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Does Belt and Road Initiative Mitigate the Impact of Exchange Rate Volatility on China's Technology-Level Exports?

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ABSTRACT

This study investigates whether the Belt and Road Initiative (BRI) mitigates the impact of exchange rate volatility on China's exports to BRI partner countries across different technology levels. A GARCH(1,1) model is employed to estimate exchange rate volatility from monthly exchange rates using bilateral export data at the SITC 5-digit level from the UN Comtrade database for the years 2006–2022. Export goods are divided into three categories: high-, medium-, and low-technology manufacturers; resource-based manufacturers; and primary products. The results imply that the BRI weakens the US dollar and mitigates the negative effects of RMB exchange rate volatility on high- and medium-tech exports. Furthermore, the policy increases China's exports in all fields of technology. The findings also reveal that China's exports increased during both the COVID-19 outbreak and the global financial crisis of 2008. The findings demonstrate that the BRI can help mitigate the negative effects of currency rate volatility and increase export stability when the global economy is uncertain.

JEL Classification: F31, F14, O33

Keywords: Exchange rate volatility; Belt and Road Initiative; Manufactured exports; Technological classification; China's exports

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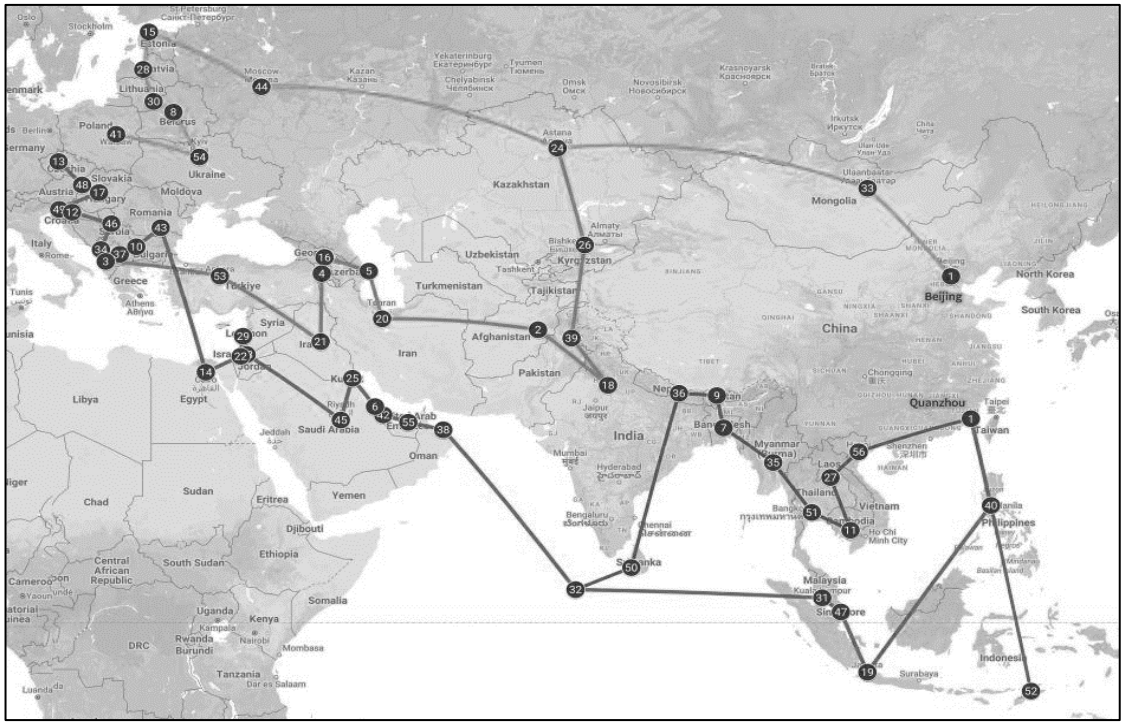
INTRODUCTION

The global financial crisis of 2008 led to a period of slow economic growth in advanced economies such as the US and Europe. On the other hand, developing countries, especially China, took advantage of it by increasing exports and investments, enabling them to grow economically despite the global downturn. At the same time, China has maintained a large trade surplus with the United States, which has sparked a trade war between the two countries. The current Sino-American trade war may yield effects similar to those of the 1930s trade wars, thereby potentially strengthening the formation of trade blocs around China and the United States (Jacks and Novy, 2020). With the intensification of trade frictions between China and the United States, China-US relations will be unable to recover to their pre-trade frictions state, as the ongoing disputes and tariffs create lasting economic and political divisions that hinder cooperation. The greatest answer would be for China and the United States to each create their own self-centered free trade zones (Thorbecke, 2021).

The BRI, also known as the “Silk Road Economic Belt and the 21st Century Maritime Silk Road," is a transnational economic zone initiated by President Xi Jinping of the People's Republic of China in 2013. It encompasses countries in East Asia, Central Asia, North Asia, West Asia, South America, and the Atlantic region, as illustrated in Figure 1. This figure lists the sample countries alphabetically, where the country names are reported in detail in Table 1. The BRI aims to build a practical platform for fostering a community with a shared future for mankind and overcoming developmental challenges through mutual benefit with other countries (Li et al., 2024). As an open trade bloc led by China, the BRI possesses significant potential to enhance the welfare of its co-construction countries (BRI countries) (Ren and Sakouba, 2024), given its aim to promote economic development through economic integration (Flint and Zhu, 2019). As China's influence in BRI co-construction countries continues to grow, questions arise regarding the potential challenge to the United States' international status. In the financial and trade sectors, the influence of the United States is largely rooted in the influence of the US dollar (USD henceforth). In this context, it becomes interesting to see how the exchange rate volatility of the RMB and the USD affects the structure of China's exports to the BRI countries.



Notes: The countries marked with numbers in the figure represent the Belt and Road Initiative (BRI) partner economies included in the empirical sample of this study. The connecting lines illustrate the cooperation network between China and the sample BRI countries under the BRI framework. The map displays only the sample countries used in the empirical analysis, rather than the full set of BRI participating economies.

Source: Compiled by the author from Google My Maps

Figure 1 Geographic Distribution of Sample BRI Countries

Table 1 Sample countries

No.	Country	No.	Country	No.	Country	No.	Country
1	China	15	Estonia	29	Lebanon	43	Romania
2	Afghanistan	16	Georgia	30	Lithuania	44	Russia
3	Albania	17	Hungary	31	Malaysia	45	Saudi Arabia
4	Armenia	18	India	32	Maldives	46	Serbia
5	Azerbaijan	19	Indonesia	33	Mongolia	47	Singapore
6	Bahrain	20	Iran	34	Montenegro	48	Slovakia
7	Bangladesh	21	Iraq	35	Myanmar	49	Slovenia
8	Belarus	22	Israel	36	Nepal	50	Sri Lanka
9	Bhutan	23	Jordan	37	North Macedonia	51	Thailand
10	Bulgaria	24	Kazakhstan	38	Oman	52	Timor-Leste
11	Cambodia	25	Kuwait	39	Pakistan	53	Turkey
12	Croatia	26	Kyrgyzstan	40	Philippines	54	Ukraine
13	Czech	27	Laos	41	Poland	55	United Arab Emirates
14	Egypt	28	Latvia	42	Qatar	56	Vietnam

The impact of exchange rate volatility on international trade has always been an important area of research. Comprehensive reviews by Mckenzie (1999), Bahmani-Oskooee and Hegerty (2007), Flores-Sosa et al. (2022) and Lal et al. (2023) show that there is no consistent conclusion in the literature. Some empirical results indicate a negative effect, while others find the impact insignificant or even positive, depending on the sample period and country groups. A major reason for this inconsistency is that most studies focus only on bilateral exchange rates and ignore the "third-country effect." Kelejian et al. (2012) addressed this matter by using a spatial gravity model to find a "crowding-out effect" in Eurozone trade. Similarly, the study of Usman et al. (2021) shows that USD volatility specifically affects the trade between Pakistan and China. But studies on third-country effects often treat all products as identical. The export of manufactured goods from China to BRI countries includes different levels of technology. Low-tech products are usually more sensitive to price changes caused by exchange rate movements, while high-tech products may be more stable due to their role in global supply chains. Therefore, this study expands the existing research by dividing manufactured goods into low-, medium-, and high-technology groups. So, we can see how third-country exchange rate volatility affects different industrial sectors in greater detail.

This study, however, examines whether the BRI has a comparable impact on the USD's influence among its member nations. The BRI encourages renminbi-denominated bilateral trade among member countries, diminishing the influence of third-country currencies (notably the U.S. dollar) and enhancing trade stability. Due to limitations in data and the short span of time for policy effects to emerge, we do not see much literature on BRI's effect on currencies and trade performances. Compared to the existing literature, this study contributes by providing a detailed empirical analysis of the impact of exchange rate volatility on China's exports to BRI countries, with a specific focus on the role of the Belt and Road Initiative in moderating these effects.

This paper uses UN Comtrade SITC 5-digit export data from 2006 to 2022 to classify goods by technology level. The disaggregated exports data by technology level are divided into 5 categories: primary product, resource-based manufacturing, high-tech manufacturing, medium-tech manufacturing, and low-tech manufacturing. The volatility of the real effective exchange rate (REER) of the RMB and that of the USD is measured using GARCH conditional standard deviations. Given that BRI member countries joined at different times and some have withdrawn, this paper includes 55 out of the 64 countries that joined the BRI in the first batch, excluding Italy and countries with significant data gaps.

The study's results show: 1) The BRI promotes China's exports of products with various technological levels to BRI countries. 2) RMB volatility has significant negative impacts on China's export structure, with the impact increasing with the technological content of products, but a non-significant positive impact on resource-based products. 3) USD volatility has significant negative effects on high-tech and low-tech products and resource-based products but has a non-significant negative impact on medium-tech products. 4) The BRI aids in achieving internationalization of the RMB and decoupling from the USD, as the impact of USD volatility is smaller than that of RMB volatility. 5) The BRI reduces the negative impact of RMB volatility on high-tech and medium-tech exports, with a greater impact on higher technological levels, but does not significantly affect the impact of USD volatility, except for a negative reinforcement on high-tech and medium-tech sub-items. 6) The global crisis enhances China's exports of finished products with various technological levels to BRI countries.

Although the BRI was launched in 2013, actual cooperation between member countries varies. This paper uses the timing of the first major project between China and co-constructing countries as an indication of actual cooperation. The study shows consistent results between BRI policy and specific practices, with the latter showing increased negative impact of USD volatility on high-tech and medium-tech exports post-cooperation, though the increase is smaller. The BRI reduces the negative impact of RMB volatility on China's exports to BRI countries, but RMB volatility still negatively affects exports, especially for higher-tech products. Therefore, China needs to stabilize the RMB exchange rate and upgrade its industrial structure to promote exports to BRI countries.

The remainder of this paper is organized as follows: Section 2 discusses the research method, defines variables, and describes the data. Section 3 presents the estimated results, and Section 4 conducts a robustness check. Section 5 concludes the study.

EMPIRICAL METHOD

Model Specification

To investigate how the Belt and Road Initiative (BRI) affects exports' responsiveness to real effective exchange rate (REER) volatility, this study employs a model based on the works of Bahmani-Oskooee and Arize (2022); Bahmani-Oskooee et al. (2023); Hooy et al. (2015); and Cushman (1983, 1986).

$$EX=f(Y, RER, Vol_{\_RMB}, Vol_{\_USD}, BRI, Crisis, \epsilon) \quad (1)$$

where EX represents the volume of exports to BRI countries, Y is the real GDP proxying BRI countries' income, and RER is the bilateral real exchange rate between the RMB and BRI countries' currency, serving as a proxy for the relative price level. The model also includes the volatility of the REER in RMB and USD. To capture the relative price effect, we include a bilateral real exchange rate, calculated using the formula: $RER_{BRI/RMB}=\frac{NER_{BRI}}{NER_{RMB}}\times\frac{P_{BRI}}{P_{China}}$, where NERBRI and NERRMB represent the nominal exchange rates of BRI countries' currencies and RMB against the USD under the direct quotation method, respectively. $\frac{NER_{BRI}}{NER_{RMB}}$ is the nominal exchange rate of BRI countries with RMB under the direct quotation method, P_{BRI} and P_{China} are the consumer price indexes of the BRI countries and China, so $RER_{BRI/RMB}$ is the real exchange rate of the currency of the BRI country against the RMB under the direct quotation method, indicating how many units of the currency of the BRI country can be exchanged for 1 yuan of RMB. The error term ε is the usual residual series. The model includes a BRI dummy variable to determine if BRI participation reduces the effect of exchange rate volatility on China's exports to BRI countries and a crisis dummy to capture the effect of crises.

We expect the coefficient of Y (income) to be positive, indicating that higher income increases demand for exports. Conversely, the coefficient of RER (relative price) is expected to be negative, as a stronger exporter's currency makes goods more expensive, reducing demand from importers. The coefficients for the RMB volatility and the USD can be either positive or negative, depending on the balance between income and substitution effects. The coefficient for the crisis dummy can also vary, depending on China's response to crises. The model captures the heterogeneous effect of REER volatility on trade, suggesting that BRI participation may mitigate the adverse effects of REER volatility due to the stabilizing influence of the trading bloc.

The regression equation is:

$$\ln EX=\beta_0+\beta_1 \ln RGDP+\beta_2 \ln RER+\beta_3 \ln Vol_{\_RMB}+\beta_4 \ln Vol_{\_USD}+\beta_5 DBRI+\beta_6 Dcrisis+\varepsilon_{it} \quad (2)$$

The inclusion of interaction terms between exchange rate volatility and BRI participation allows for the assessment of whether the BRI's stabilizing effects can buffer the adverse impacts of exchange rate volatility. This is particularly important given the BRI's goal of enhancing economic integration and stability among participating countries. Additionally, the crisis dummy variable is crucial for isolating the effects of global or regional economic downturns, which can severely disrupt trade patterns, as it helps to differentiate between normal volatility in trade and that caused by significant economic crises.

The regression equation is:

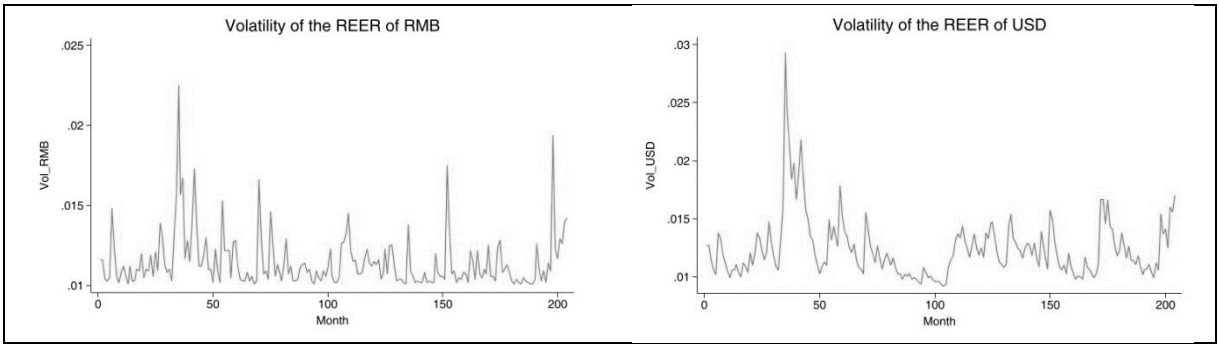
$$\ln EX_{it}^{BRI} = \beta_0 + \beta_1 \ln RGDP + \beta_2 \ln RER + \beta_3 \ln Vol_{\_RMB} + \beta_4 \ln Vol_{\_USD} + \beta_5 DBRI + \beta_6 DBRI\_\ln Vol_{\_RMB} + \beta_7 DBRI\_\ln Vol_{\_USD} + \beta_8 DCrisis + \varepsilon_{it} \quad (3)$$

Data and Variables

This study uses panel data from 55 countries over 17 years (2006 to 2022). The sample countries are listed in Table 1. Annual export volumes from China to BRI countries were obtained from the UN Comtrade database. The data includes the real GDP of the BRI countries. The annual export volumes from China to BRI countries were obtained from the UN Comtrade database. The data includes the real GDP and Price Index (CPI) of the BRI countries, China, and the United States; the nominal bilateral exchange rate between USD and BRI countries (including RMB); and the real effective exchange rates (REER) of USD and BRI countries' currency (including RMB). To calculate the conditional standard deviation using the GARCH model, monthly data from the IMF's IFS database was used. Specifically, the base year for CPI is 2010, and for real GDP, it is 2005.

The bilateral real exchange rates in this study are computed by first determining the nominal bilateral exchange rates between China and BRI countries using their respective nominal exchange rates with the USD and then adjusting for the CPI. An increase in this value signals an appreciation of the RMB. The REER is calculated as a weighted average of a country's bilateral nominal exchange rates with its trading partners' currencies, typically weighted by trade shares. It excludes the effect of inflation on the purchasing power of national currencies, making it a useful measure of international competitiveness for a country's goods. To ensure robustness, we also consider the REER of BRI countries as the relative price, where an increase indicates enhanced competitiveness for the importer.

Exchange rate volatility cannot be observed directly. Due to the nature of volatility, often featuring large shocks clustered in the conditional variance, a GARCH model is used to measure this volatility (Cheong et al., 2005). These models are widely adopted in the literature for capturing non-constant, time-varying conditional variances (Holly, 1995; Kroner and Lastrapes, 1993). Volatility is quantified by the conditional standard deviation of the REER, calculated using the GARCH(1,1) model with monthly data from January 2006 to December 2022.



Notes: Compiled by the author

Figure 2 Conditional standard deviation of REER calculated by GARCH(1, 1)

Bilateral export volumes are disaggregated by technological levels with 5-digit UN Comtrade data, based on the classification by Lall (2000) and improved by Haltmaier et al. (2009). These classifications divide products into five major categories and ten subcategories, as shown in Figure 4. The difference between them is that Lall uses a detailed classification with a 3-digit list from SITC Revision 2, while Haltmaier et al. (2009) provide a more detailed 5-digit list from SITC Revision 3. Hooy et al. (2016) further verified the technology classifications list from Haltmaier et al. (2009) and organized the five-digit SITC codes into a table. This study calculates the export products at every technology level, based on the list by Hooy et al. (2016).

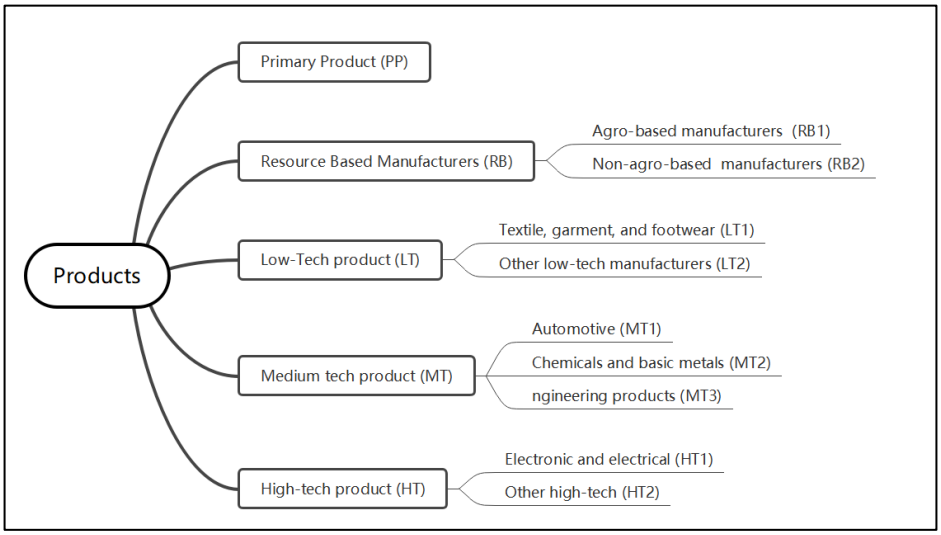


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Figure 3 Classification by technological levels

DBRI is a dummy variable used to capture the policy-level effect of the Belt and Road Initiative (BRI), taking the value of 0 for the years and before a country signed the BRI memorandum and 1 for the years thereafter. To capture the practical effect, we also use the dummy variable DFIP, which measures the impact of each BRI country's first important project with China since 2013. This variable takes the value of 0 until the first important project is launched and 1 thereafter. Between 2006 and 2022, the world experienced several crises, including the 2008 financial crisis and the COVID-19 pandemic, which severely impacted the global economy. To study the effect of exchange rate volatility on China's exports to BRI countries more accurately, this paper isolates the crisis factor. The crisis variable takes the value of 1 for the years 2008, 2009, and 2020-2022, and 0 for all other years. The year 2019 is not included as a crisis year since the COVID-19 pandemic began in late December 2019.

Descriptive Analysis

This study consists of 23 variables, including 14 dependent variables, 5 independent variables, and 4 interaction variables for 935 observations. Table 2 displays the count of observations, mean, standard deviation, minimum, median, and maximum for all variables employed in this study. The dependent variable (export volume) is categorized into five major categories and nine subcategories based on technological levels. The logarithmic form of them shows that the mean and median are close to each other, indicating a relatively symmetrical and less skewed data distribution. However, the standard deviations of these 14 variables are all relatively large. Although the sample consists mainly of developing countries, there are significant differences in the level of cooperation between these countries and China, so the occurrence of extreme values and large standard deviations is consistent with reality.

Regarding the independent variables, the mean value of lnRGDP is 20.22 with a standard deviation of 1.70, indicating moderate spread and most data points being relatively close to the mean. Both $\ln Vol_{\_RMB}$ and $\ln Vol_{\_USD}$ have negative mean values of -4.47 and -4.40, respectively, with small standard deviations of 0.07 and 0.13, reflecting stable volatility. The standard deviations of the interaction terms between the dummy variables (DBRI and DFIP) and $\ln Vol_{\_RMB}$ and $\ln Vol_{\_USD}$ are both large. Specifically, the standard deviations for DBRI and $\ln Vol_{\_RMB}$ and $\ln Vol_{\_USD}$ are 2.21 and 2.19, respectively, while those for DFIP and $\ln Vol_{\_RMB}$ and $\ln Vol_{\_USD}$ are 2.22 and 2.18. This indicates a significant interaction effect between these dummy variables and the continuous variables, suggesting that the impacts of $\ln Vol_{\_RMB}$ and $\ln Vol_{\_USD}$ on the dependent variables vary depending on the values of DBRI and DFIP.

Table 2 Descriptive Statistics

VarName	Obs	Mean	SD	Min	Median	Max
lnHT	935	16.20	2.33	5.15	16.40	21.36
lnHT1	935	15.97	2.44	5.15	16.22	21.30
lnHT2	935	14.01	2.43	2.40	14.14	18.57
lnMT	935	18.92	2.19	8.68	18.92	23.37
lnMT1	935	16.06	2.36	5.57	16.28	20.95
lnMT2	935	18.26	2.48	5.41	18.30	23.27
lnMT3	935	17.65	2.04	8.64	17.74	21.98
lnLT	935	19.16	2.12	9.26	19.32	23.23
lnLT1	935	17.33	2.36	.02	17.48	21.58
lnLT2	935	18.88	2.15	8.68	18.91	23.12
lnRB	935	19.17	2.19	10.59	19.33	23.50
lnRB1	935	17.80	1.97	10.59	17.93	21.45
lnRB2	935	18.73	2.40	7.65	18.92	23.47
lnPP	935	17.52	2.78	.16	17.60	22.54
lnRGDP	935	20.22	1.70	16.16	20.24	23.96
$lnRER_{BRIRMB}$	935	1.13	2.97	-3.33	.73	7.95
$lnREER_{BRI}$	935	4.24	2.32	-1.54	4.59	10.05
$lnVol_{RMB}$	935	-4.47	0.07	-4.56	-4.489	-4.31
$lnVol_{USD}$	935	-4.40	0.13	-4.60	-4.38	-4.07
$DBRI\_lnVol_{RMB}$	935	-2.64	2.21	-4.56	-4.45	0
$DBRI\_lnVol_{USD}$	935	-2.61	2.19	-4.60	-4.33	0
$DFIP\_lnVol_{RMB}$	935	-1.88	2.22	-4.56	0	0
$DFIP\_lnVol_{USD}$	935	-1.84	2.18	-4.60	0	0

Notes: Calculated by authors.

EMPIRICAL RESULTS

Exchange Rate Volatility, Exports, and Belt and Road Initiative - Without Interaction Items

Table 3 and Table 4present estimated results of Equation (1) using panel regression without interaction terms. Table 3displays the four major categories classified by technology: HT (high-tech), MT (medium-tech), LT (low-tech), RB (resource-based), and PP (primary products). Table presents the nine subcategories: HT1, HT2, MT1, MT2, MT3, LT1, LT2, RB1, and RB2.

Table 3 Basic model-estimations for major categories classified by technology

	(1) lnHT	(2) lnMT	(3) lnLT	(4) lnRB	(5) lnPP
lnRGDP	0.119*	0.158**	0.117*	0.129**	0.230**
	(0.061)	(0.063)	(0.064)	(0.050)	(0.112)
$lnRER_{BRI/RMB}$	-0.089***	0.068**	0.096	0.036	0.039
	(0.033)	(0.027)	(0.057)	(0.043)	(0.101)
$lnVol_{RMB}$	-4.01***	-1.645***	-1.116***	0.372	-0.310
	(0.375)	(0.264)	(0.339)	(0.337)	(0.457)
$lnVol_{USD}$	-0.579**	-0.179	-0.738***	-0.348*	0.290
	(0.271)	(0.178)	(0.229)	(0.207)	(0.306)
DBRI	1.327***	0.828***	0.480***	0.438***	0.489***
	(0.119)	(0.070)	(0.090)	(0.096)	(0.102)
Dcrisis	1.155***	0.489***	0.312***	-0.005	0.056
	(0.093)	(0.0556)	(0.075)	(0.063)	(0.092)
Constant	-7.673***	6.870***	8.073***	16.390***	12.400***
	(2.320)	(1.690)	(1.998)	(1.779)	(3.514)
N	935	935	935	935	935

Notes: Standard errors are in parentheses and the symbols *, ** and *** denote significance levels at 10%, 5% and 1%, respectively. lnRGDP refers to real GDP with base year=2005 in logarithm form, lnRER is the bilateral real exchange rate between China and BRI countries in logarithm form to represent the relative price, Vol_{RMB} is the volatility of the real effective exchange rate of RMB, and Vol_{USD} is the volatility of the real effective exchange rate of the US dollar. The dummy variable DBRI denotes the period after the launch of the Belt and Road Initiative in 2013, and the dummy variable Crisis denotes the years of 2008, 2009, 2020, 2021, and 2022 which were influenced by the 2008 financial crisis and Covid-19.

Table 4 Basic model-estimations for subcategories classified by technology

	(1) lnHT1	(2) lnHT2	(3) lnMT1	(4) lnMT2	(5) lnMT3	(6) lnLT1	(7) lnLT2	(8) lnRB1	(9) lnRB2
lnRGDP	0.137**	0.021	0.091	0.204***	0.100*	0.020	0.143**	0.112*	0.161***
	(0.063)	(0.055)	(0.067)	(0.070)	(0.059)	(0.098)	(0.060)	(0.066)	(0.057)
$lnRER_{BRI/RMB}$	-0.055	-0.055	0.025	0.114***	0.022	0.113	0.098*	0.081	0.020
	(0.035)	(0.067)	(0.063)	(0.035)	(0.028)	(0.074)	(0.055)	(0.054)	(0.047)
$lnVol_{RMB}$	-4.373***	-2.822***	-1.638***	-0.904***	-3.019***	-3.089***	-0.756**	0.169	0.381
	(0.458)	(0.482)	(0.301)	(0.305)	(0.234)	(0.308)	(0.373)	(0.283)	(0.372)
$lnVol_{USD}$	-0.391	-0.981***	-0.668*	-0.737***	1.204***	-0.444**	-0.813***	-0.479***	-0.176
	(0.313)	(0.319)	(0.343)	(0.254)	(0.193)	(0.203)	(0.238)	(0.161)	(0.229)
DBRI	1.545***	0.510***	0.787***	0.655***	1.227***	0.475***	0.484***	0.574***	0.401***
	(0.138)	(0.098)	(0.112)	(0.089)	(0.064)	(0.114)	(0.093)	(0.094)	(0.113)
Dcrisis	1.206***	1.029***	1.132***	0.395***	0.565***	0.516***	0.319***	0.205***	-0.120
	(0.099)	(0.068)	(0.083)	(0.076)	(0.058)	(0.070)	(0.084)	(0.046)	(0.078)
Constant	-9.259***	-3.877*	3.150*	6.228***	6.516***	0.615	8.539***	13.69***	16.19***
	(2.623)	(2.281)	(1.803)	(2.064)	(1.745)	(2.571)	(2.087)	(1.879)	(1.976)
N	935	935	935	935	935	935	935	935	935

Notes: Standard errors in parentheses and the symbols *, ** and *** denote significance levels at 10%, 5% and 1%, respectively.

Table 3 shows that the estimated coefficients for the importer's income are significantly positive and inelastic across all categories. This indicates that as the importer's income increases, the demand for these technological products rises, but at a less than proportional rate. This inelasticity suggests that these products are essential or have few substitutes, meaning that importers will continue to purchase them despite changes in their income. This pattern shows how important and necessary these technology products are to the importer's economy. Regarding the bilateral exchange rate effect, only HT and MT are significant. HT is negative and MT is positive, with small coefficients of -0.0892 and 0.0684, respectively. This means that the appreciation of the RMB has little impact on China's exports to BRI countries. The appreciation of the RMB in this context suggests that while currency fluctuations can affect trade, the specific characteristics of HT and MT products, such as their demand elasticity and market competitiveness, mitigate this impact to a great extent.

For the real effective exchange rate volatility of RMB, it is significantly negative and elastic for HT, MT, and LT, but non-significant for RB and PP. For the significant categories, as the level of technology decreases, the impact becomes smaller. The coefficients are -4.006, -1.645 and -1.116, respectively. This finding is consistent with Hooy et al. (2016). Because high-tech goods are worth more per unit, their hedging costs are also higher (Smirnov et al., 2021). Therefore, as the level of technology increases, the risk level brought by exchange rate volatility also increases. This suggests that businesses involved in exporting high-tech products are more sensitive to currency volatility and may engage in more substantial hedging activities to mitigate risks.

The effect of REER volatility on HT, LT, and RB is significantly negative, consistent with Kelejian et al. (2012), who found that the third country currency has a "crowding-out effect" on bilateral trade within the trade bloc. Their coefficients are inelastic: -0.578, -0.738, and -0.348 for HT, LT, and RB, respectively. The coefficients are much smaller than those of the volatility of RMB, indicating that the impact of RMB's REER volatility is much stronger than that of USD. The dummy variable Dcrisis has significant positive effects on HT, MT, and LT, with coefficients of 1.155, 0.489, and 0.312, respectively. Thus, the positive impact increases as the technological level of the product rises, especially for HT, where the coefficient reaches 1.155 elastically. This suggests that during economic crises, there is an increasing demand for high-tech, medium-tech, and low-tech products, possibly due to increased government and private sector investments in technology to drive recovery and growth. The non-significant negative effect on RB products may indicate that raw materials and primary products are less influenced by crisis conditions compared to more technologically advanced goods. Overall, China's export to BRI countries benefited from the crisis, likely due to adaptive strategies and resilient supply chains that helped maintain export levels even during economic downturns (Gereffi et al., 2022).

Table presents the subcategories' coefficients. The coefficients for income are all positive and inelastic. All categories are significant except for HT1, MT1, and LT1. The most elastic category is chemical and basic metals (MT2), followed by non-agricultural-based (RB2), other low-tech manufacturers (LT2), and electronic and electrical products (HT1). The price effect is significantly positive for MT2 at 1% and LT2 at 10%, and all of the coefficients are inelastic. The REER volatility of RMB has significant negative effects on the export of all tech-level products except for RB1 and RB2. Among them, HT1, HT2, MT1, MT3, and LT1 are significant at the 1% confidence level and elastic, ranked from highest to lowest in elasticity: HT1, LT1,

MT3, HT2, and MT1. MT2 is significant at 1% and LT2 at 5%, both inelastic, with coefficients of -0.904 and -0.756, respectively. Except for MT3, the REER volatility of USD has a negative impact, with inelastic coefficients, and only HT1 and RB2 are non-significant. The impact on engineering products (MT3) is significantly positive at the 1% confidence level and elastic, with a coefficient of 1.204. This suggests that China has diversified the market for engineering products (MT3) through the BRI, reducing dependence on a single currency area (the USD) and dispersing risks (Goldberg and Kolstad, 1995). The dummy variable DBRI has significant positive effects across all nine subcategories, especially elastic for HT1 and MT3, with coefficients of 1.545 and 1.227, respectively. This finding indicates that electronic and electrical (HT1) and engineering products (MT3) have benefited most from the Belt and Road Initiative (BRI). The dummy variable Dcrisis has significant positive effects on all subcategories, except for RB2, which has a non-significant negative impact. The coefficients for HT1, HT2, and MT1 are elastic, at 1.206, 1.209, and 1.132, respectively. This result demonstrates that regional economic cooperation has intensified during financial crises (Drezner, 2014) and that the BRI has promoted economic ties and cooperation mechanisms between China and countries along the route, making bilateral trade more convenient and efficient (Jin, 2017).

Exchange Rate Volatility, Exports, and Belt and Road Initiative - With Interaction Items

To evaluate the extent to which the Belt and Road Initiative (BRI) affects the impact of Real Effective Exchange Rate (REER) volatility on China's exports to BRI countries, we use the interaction terms DBRI_lnVol_RMB and DBRI_lnVol_USD. As shown in Table 5 RMB's REER volatility negatively and significantly affects the exports of high-technology (HT) and medium-technology (MT) products. However, the interaction terms between RMB's REER volatility and DBRI have a significant positive effect on the exports of HT and MT products, although these positive effects are weaker than the negative ones. These results indicate that the BRI can reduce the negative impact of RMB's REER volatility on China's exports to BRI countries in HT and MT sectors. In other words, the BRI effectively mitigates the exchange rate volatility of the RMB, thereby promoting China's exports of HT and MT products. In contrast, when analyzing the effects of the REER volatility of USD, the single terms generally show non-significant impacts, except for a significant negative effect on low-technology (LT) products. Additionally, all interaction terms between USD's REER volatility and DBRI are non-significant, providing no evidence that the BRI can reduce the impact of USD volatility.

Table 5 Estimations by technology with interaction items

	(1) lnHT	(2) lnMT	(3) lnLT	(4) lnRB	(5) lnPP
lnRGDP	0.104	0.149***	0.114***	0.130***	0.227***
	(0.064)	(0.035)	(0.043)	(0.039)	(0.046)
$lnRER_{\_BRI/RMB}$	-0.085	0.065*	0.093**	0.036	0.037
	(0.066)	(0.036)	(0.044)	(0.040)	(0.048)
$lnVol_{\_RMB}$	-9.177***	-2.683***	-0.821	0.717	-0.642
	(1.587)	(0.867)	(1.057)	(0.961)	(1.149)
$lnVol_{\_USD}$	0.827	-0.516	-1.184**	-0.448	0.099
	(0.796)	(0.435)	(0.530)	(0.482)	(0.576)
DBRI	30.800***	15.000***	3.668	-1.440	6.122
	(5.557)	(3.033)	(3.700)	(3.364)	(4.021)
Dcrisis	1.265***	0.550***	0.329***	-0.012	0.081
	(0.093)	(0.051)	(0.062)	(0.056)	(0.067)
$DBRI\_lnVol_{\_RMB}$	7.913***	2.436**	0.048	-0.519	0.891
	(1.818)	(0.992)	(1.210)	(1.100)	(1.316)
$DBRI\_lnVol_{\_USD}$	-1.334	0.749	0.676	0.100	0.376
	(0.896)	(0.489)	(0.597)	(0.542)	(0.648)
Constant	-24.240***	0.980	7.506**	17.470***	10.180***
	(4.705)	(2.568)	(3.132)	(2.848)	(3.405)
N	935	935	935	935	935

Notes: Standard errors are in parentheses and the symbols *, ** and *** denote significance levels at 10%, 5% and 1%, respectively. $DBRI\_lnVol_{\_RMB}$ and $DBRI\_lnVol_{\_USD}$ are the interaction terms of the dummy variable DBRI with $lnVol_{\_RMB}$ and $lnVol_{\_USD}$.

Table 6 presents the details of the nine subcategories. The interaction term between the BRI and RMB's exchange rate volatility in the regression equations for HT1, HT2, MT1, MT2, and MT3 shows significantly positive and elastic coefficients, with HT1 and MT1 having the largest coefficients of 9.598 and 8.327, respectively. It is worth noting that for medium-technology category 2 (MT2) products, the coefficient of 2.211 completely offsets the negative impact of the fluctuations in the real effective exchange rate of the RMB

(-1.758), indicating a threshold effect, that is, the "Belt and Road Initiative" can completely alleviate the adverse effects of exchange rate volatility. The interaction term between the "Belt and Road Initiative" and the US dollar exchange rate volatility shows a significant negative effect on high-technology category 1 (HT1) and medium-technology category 1 (MT1) products but is not significant for other products. Specifically, the coefficients for automobiles (MT1) and electronic and electrical products (HT1) are -4.296 and -2.110, respectively. This indicates that the Belt and Road Initiative has exacerbated the adverse impact of US dollar fluctuations on the exports of China's MT1 and HT1 products to Belt and Road countries, suggesting that the influence of the US dollar in the trade of these two types of products remains strong. However, for HT1 and MT1, the coefficient of the interaction term between the "Belt and Road Initiative" and the fluctuation of the RMB exchange rate is significantly greater than the absolute value of the coefficient of the interaction term between the "Belt and Road Initiative" and the fluctuation of the US dollar exchange rate.

Table 6 Estimations for subcategories by technology with interaction items

	(1) lnHT1	(2) lnHT2	(3) lnMT1	(4) lnMT2	(5) lnMT3	(6) lnLT1	(7) lnLT2	(8) lnRB1	(9) lnRB2
lnRGDP	0.120*	0.012	0.087	0.194***	0.092**	0.019	0.140***	0.112***	0.162***
	(0.071)	(0.068)	(0.068)	(0.041)	(0.041)	(0.074)	(0.043)	(0.036)	(0.046)
$lnRER_{\_BRIRMB}$	-0.048	-0.053	0.042	0.110***	0.021	0.116	0.095**	0.079**	0.021
	(0.074)	(0.071)	(0.071)	(0.042)	(0.043)	(0.077)	(0.045)	(0.037)	(0.048)
$lnVol_{\_RMB}$	-10.880***	-5.760***	-8.461***	-1.758*	-4.600***	-4.101**	-0.325	0.988	0.470
	(1.765)	(1.693)	(1.692)	(1.012)	(1.019)	(1.841)	(1.064)	(0.888)	(1.147)
$lnVol_{\_USD}$	1.642*	-0.178	2.733***	-1.165**	1.348***	0.0875	-1.335**	-0.928**	-0.049
	(0.885)	(0.849)	(0.848)	(0.507)	(0.511)	(0.923)	(0.534)	(0.445)	(0.575)
DBRI	35.130***	17.190***	19.070***	14.330***	14.050***	2.823	3.413	-1.086	-2.129
	(6.180)	(5.926)	(5.922)	(3.542)	(3.566)	(6.443)	(3.724)	(3.108)	(4.016)
Dcrisis	1.327***	1.091***	1.180***	0.455***	0.617***	0.521***	0.335***	0.202***	-0.132**
	(0.103)	(0.099)	(0.099)	(0.059)	(0.060)	(0.107)	(0.062)	(0.052)	(0.067)
$DBRI\_lnVol_{\_RMB}$	9.598***	4.489**	8.327***	2.211*	2.810**	1.198	-0.107	-0.945	-0.344
	(2.022)	(1.939)	(1.937)	(1.159)	(1.167)	(2.108)	(1.218)	(1.017)	(1.314)
$DBRI\_lnVol_{\_USD}$	-2.110**	-0.765	-4.296***	0.864	0.0612	-0.682	0.775	0.582	-0.226
	(0.996)	(0.956)	(0.955)	(0.571)	(0.575)	(1.039)	(0.600)	(0.501)	(0.647)
Constant	-29.020***	-13.270***	-12.310**	0.756	0.267	-1.565	8.248***	15.380***	17.110***
	(5.232)	(5.017)	(5.013)	(2.998)	(3.019)	(5.455)	(3.153)	(2.631)	(3.400)
N	935	935	935	935	935	935	935	935	935

Notes: Standard errors are in parentheses and the symbols *, ** and *** denote significance levels at 10%, 5% and 1%, respectively.

These results indicate that the "Belt and Road Initiative" can reduce exchange rate fluctuations, thereby promoting China's exports, especially in high-tech and medium-tech products and their subcategories. By alleviating exchange rate fluctuations and related risks, the "Belt and Road Initiative" not only boosts China's export growth but also strengthens economic ties with member countries, promoting the formation of a more resilient and integrated regional economic system. Policymakers should consider these differential impacts when designing strategies to mitigate exchange rate risks and promote sustainable trade growth under major economic initiatives like the BRI.

ROBUSTNESS TEST

To validate results, we conducted three additional empirical tests, including variables such as income, relative price, exchange rate volatility, and dummy variables representing the launch of BRI both on paper and in practice, focusing on regressions with interaction terms. The dummy variable DCrisis proxies the crisis years of 2008, 2009, 2020, 2021, and 2022, which were influenced by the 2008 financial crisis and Covid-19. Overall, the main results remain robust. The BRI mitigates the adverse effect of RMB volatility on China’s exports to BRI countries across high-technology (HT), medium-technology (MT), and their subcategories. Additionally, the BRI promotes RMB internationalization and reduces reliance on the USD, which can enhance China's economic stability and strengthen its trade relationships with BRI countries.

First, the currency competitiveness of importing countries affects China's export structure. To understand the effects of the BRI after economic development and improved currency purchasing power in BRI countries, we use the REER of the importers as the relative price, following the models of Sukar and Hassan (2001). Regression results reveal that the REER of BRI countries significantly positively affects medium-term (MT) and long-term (LT) exports, particularly for subcategories MT2, MT3, LT1, and LT2. The

BRI has significantly strengthened its impact on promoting China's exports to BRI countries and mitigating the negative effects of RMB volatility. For MT, especially MT2, the absolute value of the interaction term coefficient exceeds that of the RMB volatility coefficient, indicating that the BRI completely offsets the risks posed by RMB volatility (Table 7 and Table 8).

Table 7 Estimations using REER_BRI countries as relative price_major categories

	(1) lnHT	(2) lnMT	(3) lnLT	(4) lnRB	(5) lnPP
lnRGDP	0.102	0.157***	0.123***	0.131***	0.238***
	(0.064)	(0.035)	(0.043)	(0.039)	(0.046)
$lnREER_{\_BRI}$	-0.036	0.141***	0.154***	0.016	0.206***
	(0.080)	(0.043)	(0.053)	(0.048)	(0.057)
$lnVol_{\_RMB}$	-9.249***	-2.628***	-0.742	0.747	-0.609
	(1.588)	(0.862)	(1.05)	(0.961)	(1.140)
$lnVol_{\_USD}$	0.859	-0.498	-1.176**	-0.461	0.155
	(0.797)	(0.433)	(0.529)	(0.482)	(0.572)
DBRI	31.080***	14.320***	2.896	-1.562	5.227
	(5.570)	(3.025)	(3.697)	(3.370)	(3.999)
Dcrisis	1.270***	0.536***	0.313***	-0.015	0.062
	(0.093)	(0.051)	(0.062)	(0.056)	(0.067)
$DBRI\_lnVol_{\_RMB}$	8.015***	2.335**	-0.0872	-0.562	0.807
	(1.818)	(0.987)	(1.207)	(1.100)	(1.305)
$DBRI\_lnVol_{\_USD}$	-1.373	0.704	0.644	0.116	0.269
	(0.897)	(0.487)	(0.595)	(0.543)	(0.644)
Constant	-24.320***	0.635	7.185**	17.500***	9.534***
	(4.715)	(2.560)	(3.129)	(2.853)	(3.385)
N	935	935	935	935	935

Notes: Standard errors are in parentheses and the symbols *, ** and *** denote significance levels at 10%, 5% and 1%, respectively.

Table 8 Estimations using REER_BRI countries as relative price subcategories

	(1) lnHT1	(2) lnHT2	(3) lnMT1	(4) lnMT2	(5) lnMT3	(6) lnLT1	(7) lnLT2	(8) lnRB1	(9) lnRB2
$lnRGDP_{\_BRI}$	0.120*	0.007	0.089	0.204***	0.098**	0.035	0.148***	0.116***	0.164***
	(0.072)	(0.069)	(0.069)	(0.041)	(0.041)	(0.074)	(0.043)	(0.036)	(0.047)
$lnREER_{\_BRI}$	0.007	-0.072	0.038	0.170***	0.104**	0.284***	0.129**	0.058	0.019
	(0.089)	(0.085)	(0.085)	(0.051)	(0.051)	(0.092)	(0.053)	(0.045)	(0.058)
$lnVol_{\_RMB}$	-10.920***	-5.804***	-8.425***	-1.665*	-4.582***	-4.001**	-0.244	1.055	0.488
	(1.765)	(1.692)	(1.691)	(1.008)	(1.016)	(1.832)	(1.062)	(0.889)	(1.146)
$lnVol_{\_USD}$	1.669*	-0.177	2.724***	-1.160**	1.375***	0.130	-1.337**	-0.948**	-0.052
	(0.885)	(0.849)	(0.848)	(0.506)	(0.510)	(0.919)	(0.533)	(0.446)	(0.575)
DBRI	35.180***	17.570***	18.860***	13.460***	13.590***	1.485	2.738	-1.446	-2.239
	(6.191)	(5.935)	(5.931)	(3.538)	(3.563)	(6.427)	(3.727)	(3.118)	(4.022)
Dcrisis	1.328***	1.099***	1.175***	0.437***	0.607***	0.493***	0.321***	0.195***	-0.134**
	(0.103)	(0.099)	(0.099)	(0.059)	(0.060)	(0.107)	(0.062)	(0.052)	(0.067)
$DBRI\_lnVol_{\_RMB}$	9.650***	4.562**	8.272***	2.053*	2.765**	1.009	-0.239	-1.044	-0.371
	(2.021)	(1.937)	(1.936)	(1.155)	(1.163)	(2.098)	(1.216)	(1.018)	(1.313)
$DBRI\_lnVol_{\_USD}$	-2.150**	-0.757	-4.290***	0.834	0.009	-0.781	0.760	0.602	-0.223
	(0.997)	(0.956)	(0.955)	(0.570)	(0.574)	(1.035)	(0.600)	(0.502)	(0.648)
Constant	-29.160***	-13.140***	-12.340**	0.419	-0.052	-2.291	8.018**	15.360***	17.090***
	(5.240)	(5.023)	(5.020)	(2.994)	(3.016)	(5.439)	(3.154)	(2.639)	(3.404)
N	935	935	935	935	935	935	935	935	935

Notes: Standard errors are in parentheses and the symbols *, ** and *** denote significance levels at 10%, 5% and 1%, respectively.

Second, we use the real bilateral exchange rate as the relative price and the dummy variable DFIP instead of DBRI. DBRI represents cooperation on paper, while DFIP, which stands for the First Important Project (FIP), reflects actual cooperation. The regression results are consistent with those using DBRI. For HT, MT, and their subcategories, the coefficients of the interaction item DFIP and RMB volatility are elastic and significantly positive. For MT, MT1, and MT2, the coefficients exceed the absolute value of the RMB volatility coefficient. For MT, MT1, and MT2 products, the BRI can completely offset the negative impact of RMB fluctuations, showing the BRI's success in stabilizing exports of these products (Table 9**Error! Reference source not found.** and Table 10).

Table 9 Robust testing using DFIP instead of DBRI_major categories

	(1) lnHT	(2) lnMT	(3) lnLT	(4) lnRB	(5) lnPP
lnRGDP	0.080	0.137***	0.103**	0.118***	0.218***
	(0.070)	(0.036)	(0.044)	(0.040)	(0.047)
$lnRER_{BRI/RMB}$	0.001	0.115***	0.130***	0.067	0.067
	(0.071)	(0.037)	(0.045)	(0.041)	(0.048)
$lnVol_{RMB}$	-8.326***	-3.662***	-1.848**	0.212	-0.846
	(1.311)	(0.689)	(0.838)	(0.760)	(0.893)
$lnVol_{USD}$	-0.727	-0.324	-1.225***	-0.863***	-0.090
	(0.564)	(0.296)	(0.360)	(0.327)	(0.384)
DFIP	25.940***	14.830***	6.446*	1.296	6.112
	(5.710)	(3.001)	(3.648)	(3.311)	(3.890)
Dcrisis	1.283***	0.496***	0.365***	0.0238	0.0564
	(0.103)	(0.054)	(0.066)	(0.060)	(0.070)
$DFIP\_lnVol_{RMB}$	7.335***	4.266***	1.019	0.0587	1.319
	(1.678)	(0.882)	(1.072)	(0.973)	(1.143)
$DFIP\_lnVol_{USD}$	-1.785**	-1.137**	0.359	0.167	-0.049
	(0.888)	(0.467)	(0.567)	(0.515)	(0.605)
Constant	-26.57***	-2.212	3.066	13.72***	8.671***
	(4.445)	(2.336)	(2.840)	(2.578)	(3.028)
N	935	935	935	935	935

Notes: Standard errors are in parentheses and the symbols *, ** and *** denote significance levels at 10%, 5% and 1%, respectively. $DFIP\_lnVol_{RMB}$ and $DFIP\_lnVol_{USD}$ are the interaction term.

Table 10 Robust testing using DFIP instead of DBRI_ sub-categories

	(1) lnHT1	(2) lnHT2	(3) lnMT1	(4) lnMT2	(5) lnMT3	(6) lnLT1	(7) lnLT2	(8) lnRB1	(9) lnRB2
lnRGDP	0.091	0.007	0.070	0.185***	0.072	0.002	0.130***	0.098***	0.150***
	(0.077)	(0.069)	(0.071)	(0.041)	(0.044)	(0.075)	(0.044)	(0.037)	(0.047)
$lnRER_{BRI/RMB}$	0.052	-0.020	0.092	0.149***	0.096**	0.159**	0.131***	0.118***	0.052
	(0.080)	(0.071)	(0.073)	(0.042)	(0.045)	(0.077)	(0.046)	(0.039)	(0.049)
$lnVol_{RMB}$	-9.373***	-5.321***	-5.754***	-2.674***	-5.155***	-5.792***	-1.198	0.098	-0.051
	(1.473)	(1.310)	(1.346)	(0.785)	(0.835)	(1.433)	(0.842)	(0.713)	(0.902)
$lnVol_{USD}$	-0.596	-0.568	0.010	-0.840**	0.795**	-0.301	-1.380***	-1.182***	-0.598
	(0.634)	(0.563)	(0.579)	(0.338)	(0.359)	(0.616)	(0.362)	(0.307)	(0.388)
DFIP	29.460***	11.220**	11.690**	15.260***	12.860***	11.230*	5.115	3.059	1.234
	(6.415)	(5.704)	(5.860)	(3.418)	(3.638)	(6.241)	(3.668)	(3.104)	(3.928)
Dcrisis	1.364***	1.078***	1.281***	0.394***	0.573***	0.665***	0.358***	0.219***	-0.065
	(0.116)	(0.103)	(0.106)	(0.062)	(0.066)	(0.112)	(0.066)	(0.056)	(0.071)
$DFIP\_lnVol_{RMB}$	8.332***	4.296**	5.851***	3.940***	4.428***	3.396*	0.622	0.219	0.182
	(1.885)	(1.676)	(1.721)	(1.004)	(1.069)	(1.833)	(1.077)	(0.912)	(1.154)
$DFIP\_lnVol_{USD}$	-2.030**	-1.910**	-3.398***	-0.679	-1.825***	-0.937	0.456	0.372	0.046
	(0.997)	(0.887)	(0.911)	(0.531)	(0.565)	(0.970)	(0.570)	(0.482)	(0.611)
Constant	-31.270***	-12.850***	-11.670**	-1.653	-4.056	-10.340**	4.456	10.670***	12.710***
	(4.994)	(4.440)	(4.562)	(2.661)	(2.832)	(4.859)	(2.855)	(2.416)	(3.058)
N	935	935	935	935	935	935	935	935	935

Notes: Standard errors are in parentheses and the symbols *, ** and *** denote significance levels at 10%, 5% and 1%, respectively.

Third, using the REER of BRI countries as the relative price and the dummy variable DFIP, the regression results are consistent with those using RER and DBRI. HT, MT, and their subcategories, the coefficients of the interaction item DFIP, and RMB volatility are elastic and significantly positive. For MT, MT1, and MT2, the coefficients exceed the absolute value of the RMB volatility coefficient. For MT, MT1, and MT2 products, the BRI can completely offset the negative impact of RMB fluctuations, showing the BRI's success in stabilizing exports of these products (Table 11 and Table 12).

Table 11 Estimations using REER_BRI countries as relative price and DFIP - major categories

	(1) lnHT	(2) lnMT	(3) lnLT	(4) lnRB	(5) lnPP
lnRGDP	0.087	0.150***	0.116***	0.123***	0.233***
	(0.069)	(0.036)	(0.044)	(0.040)	(0.047)
$lnREER_{BRI}$	0.123	0.214***	0.225***	0.076	0.249***
	(0.084)	(0.044)	(0.054)	(0.049)	(0.057)
$lnVol_{RMB}$	-8.228***	-3.485***	-1.660**	0.276	-0.643
	(1.311)	(0.685)	(0.834)	(0.761)	(0.886)
$lnVol_{USD}$	-0.709	-0.325	-1.228***	-0.871***	-0.073
	(0.563)	(0.294)	(0.358)	(0.327)	(0.380)
DFIP	25.190***	13.520***	5.068	0.829	4.588
	(5.727)	(2.990)	(3.643)	(3.325)	(3.867)
Dcrisis	1.273***	0.476***	0.343***	0.016	0.034
	(0.103)	(0.054)	(0.066)	(0.060)	(0.070)
$DFIP\_lnVol_{RMB}$	7.189***	3.964***	0.697	-0.061	0.996
	(1.678)	(0.876)	(1.068)	(0.974)	(1.133)
$DFIP\_lnVol_{USD}$	-1.801**	-1.119**	0.382	0.184	-0.055
	(0.886)	(0.463)	(0.564)	(0.515)	(0.598)
Constant	-26.710***	-2.443	2.824	13.640***	8.396***
	(4.441)	(2.318)	(2.825)	(2.579)	(2.999)
N	935	935	935	935	935

Notes: Standard errors are in parentheses and the symbols *, ** and *** denote significance levels at 10%, 5% and 1%, respectively. $DFIP\_lnVol_{RMB}$ and $DFIP\_lnVol_{USD}$ are the interaction terms of the dummy variable DFIP with $lnVol_{RMB}$ and $lnVol_{USD}$.

Table 12 Estimations using REER_BRI countries as relative price and DFIP_subcategories

	(1) lnHT1	(2) lnHT2	(3) lnMT1	(4) lnMT2	(5) lnMT3	(6) lnLT1	(7) lnLT2	(8) lnRB1	(9) lnRB2
lnRGDP	0.103	0.006	0.078	0.199***	0.085*	0.024	0.142***	0.106***	0.155***
	(0.077)	(0.069)	(0.071)	(0.041)	(0.044)	(0.075)	(0.044)	(0.038)	(0.048)
$lnREER_{BRI}$	0.192**	-0.014	0.137	0.221***	0.216***	0.365***	0.201***	0.127***	0.083
	(0.094)	(0.084)	(0.086)	(0.050)	(0.053)	(0.091)	(0.054)	(0.046)	(0.058)
$lnVol_{RMB}$	-9.216***	-5.333***	-5.639***	-2.489***	-4.976***	-5.492***	-1.031	0.206	0.0179
	(1.472)	(1.312)	(1.347)	(0.783)	(0.831)	(1.425)	(0.841)	(0.714)	(0.903)
$lnVol_{USD}$	-0.583	-0.564	0.004	-0.849**	0.800**	-0.292	-1.387***	-1.196***	-0.600
	(0.632)	(0.563)	(0.578)	(0.336)	(0.357)	(0.612)	(0.361)	(0.307)	(0.388)
DFIP	28.280***	11.300**	10.850*	13.910***	11.530***	8.996	3.888	2.286	0.727
	(6.427)	(5.728)	(5.881)	(3.418)	(3.628)	(6.225)	(3.671)	(3.119)	(3.942)
Dcrisis	1.347***	1.080***	1.268***	0.373***	0.553***	0.631***	0.339***	0.206***	-0.073
	(0.116)	(0.103)	(0.106)	(0.062)	(0.065)	(0.112)	(0.066)	(0.056)	(0.071)
$DFIP\_lnVol_{RMB}$	8.082***	4.321**	5.650***	3.615***	4.131***	2.896	0.328	0.019	0.061
	(1.884)	(1.678)	(1.723)	(1.002)	(1.063)	(1.824)	(1.076)	(0.914)	(1.155)
$DFIP\_lnVol_{USD}$	-2.035**	-1.917**	-3.379***	-0.648	-1.815***	-0.922	0.483	0.404	0.056
	(0.995)	(0.886)	(0.910)	(0.529)	(0.561)	(0.963)	(0.568)	(0.483)	(0.610)
Constant	-31.480***	-12.830***	-11.810***	-1.889	-4.292	-10.740**	4.241	10.540***	12.620***
	(4.984)	(4.442)	(4.560)	(2.651)	(2.813)	(4.827)	(2.847)	(2.419)	(3.057)
N	935	935	935	935	935	935	935	935	935

Notes: Standard errors are in parentheses and the symbols *, ** and *** denote significance levels at 10%, 5% and 1%, respectively.

CONCLUDING REMARKS

In this paper, we empirically investigate whether the "One Belt One Road" Initiative (BRI) reduces the impact of exchange rate volatility on China's disaggregated exports by technology level to BRI co-construction countries (BRI countries). Utilizing Standard International Trade Classification's (SITC) 5-digit UN COMTRADE data from 2006 to 2022, we employed panel regression models to test the impacts of the BRI both on paper and in practice.

This study yields four key findings with significant policy implications. First, volatilities in both the RMB and USD Real Effective Exchange Rates (REER) negatively affect China's exports to BRI countries, though the smaller impact of USD volatility indicates that the BRI has advanced RMB internationalization and reduced dollar dependence. Second, mechanisms under the Belt and Road Initiative, such as financial cooperation, local currency settlement, and trade facilitation, help mitigate the adverse effects of RMB exchange rate volatility but at the same time amplify the negative impact of US dollar volatility. This phenomenon reflects both the stabilizing role of the Belt and Road Initiative and the potential risks it poses to China's high-tech exports, particularly increased vulnerability to fluctuations in the US dollar and challenges maintaining competitiveness in global markets. Third, policies and infrastructure connectivity related to the Belt and Road Initiative have significantly promoted China's exports to member countries, particularly by

enhancing trade routes and reducing transportation costs, thereby facilitating quicker, more efficient delivery of goods. Finally, China has taken advantage of global shocks, including the 2008 financial crisis and the COVID-19 pandemic, to deepen trade integration and consolidate its export position in the Belt and Road network.

These research findings are of great significance and have clear policy-making relevance. The results show that deeper integration within the Belt and Road Initiative can partially buffer external shocks and enhance trade stability, highlighting the initiative's role in promoting currency and economic resilience. Against the backdrop of escalating geopolitical tensions, such as the Ukraine war and the Red Sea crisis, the Belt and Road Initiative serves as a platform for cooperation, bridging developed and developing economies. By clarifying how the Belt and Road Initiative can mitigate exchange rate volatility and promote the internationalization of the RMB, this study offers actionable insights for policymakers: advancing local currency settlement, financial cooperation, and trade facilitation can further enhance regional stability and growth. For enterprises and investors, the research findings reveal potential opportunities in Belt and Road-related industries most likely to benefit from these stabilizing effects.

Future research should further explore the intrinsic mechanisms through which the Belt and Road Initiative and similar initiatives influence trade patterns, currency dynamics, and economic stability. Specifically, attention should be paid to the impact of exchange rate fluctuations on exports at different technological levels to optimize trade and industrial policies. These insights will help policymakers maximize the economic development and stability effects of the Belt and Road Initiative and other regional cooperation frameworks.

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