trade shows a trend of fluctuation and decline. The economic and financial situation of importing countries or regions with a high economic development level has a significant impact on China's wooden furniture export trade, which is consistent with the conclusion drawn above.

## Conclusion

Based on the data of 37 major trading partners of China's wooden furniture from 1995 to 2020, this article analyzed the influencing factors of China's wooden furniture export trade by using a stochastic frontier gravity model. The research found that the economic scale and population scale of trading partners and China, the forest resource endowment of trading partners, the characteristic of high income, and the inland characteristics all have a significant impact on the export trade of Chinese wooden furniture, which is consistent with the conclusions of many studies (Zhang and Li 2009, Wang et al. 2019, Vu et al. 2020, Muhammad et al. 2020).

The aggravation of country risk threat is closely related to wooden furniture export trade. This article used the one-step trade inefficiency model to estimate the trade inefficiency of Chinese wooden furniture export and introduced the indicators of political risk, economic risk, and financial risk of trading partners into the inefficiency model so as to explore the influencing factors of the trade efficiency of Chinese wooden furniture export. The main conclusions are as follows. First, the economic risk and financial risk of trading partners have a significant negative impact on China's wooden furniture export trade, while political risk has a significant promoting effect on China's wooden furniture export trade. Second, China's wooden furniture export trade efficiency is at the general level, indicating that China's wooden furniture export still has a large space to expand. Moreover, there are obvious differences in export trade efficiency among different countries or regions. In addition, affected by economic and financial risks, China's export trade efficiency to trading partners with higher

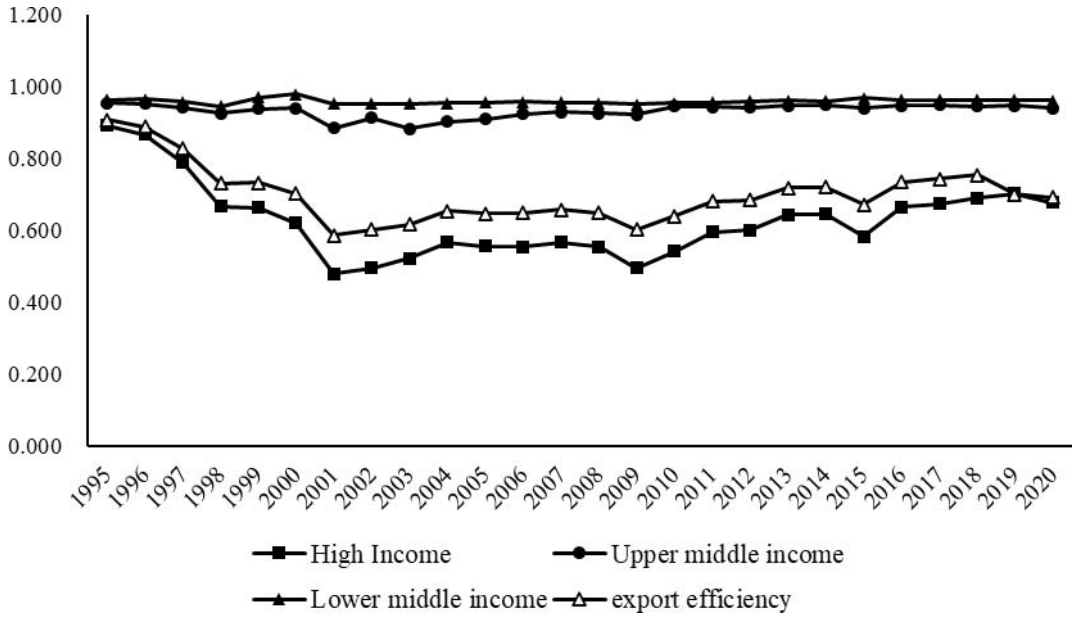


*Figure 1.—Comparison of China's export efficiency to different types of trading partners.*

economic development levels is lower than that of importing countries or regions with backward economic development.

In addition, the research in this article can be built on in terms of the following aspects. First, considering the representativeness of the research samples, only the main trading partners of China's wooden furniture export from 1995 to 2020 were selected, and the indirect trade relationship between the trading partners was not taken into account, so the number of research samples can be improved. Second, this article considered the impact of the country risk of trading partners on China's wooden furniture export, and the impact of COVID-19 pandemic on wooden furniture export trade was not taken into account. In our future studies, we will collect more relevant data and continue to explore, and China's country risk could also be added into the research framework from the perspective of importing countries or regions.

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