

# *Impact of Exchange Rate Fluctuations on the Quality of Products Exported by Enterprises*

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**Abstract:** This paper uses the data matched between China's 2000-2006 industrial enterprise database and the customs product side of the transaction database to study the impact of RMB exchange rate fluctuations on the quality of enterprise export products. This paper finds that: the RMB exchange rate and enterprise product quality are positively correlated with each other, and the effect is significant, the appreciation of RMB helps to upgrade the quality of export products; at the same time, it analyses that in the face of different enterprise productivity, the impact of exchange rate fluctuations on product quality is heterogeneous, the greater the enterprise productivity, the greater the motivation of enterprises to improve product quality in the case of RMB appreciation; when analysing the impact mechanism, it verifies that the impact of exchange rate fluctuations on product quality is through the export of high quality, low quality and high quality products by enterprises. In the analysis of the influence mechanism, it is verified that the influence of exchange rate fluctuation on product quality is through the enterprises' choice of high-quality and low-quality products when exporting.

## 1. Introduction

More than 20 years after joining the World Trade Organization (WTO), China's export growth rate has been stable at a high level for a long time, and the scale of exported goods has been expanding, but the long-term sloppy development of export trade has been deeply criticised, and it has been in the stage of sloppy growth of big but not strong, and made-in-China rather than created-in-China for a long time. At present, the comprehensive deepening of reform requires the continuous optimisation and upgrading of industrial structure, seeking higher quality, higher level of development, quality and efficiency for economic development, so the transformation and upgrading of foreign exports is also urgent. Theoretically, the appreciation of a country's exchange rate will cause export enterprises to lose their original price advantage, which will adversely affect the export trade in the short term. Wang Yaqi and Yu Miaojie (2021) [9] found that exchange rate changes will significantly affect the share of processing trade exports: the appreciation of the RMB exchange rate will cause a decline in the share of China's processing trade exports. Zhang HuiQing and Tang Hai-Yan (2012) [15] found that the appreciation of the RMB has a significant negative impact on the export of enterprises, both in terms of the margin of aggregation and the margin of expansion, and at the same time, it is not conducive to the optimisation, upgrading and adjustment

of the structure of the export trade in the overall level.

The current literature focuses more on the impact of exchange rate changes on the export trade volume of enterprises, mainly on the analysis of the overall trade volume, but not in-depth to the level of enterprise export product quality. With the deepening of reform, the international situation changes, the quality of export enterprise products are increasingly concerned, China's economic transformation needs to accelerate the development of high-level exports, and in this way to promote the transformation and upgrading of the economic structure, as the world's factory at the same time, to the development of the two ends of the value chain. From the perspective of real data, since joining the WTO, the RMB exchange rate has been appreciating. Some domestic literature measurements show that the quality of China's export products is gradually showing a trend that is nearly in line with the RMB. Xu Jiayun, Tong Jiadong and Mao Qilian (2015) [10] show that RMB appreciation will force enterprises to improve the quality of their export products, but due to the differences in the productivity level, financing constraints, ownership and trade patterns of enterprises, it will give rise to significant heterogeneous effects. Yuan Zhigang, Shao Ting (2011) [11] show that the appreciation of RMB will hurt the efficiency of labour-intensive industries and competitive industries with less R&D investment, while benefiting capital-intensive and monopolistic industries with more R&D investment. In summary, the impact of exchange rate fluctuations on different industries is differentiated, and the impact of RMB appreciation on product quality is through multiple channels. As a result, the differential role of RMB appreciation on export product quality deserves more in-depth study.

## 2. Literature Review

The literature on the study of this paper is divided into two main aspects: on the one hand, it is the research on the relevant influencing factors on the quality of Chinese enterprises' export products; in addition, it is the research on how exchange rate fluctuations affect the quality of enterprises' export products. For the first aspect of the existing literature, Shi Bingzhan, Shao Wenbo (2014) [5] found that production, research and development efficiency, advertising efficiency, government subsidies, financing constraints alleviation, market competition and other factors will enhance the quality of the product; Zhang Jie (2015) [16] believes that the relationship between the financing constraints and the quality of the enterprise's export products shows an inverted U-shaped effect, and the effect is significant. The results of Yin Desheng (2011) [14] found that the decline of unit trade cost, the increase of export scale and the expansion of the economic scale of trade partner countries will accelerate the improvement of China's export product quality. Bas et al. (2015) [20] found that China's promotion of intermediate product trade liberalisation is conducive to the enterprises to import more high-quality intermediary products, and improve the quality of export products with high-quality inputs. The study by Fan Haichao, Huang Wenjing, and Wu Caiyun (2022) [1] also concluded that reducing tariffs on imported intermediate products has a positive impact on the quality of export products. Zhu Shujin, Li Jiang, Zhang Qian, and Zhong Tenglong (2022) [19] incorporate environmental information disclosure into their model and find that rising environmental disclosure also increases firms' environmental costs, which in turn pushes firms to improve the quality of their export products. Li, Ruiqin, and Wen, Jun (2021) [3] find that both upstream and downstream industrial agglomeration have a positive effect on the quality of export products from the perspective of upstream industry linkages. However, the overall positive effect of upstream is higher than that of downstream.

In the second category of literature, Zhang Mingzhi, Ji Kejia (2018) [17] found that the impact of RMB exchange rate fluctuations on the quality of "firm-destination" export products can be realised by encouraging firms to adjust product quality differentiation. Wang Yaqi, Tan Xiaofen, Zhang

Jinhui, Lu Bing (2018)[7] found that RMB appreciation can improve the quality of general trade products, but has a negative impact on the quality of processing trade products. At the same time, low-quality products are more likely to exit the market than high-quality products, which improves the quality of all remaining products in the market. Yaqi Wang, Miaojie Yu (2020) [8] It is estimated that if the exchange rate of RMB appreciates relatively, the import cost of exporters decreases, but exporters will choose to produce better quality products, thus increasing the price of exported products and offsetting part of the import cost of the affected exchange rate. Zhang Xia, Wang Yannan, Shi Bingzhan (2020) [18] concluded that the fixed exchange rate system reduces the threshold of enterprises to participate in exports and has a negative effect on the quality of export products. Mao Risheng, Chen Yaowen (2021) [4] showed that the optimal allocation of products in the industry (new product entry, backward product exit) will also be similarly affected by the exchange rate appreciation, thus promoting the export quality improvement, the degree of impact is positively correlated with the imported intermediate goods inputs, the higher the price of intermediate product imports, the greater the impact of export product quality upgrading by exchange rate changes.

In summary, the existing research literature mainly explores the factors and mechanisms influencing the quality of export products at both the micro and macro levels. Studies on exchange rate and export product quality all agree that RMB exchange rate appreciation is conducive to product quality, but there may be slightly different channels of influence, either through imported intermediates, or through the entry and exit of firms and products, or there are also channels such as the overall improvement of all exported products that have an effect on quality. This paper explores in depth the specific impact of RMB appreciation on product quality on the basis of previous work.

### 3. Research Design

#### 3.1 Data Description and Formulae for Measuring Key Indicators

In this paper, we use China's 2000-2006 industrial enterprise database and the Customs Product Transaction Database<sup>1</sup>, which are obtained after matching, and mainly include wages, firm size, GDP per capita in export destinations, the real exchange rate, as well as Total Factor Productivity (TFP) and product quality at the destination level of the firms [6].

The real exchange rate between China and the export destination country  $d$  in year  $t$  is expressed as:  $RER_{dt} = \frac{NER_{dt}CPI_{china,t}}{CPI_{d,t}}$ , with  $NER_{dt}$  is the nominal exchange rate expressed in the indirect markup method (between China and export destination  $d$  in year  $t$ ),  $CPI_{china,t}$  is the consumer price index of China in year  $t$ , and  $CPI_{d,t}$  is the consumer price index of export destination  $d$  in year  $t$ .

Based on the data and measurement method of Zhang Mingzhi, Ji Kejia (2018)[2], the measurement of product quality at the firm-product-destination level is adopted as in equation (1):

$$\ln(X_{fhd,t}) + \delta \ln(P_{fhd,t}) = \alpha_h + \alpha_{dt} + \varepsilon_{fhd,t} \quad (1)$$

The subscript  $f$  represents the firm,  $h$  is the product in the HS six-digit code,  $d$  denotes the export destination, and  $t$  denotes the year.  $\delta$  denotes the elasticity of demand for the product  $\ln(P_{fhd,t})$  denotes the logarithm of the price of product  $h$  exported by firm  $f$  to destination  $d$  in year  $t$ , and  $\ln(X_{fhd,t})$  denotes the logarithm of the quantity of product  $h$  exported by firm  $f$  to destination  $d$  in year  $t$ .  $\alpha_h$  Denote product-level fixed effects,  $\alpha_{dt}$  denote year-destination fixed effects, with OLS estimation of equation (1) to obtain the residuals  $\varepsilon_{fhd,t}$  to find the quality of exported products:

<sup>1</sup> This paper uses the HS six-digit code for product categorisation, and since HS1996 codes were used before 2002 and HS2002 codes were used after 2002, this paper converts the post-2002 codes to S1996 codes for consistency, following the conversion table available on the United Nation website.

$$q_{fhd t} = \varepsilon_{fhd t} / (\delta - 1) \quad (2)$$

The product quality of the product  $h$  exported by firm  $f$  to destination  $d$  in year  $t$  is  $q_{fhd t}$ . Standardise it with the formula:  $q_{fhd t} = (q_{fhd t} - q_{hmin}) / (q_{hmax} - q_{hmin})$ , where  $q_{hmin}$  denotes the minimum export product quality in product  $h$ , and  $q_{hmax}$  denotes the largest export product quality in product  $h$ . Finally, the proportion of the product's export value in the destination country in that year to the total export value of the enterprise in the destination country is used as a weighting indicator to weight and obtain the product quality index of the enterprise's exports to the destination country  $q_{fd t}$ .

### 3.2 Econometric Modelling

Based on the existing empirical analysis literature and related theoretical studies, this paper sets the regression model as shown in equation (3):

$$\text{Quality}_{fd t} = \beta_1 \ln RER_{dt} + \beta_2 X_{fd t} + \alpha_{fd} + \alpha_t + \varepsilon_{fd t} \quad (3)$$

where the variable subscript  $f$  represents the firm,  $d$  is the export destination, and  $t$  denotes the year of export;  $X_{fd t}$  denotes time-varying control variables at the firm-destination level in year  $t$ , including productivity ( $tfp$ ), wages ( $wage$ ), firm size ( $size$ ), and real GDP per capita at the export destination ( $perrgdp$ ). Also controlling for firm-destination fixed effects ( $\alpha_{fd}$ ) and year fixed effects ( $\alpha_t$ ), with  $\varepsilon_{fd t}$  are random perturbation terms.

## 4. Regression Analysis

### 4.1 Baseline Regression Results

According to the model setting of equation (3), regression analysis of the impact of RMB exchange rate changes on the quality of export products is carried out, and the regression results are shown in Table 1 below, with the first five columns following the step-by-step regression method, which are the estimation results of adding control variables sequentially.

In column 1, the real exchange rate coefficient is positive at the significant level of 1%, indicating that the appreciation of RMB (indirect markup method,  $\ln RER$  increase indicates appreciation) leads to the improvement of the quality of export products. The productivity control variables are added to the second column, and the results show that at the significance level of 1%, the real exchange rate coefficient is still significantly positive, and the productivity coefficient is significantly positive. The results show that the productivity coefficient of enterprises with high productivity level is also significantly positive, indicating that the export products produced by enterprises with high productivity level are of higher quality. In the third column, the enterprise scale is further added, and the result is still significantly positive, indicating that the larger the enterprise scale, the better the production capacity and the higher the quality of export products. In column 4, wages are added, and the coefficient is significantly positive, indicating that the higher the average wages paid by enterprises, the higher the quality of their export products. The reason for this may be that firms pay high level of wages to hire high quality employees who can improve the quality of their products, and at the same time, firms with high quality of export products tend to invest more in R&D, which requires more high quality personnel and pulls up the average wage; Column 5 adds the per capita GDP of the export destination, and the coefficient is significant and positive at 1% level of significance, which suggests that high-income countries prefer higher quality of products. 6 Columns Considering productivity, the effect of heterogeneity in the results of regression analysis shows that the coefficient of the interaction between productivity and exchange

rate is positive at the 5 per cent significance level, indicating that the higher the productivity, and the appreciation of the RMB exchange rate (upward) promotes the higher and more pronounced product quality of the firms' exports [12-13].

Table1: Results of regression analyses of the impact of exchange rate changes on the quality of firms' export products

	(1)	(2)	(3)	(4)	(5)	(6)
	Quality_kh					
lnRER	0.0097*** (0.0028)	0.0098*** (0.0028)	0.0102*** (0.0028)	0.0101*** (0.0028)	0.0145*** (0.0032)	0.0132*** (0.0045)
lnfp		0.0024*** (0.0002)	0.0026*** (0.0002)	0.0026*** (0.0002)	0.0026*** (0.0002)	0.0021*** (0.0003)
lnsize			0.0020*** (0.0002)	0.0019*** (0.0002)	0.0020*** (0.0002)	0.0020*** (0.0003)
lnwage				0.0008*** (0.0003)	0.0008*** (0.0003)	0.0008** (0.0004)
lnperrgdp					0.0081*** (0.0013)	0.0083*** (0.0018)
c.lnRER*c.lnfp						0.0005** (0.0002)
time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Firm-destination fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
sample size	1266963	1266942	1266942	1266163	1226130	1650679
adjustedR <sup>2</sup>	.3718	.3719	.372	.3721	.3642	.4203

Standard errors in parentheses: \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

## 4.2 Robustness Tests

Table2: Robustness test

	Continuous exporters	Destination of enterprises with continuous exports	Industry level
lnRER	0.0139*** (0.0038)	0.0180*** (0.0060)	0.0625*** (0.0223)
lnfp	0.0027*** (0.0003)	0.0029*** (0.0004)	0.0040*** (0.0012)
lnsize	0.0020*** (0.0003)	0.0023*** (0.0004)	0.0046*** (0.0014)
lnwage	0.0014*** (0.0004)	0.0016*** (0.0005)	0.0050*** (0.0016)
lnperrgdp	0.0086*** (0.0015)	0.0065** (0.0026)	0.1562*** (0.0155)
time fixed effect	Yes	Yes	Yes
Firm-destination fixed effects	Yes	Yes	Yes
sample size	628911	222316	99547
adjustedR <sup>2</sup>	.3688	.3595	.4307

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

The number of exporters in the sample varies from year to year, and some firms export intermittently or only in a given year, so the quality of their exports is contingent and the export decision is not necessarily determined by the exchange rate. For continuous exporters, there may be multiple export destinations, but some destinations are exported continuously and some exports last

only one year or are intermittent. This phenomenon suggests that exporters can only engage in tentative market exploration and make decisions about the relationship between the exchange rate and product quality, and the data sample is not representative in these cases. To avoid the above mentioned problems, the sample data are eliminated and the data are reprocessed in column 1 of Table 2 by deleting the sample of firms that have not exported for seven consecutive years, while only the sample of firms-destinations that have exported for seven consecutive years is retained in column 2. To further test the robustness of the results, the product-level quality measure is adjusted to an industry-level quality measure and regressed on this, and the regression results remain significantly positive. The regression results in Table 2 show no reversal in the direction of the sign of the core explanatory variables and the significance of the coefficients compared to the results in the benchmark regression in Table 1, which suggests that the regression results are more robust.

In this paper, the explanatory variable is the product quality at the level of "enterprise-destination", and the core explanatory variable is the real exchange rate of RMB shown by the indirect markup method, the former is the data at the micro level of enterprises, and the latter is the data at the macro level, which does not have the problem of causality and endogeneity, but there may be measurement errors and some control variables may be omitted from the calculation of the indicators. Some variables may be missed from measurement errors and control variables. In order to further demonstrate the robustness of the benchmark regression results; this paper uses different methods of measuring product quality to obtain new product quality data for regression.

Table3: Robustness test

	(1)	(2)	(3)
	AC	MZ	KH
lnRER	0.0617*** (0.0177)	0.0748*** (0.0213)	0.0145*** (0.0032)
Intfp	0.0178*** (0.0012)	0.0225*** (0.0016)	0.0026*** (0.0002)
lnsize	0.0190*** (0.0013)	0.0205*** (0.0018)	0.0020*** (0.0002)
lnwage	0.0047*** (0.0016)	0.0061*** (0.0022)	0.0008*** (0.0003)
lnperrgdp	0.0485*** (0.0071)	0.0301*** (0.0101)	0.0081*** (0.0013)
time fixed effect	Yes	Yes	Yes
Firm-year fixed effects	Yes	Yes	Yes
sample size	1222891	1200936	1226130
adjustedR <sup>2</sup>	.2204	.222	.3642

Standard errors in parentheses: \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

In this paper, in addition to drawing on the measure of Khandelwal et al. (2013) (KH) adopted by Zhang, M.C., Ji, K.J. (2018), two other measures are also used: one is the measure of Auer and Chaney (2009) (AC):  $Qua_{abpt} = (pri_{abpt} - avp_{bpt})/sd_{bpt}$ ; and two, the method of Manova and Zhang (2012) (MZ):  $Qua_{abpt} = \log(pri_{abpt}/avg_{bpt})$ ,  $Qua_{abpt}$  denotes the quality of product p exported by firm a to destination b in year t.  $pri_{abpt}$  denote the price of product p exported by firm a to destination b in year t.  $avp_{bpt}$  denote the average price of all products p exported to destination b in year t.  $sd_{bpt}$  denotes the standard deviation of the price of product p for all exports to destination b in year t.

The regression results of the robustness test are shown in Table 3. Column 1 is the regression with the help of the AC measure, which shows that the real exchange rate coefficient is significantly positive at the 1% significance level; column 2 shows the regression results with the help of the MZ

measure, whose sign and significance remain robust; and column 3 shows the results of the benchmark regression. The regression results in table 3 are generally consistent with the benchmark regression results, which further strongly suggests that the benchmark regression results are robust.

## 5. Expanded Research

There are numerous studies on the impact of exchange rate fluctuations on product quality, and this paper finds that RMB appreciation has a significant positive impact on the overall product quality of enterprises exporting to the destination country, which helps to promote the rise of export product quality, but the increase in product quality may be the result of the common quality improvement of all products under the effect of exchange rate, or it may be that the exchange rate fluctuations have forced the export of high-quality products to account for the share of the total export Mao Risheng and Chen Yaowen (2021)[4] show that exchange rate appreciation affects the optimal allocation of products in the industry, leading to the net entry of new products and the exit of backward production capacity, which promotes export quality improvement. In this paper, in order to verify the influence mechanism that export product quality improvement is due to the entry of high-quality products and the exit of low-quality products, we try to analyse the different effects of exchange rate changes on the heterogeneity of export product quality.

Table 4: Study of the impact of exchange rate changes on quality through product entry and exit

	go into		abort	
	high quality	low mass	high quality	low mass
lnRER	0.2501**	-0.3431***	0.0454	0.6295***
	(0.1117)	(0.1164)	(0.1257)	(0.1941)
lnltp	0.0549***	0.0426***	-0.1401***	-0.0235**
	(0.0075)	(0.0063)	(0.0082)	(0.0096)
lnsize	0.0096**	0.0159***	-0.1185***	-0.0154***
	(0.0040)	(0.0035)	(0.0047)	(0.0054)
lnwage	-0.0261**	-0.0273***	0.0261**	0.0260*
	(0.0102)	(0.0100)	(0.0121)	(0.0141)
lnperrgdp	0.0351	0.2568***	-0.2737***	0.1692
	(0.0590)	(0.0648)	(0.0702)	(0.1251)
N	192431	133069	127389	53078
adjustedR <sup>2</sup>	.05023	.04598	.08134	.2519

Standard errors in parentheses: \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

In order to analyse the adjustment of export enterprises to different quality products in the face of exchange rate fluctuations, the article carries out empirical analyses of the entry of high-quality products and the exit of low-quality products respectively. The classification criteria for high and low quality products in this paper refer to the following method: the average value of product quality is calculated at the HS six-digit product level, and products greater than or equal to it are judged to be of high quality, while those lower than the average are considered to be of low quality. In addition, for the definition of product entry and exit, drawing on Tang and Zhang (2012)[21], the previous period is not exported, while the current period is exported as product entry; the previous period is exported, and the current period is not exported as product exit. Also, controlling for product, purpose, and year levels are fixed effects.

As can be seen from Table 4, RMB appreciation has a significant positive effect on the entry of high-quality products, but also inhibits the entry of low-quality products. In terms of export product exports, RMB appreciation has a significant promotion effect on the export of low-quality products. And it is not significant for the exit of high-quality products. The results in Table 4 confirm the impact of exchange rate fluctuations on the selection effect caused by firms when exporting, the

appreciation of the RMB enhances the incentive for firms to export high-quality products, making firms focus more on high-quality products, and as the proportion of higher-quality products exported by firms to a certain destination rises, it ultimately brings about an increase in the quality of the overall products exported by the firms to that destination.

## 6. Conclusions

This paper focuses on the relationship between exchange rate fluctuations and enterprise export product quality on the basis of correlation analysis of factors affecting export product quality. Through the correlation study, it is found that RMB appreciation has a promoting effect on export product quality, which is in line with the theoretical analysis of the relationship between the two in the existing literature. The results remain significant after controlling for firm productivity, size, average wage, and GDP per capita in export destinations. With the help of the interaction term between productivity and exchange rate it is found that firms with high productivity are more likely to enhance their motivation to improve product quality in the face of exchange rate appreciation by optimising the production process, improving the efficiency of production resource use, and increasing production efficiency. In the extended analysis, considering the different impacts of exchange rate fluctuations on quality differentiated products, further empirical analysis finds that in the face of people's appreciation, enterprises will improve the overall quality level of products in export destinations by increasing the entry of high-quality products into the export market and at the same time guiding the exit of poor-quality products from the market as soon as possible, i.e., the enterprises make proactive adjustments to the quality heterogeneous products in order to cope with the exchange rate fluctuations on the enterprises' the impact brought by exchange rate fluctuations.

Based on the above analyses, we have gained the following insights: the impact of the appreciation of the renminbi on the exports of enterprises should be seen in a qualitatively positive light while focusing on the quantitatively negative impact. According to the trade theory, the depreciation of a country's currency is favourable to a country's exports and promotes the development of export trade, and for some time China has implemented the managed floating exchange rate system, the rapid expansion of the scale of export trade, which promotes the development of China's trade. However, at present, in the context of the double cycle, the expansion of the scale of foreign exports is no longer our main direction of development, and the quality and efficiency of foreign exports is increasingly placed in an important position. Therefore, according to the findings of this paper, considering the results of productivity heterogeneity, it is revealed that in the face of exchange rate shocks, different types of enterprises will make differentiated decisions, and this part of the impact should be taken into account when formulating policies. Although the appreciation of the RMB reduces the price advantage of enterprises' export products, which adversely affects the overall export scale, it is also important to see that the appreciation of the product quality of the enterprise brings the role of the pushback, through more high-quality products exported, the exit of low-quality products to achieve the improvement of the overall export product quality level. In short, the appreciation of the renminbi will effectively drive the quality of export products, promote the development of export trade mode of transformation and upgrading, to achieve China's exports from a large exporting country to the transformation of export power.

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