

Research on the Effect of Product Quality Upgrading on Enterprise Export Behavior ——Based on the Perspective of Enterprise Heterogeneity

Jingshui Sun^{1, *} Pingping Hu²

¹*School of Economics, Zhejiang Gongshang University, Hangzhou 310018, China*

²*School of Economics, Zhejiang Gongshang University, Hangzhou 310018, China*

* *Corresponding author. Email: hzsunjingshui@163.com*

ABSTRACT

Based on the theory of enterprise heterogeneity trade, this article designs the evaluation index of product quality upgrading, constructs theoretical model of product quality heterogeneity, and reveals the influence mechanism of product quality upgrading on the export behavior of enterprises. Using the microdata of China's industrial enterprise database and customs database from 2000 to 2013, we conduct an empirical study on the relationship between product quality upgrading and enterprise export behavior. The results show that: (1) Product quality upgrading has a significant positive impact on export status of enterprises. Among them, the better the enterprise performance, the stronger the innovation ability, the larger the enterprise size, and the higher the proportion of foreign capital, the greater the export probability. (2) Product quality upgrading has a significant positive impact on export scale of enterprises. Among them, the higher the enterprise productivity, the higher the capital intensity, the lower the labor cost, and the greater the industry competition, the larger the export scale. (3) The low-level product quality upgrading has a significant negative impact on export scale, while medium-level and high-level product quality upgrading have a significant positive impact on export scale. The above results provide important policy implications.

Keywords: *Product quality upgrading, enterprise heterogeneity, export behavior*

1. INTRODUCTION

Since the reform and opening up, China's trade has made world-renowned achievements, and the growth rate of export share has been particularly alarming. Since joining the WTO in 2001, China's trade has reached leapfrog development, and China has become the world's largest exporter in 2011. But in fact, the rapid development of China's export mainly depends on the growth of export volume. The fundamental reason is the competitive advantage brought by the low-cost production factors (such as labor, land and resources), but ignoring the product quality upgrading. As China's trade advantages encounter more restrictions, people gradually realize that there is a fundamental difference between high-speed growth and high-quality growth in economic. In recent years, China has been emphasizing the building of "quality power", promoting the transformation of economic development from high-speed growth to high-quality growth. So, has China's export products quality been upgraded? Which factors are driving export expansion? What is the impact of product quality upgrading on

export? Many scholars have discussed the above issues from different perspectives, but most of them only focused on national or industry level, and rarely analyzed the impact of product quality upgrading on enterprise export behavior based on the microdata. Therefore, this article explores the impact of product quality upgrading on export behavior from theoretical analysis and empirical study based on the theory of enterprise heterogeneity trade, which is of great theoretical and practical significance to understand the relationship between product quality upgrading and export behavior, the government's formulation of trade policy and China's promotion of optimizing industrial structure to expand export.

1.1. Literature Review

With the gradual development of the enterprise heterogeneity trade theory represented by Melitz (2003) [1], scholars found that product quality is also an important source of enterprise heterogeneity, they tried to introduce product quality into the enterprise

heterogeneous theoretical model. As a result, the research on the impact of product quality upgrading on enterprise export behavior gets more and more attentions. Liu Weili (2018) [2] proposed that product quality upgrading is a sudden change process, while product quality improvement is a gradual change. At present, scholars mainly measure the product quality upgrading by whether or not the enterprise has obtained international quality certification. If an enterprise gets international quality certification, it means the product quality has been upgraded and vice versa. The existing literatures have different views on the impact of product quality upgrading on export. Some scholars believe that there is a positive correlation, while some scholars believe that the correlation is small or negative.

Swann et al. (1996) [3] used the number of national standards and international standards to represent product quality upgrading based on the sample data of the UK from 1985 to 1991, and found that international standards would promote export to a lesser extent, while national standards obviously promote export. Blind (2001) [4] proposed that the increase of international and national standards is positively correlated with import and export in Swiss. Grajek (2004) [5] introduced the "gravity model" to analyze panel data of 101 countries from 1995 to 2001, and believed that the spread of a country's standards would promote export. Moenius (2004) [6] found that national standards are beneficial to trade exchanges between countries, every 1% increase in standards, trade volume will increase by 0.27%. Verhoogen (2008) [7] came to a conclusion that product quality upgrading is closely related to enterprise export behavior. Crozet et al. (2012) [8] constructed an empirical study on export data of wine industry in French, pointed out product quality upgrading will promote export participation. Domestic scholars Song Mingshun and Xiong Minghua (2001) [9] counted the number of Chinese enterprises that obtained ISO9000 from 1994 to 1999, and found that product quality upgrading can promote export. Sun Ying and Zhang Xukun (2011) [10] constructed an empirical analysis of the cross-sectional data of 36 economies in 2008, they found that the increase of ISO9000 standard certification is beneficial to export. Zhu Weiping (2012) [11] studied the relationship between ISO9000 certification and trade, the outcome is ISO9000 standard certification can be beneficial to the trade development. Based on the relevant data of 2012 surveyed by the World Bank, Zheng Yanyan et al. (2015) [12] concluded that international quality standard certification has a significant impact on export. However, some scholars have different conclusions. Simmons and White (1999) [13] took 126 enterprises in the electronics industry in the United States and Canada as the object, they found that there is no obvious difference between enterprises with ISO certification and without ISO certification in terms of export. Moenius (2006) [14] researched the

impact of the implementation of standards on export in EU countries and non-EU countries, and believed EU national standards would promote export in EU countries, but would have a negative impact on non-EU countries.

In addition, there are many other enterprise heterogeneities that can affect enterprise export behavior. Tomiura (2007) [15] constructed an empirical study based on the microdata of manufacturing industries in Japan, the results revealed the productivity of exporting enterprises is higher than that of non-exporting enterprises. Helpman (2008) [16] found export status mainly depends on the critical point obtained by comparing the productivity of the domestic enterprise with that of the destination enterprise. Bernard and Jensen (2004) [17] empirically researched the influencing factors of US export based on the US manufacturing panel data from 1987 to 1992, pointed out that the prosperous export is not only affected by enterprise productivity, but also enterprise size. Grossman and Helpman (1991) [18] put forward that there are many factors affecting national trade growth, and believed that technological innovation determines the international competitiveness of enterprise products. Based on Spanish enterprise data from 1990 to 1997, Salomon and Shaver (2005) found that technological innovation can promote enterprise export. Domestic scholars Meng Xia and Cheng Lei (2011) [19] concluded that the financing capacity of enterprises can be affected by financial development, which in turn would help enterprise export. Wu Qiang et al. (2013) [20] analyzed export issues from a cost perspective, and confirmed that the reduction of trade costs has a significant impact on enterprise export.

In summary, domestic and foreign scholars have made lots of discussions on the relationship between product quality upgrading and enterprise export behavior, and have obtained valuable conclusions, but there are still some unresolved problems. Firstly, the meaning of product quality upgrading is still unclear, and a unified evaluation index has not been constructed. How to understand the meaning of product quality upgrading correctly? How to design more abundant and in line with China's actual conditions evaluation indicators? They need to be further explored. Secondly, the existing literatures about the impact of product quality upgrading on export behavior which are mainly on the national or industry level, and there are fewer empirical tests on enterprise level. This is the direction that this article needs to explore further. Thirdly, enterprise heterogeneity has a significant impact on export behavior, which has been confirmed by many scholars. However, when establishing the econometric model, which enterprise heterogeneous variables can be selected to explain the actual situation in China better, this is the subject that this article needs to explore further.

1.2. Our Contributions

Compared with existing researches, the main contributions of this article are as follows: Firstly, on the basis of existing literatures, a theoretical model about product quality upgrading and enterprise export behavior is constructed, which revealing the influence mechanism of product quality upgrading on the export behavior, and put forward relevant research hypotheses. Secondly, this article defines the connotation of product quality upgrading, designs evaluation indicators for product quality upgrading, and classifies product quality upgrading according to quality standard levels. Thirdly, after controlling the indicators of enterprises within the system (state-owned enterprises, enterprises directly under the central government), this article empirically explores the specific impact of product quality upgrading on export behavior (export status, export scale), and analyzes the impact of product quality upgrading at different levels on export behavior. And this article introduces heterogeneous characteristic variables into models, such as: total factor productivity, capital intensity, enterprise size, enterprise performance, and innovation capabilities, which are relatively rare in the existing relevant literature.

2. THEORETICAL MODEL

Based on the model framework of Hallk et al. (2009) [21], this article explores the influence mechanism of enterprise heterogeneity variables, such as product quality, enterprise productivity. In the monopolistic competition market, each enterprise facing the demand of CES only produces one product, and the demand quantity of product j is:

$$q_j = p_j^{-\sigma} \lambda_j^{\sigma-1} \frac{E}{P}, \sigma > 1 \tag{1}$$

Among them, p_j represents the price of product j , λ_j represents the quality of product j , q_j represents the quantity of product j , σ represents the elasticity of substitution between products, E is the expenditure level, and P is the price index. The above formula shows that the quality and price of the product determine its demand. The marginal cost function and fixed cost function of the firm are:

$$MC(\lambda, \varphi) = \frac{c}{\varphi} \lambda^\beta, 0 \leq \beta < 1 \tag{2}$$

$$FC(\lambda, \varepsilon) = F_0 + \frac{f}{\varepsilon} \lambda^\alpha, \alpha > (1-\beta)(\sigma-1) \tag{3}$$

Among them, f and c are constants, α and β are the quality elasticities of fixed cost and marginal cost, φ is

productivity heterogeneity, and ε is quality production capacity. The above two formulas indicate that the higher the product quality, the higher the fixed costs and marginal costs.

Using information such as output, price, marginal cost, and fixed cost, we get the equation of enterprise profit:

$$\pi(\lambda, \varphi) = q_j \cdot p_j - q_j \cdot MC - FC \tag{4}$$

Under the requirement of maximizing enterprise profits, we obtain the first derivative of price:

$$p_d(\varphi) = \left(\frac{\sigma}{\sigma-1}\right) \frac{c}{\varphi} \lambda^\beta \tag{5}$$

Since export behavior requires a certain iceberg cost $\tau(\lambda)$, that is the cost caused by factors such as transportation cost, return freight information mismatch and so on. The foreign pricing is:

$$p_x(\varphi) = \left(\frac{\sigma}{\sigma-1}\right) \frac{\tau c}{\varphi} \lambda^\beta \tag{6}$$

Based on the above information, we can calculate the function of foreign profit of an enterprise:

$$\begin{aligned} \Pi_x(\varphi, \lambda) &= p_x(\varphi, \lambda) \cdot q_x(\varphi, \lambda) - f_x \\ &= K(\tau\varphi)^{\sigma-1} \lambda_x^{(1-\beta)(\sigma-1)} - f_x \end{aligned} \tag{7}$$

Among them, $K = [(\frac{c\sigma}{\sigma-1})]^{1-\sigma} \frac{E^*}{P^*}$, Ex is export status of the enterprise (export $Ex = 1$, no export $Ex = 0$), $P(Ex = 1)$ represents the probability of enterprise export, and suppose μ is lower bound of the profit that enterprise export can bear, and the following formula can be obtained:

$$P(Ex = 1) = P(\Pi_x(\varphi, \lambda) > \mu) = \Phi(\Pi_x(\varphi, \lambda)) \tag{8}$$

Since $\sigma > 0, 0 \leq \beta < 1$, the partial derivative of product quality can be obtained:

$$\frac{\partial P(Ex = 1)}{\partial \lambda_x} = K(\tau\varphi)^{\sigma-1} (1-\beta)(\sigma-1) \lambda_x^{(1-\beta)(\sigma-1)-1} > 0 \tag{9}$$

According to formula (9), the following research hypothesis is obtained:

Hypothesis 1: The product quality upgrading of enterprise has a significant positive impact on export status. The higher the product quality upgrading, the greater the probability of enterprise export.

Based on profit maximization, the optimal export quantity of enterprise can be expressed as:

$$q_x = [(\frac{\sigma}{\sigma-1}) \frac{\tau c}{\varphi} \lambda_x^\beta]^{-\sigma} \lambda_x^{\sigma-1} \frac{E^*}{P^*} \tag{10}$$

The export scale of an enterprise can be expressed as:

$$Export = q_x \cdot p_x = K\varphi^{\sigma-1} \lambda_x^{(1-\beta)(\sigma-1)} \tag{11}$$

Among them, *Export* represents the export scale of enterprises, $K = [(\frac{\tau c \sigma}{\sigma - 1})]^{1-\sigma} \frac{E^*}{P^*}$, it can be seen that the export scale of enterprise will be affected by product quality and productivity, the partial derivative of the product quality is obtained:

$$\frac{\partial Export}{\partial \lambda_x} = K \varphi^{\sigma-1} (1-\beta)(\sigma-1) \lambda_x^{(1-\beta)(\sigma-1)-1} > 0 \quad (12)$$

According to formula (12), the following research hypothesis is obtained:

Hypothesis 2: The product quality upgrading of enterprise has a significant positive impact on export scale. The higher the product quality upgrading, the larger the export scale of the enterprise.

As a rational actor, an enterprise always chooses export behavior based on profit maximization, and always obtains the maximum profit at the optimal export quantity q_x^* . The profit function of an enterprise can be expanded to:

$$\pi_x(X_x^I, X_x^E) = p_x(X_x^I, X_x^E) \cdot q_x^* - MC \cdot q_x^* - FC \quad (13)$$

Among them, q_x^* represents optimal foreign sales volume of enterprise products, X_x^I represents the internal heterogeneity characteristics and other variables are consistent with the previous article. In addition to the product quality and productivity mentioned in the previous article, there are also enterprise size, enterprise performance, innovation capabilities, financing costs, proportion of foreign capital, labor costs, etc. X_x^E represents external factors.

Generally speaking, enterprise productivity, enterprise size, enterprise performance, innovation capabilities, which are conducive to enterprises export; lower labor costs will increase enterprise profits and expand enterprise export. To this end, the following research hypothesis is proposed:

Hypothesis 3: Enterprise heterogeneity characteristic variables have significant impact on export scale. The greater the enterprise productivity, the higher the enterprise performance, the stronger the innovation ability, and the lower the labor cost, the larger the export scale.

Based on the above research and model analysis, the following econometric model is constructed in this article:

$$P(Ex = 1) = \beta_0 + \beta_1 qu + \sum \gamma_i firmheter_i + \sum \gamma_j Control_j + \varepsilon \quad (14)$$

$$\ln export = \beta_0 + \beta_1 qu + \sum \gamma_i firmheter_i + \sum \gamma_j Control_j + \varepsilon$$

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In the formula, *Ex* is export status, *export* is export scale; *qu* is product quality upgrading; *firmheter* is a collection of enterprise heterogeneity variable (including enterprise productivity, capital intensity, innovation capability, enterprise performance, enterprise size etc.); *Control* is a collection of control variables (including state-owned enterprises, enterprises directly under the central government); ε is a random error term.

3. RESERCH DESIGN

Enterprise heterogeneity is proposed relative to the assumption of enterprise homogeneity. It refers to the significant differences of enterprises factor intensity, factor productivity, innovation ability, enterprise performance, enterprise age, enterprise size, ownership, etc. The product quality upgrading in this article means that within a certain time and space, the product quality of enterprise meets or exceeds a certain standard (such as national or international product quality certification), or obtains recognized quality reputations or honors (such as a national or international well-known trademarks, famous brand products, quality awards), it is called product quality upgrading, otherwise the product quality is not upgraded. The export behavior involved in this article mainly refers to export status and export scale.

3.1. Variables Description

According to the above research hypothesis and measurement model, the explained variables in this article are export status (export or not) and export scale (export delivery value is logarithmic). The main explanatory variables are product quality upgrading, total factor productivity, capital intensity, enterprise performance (return on total assets, profitability), enterprise age, enterprise size, and enterprise innovation capabilities (R&D intensity). In addition, there are indicators such as the status of foreign capital, the proportion of foreign capital, export subsidies (subsidy status, subsidy intensity), and enterprise costs (financing costs, labor costs, debt ratio). The article selects state-owned enterprises and enterprises directly under the central government as control variables. The symbols and meanings of the variables in the model are shown in Table 1.

3.2. Data Source

The data in this article comes from the China industrial enterprise database and the customs

database from 2000 to 2013. This article refers to the method of Yu Miaojie (2013) [22] to process the Chinese industrial enterprise database: (1) Exclude samples with missing or obvious abnormalities in the variables involved in this article. (2) Exclude samples with key indicator variables less than 0, including export delivery value, industrial added value, payable wages, enterprise assets, sales income, subsidy income, etc. (3) Exclude samples with an average annual number of employees less than 8 people, total fixed assets less than 100,000, and total sales less than 5 million. (4) Exclude samples with a ratio of industrial added value to industrial sales value greater than 1, and samples with a ratio of export delivery value to enterprise sales revenue greater than 1. At the same time, this article refers to the method of Fan Haichao (2015) [23] to process the customs database: (1) Exclude samples that do not reflect the real product quality, including samples with keywords in the enterprise name such as import and export, foreign trade, economy and trade, and logistics. (2) Exclude samples with a single trade volume of less than \$50 and samples with a trade volume of less than 1. (3) Since the HS codes used around 2002 are inconsistent, in order to maintain consistency, follow the transcoding table provided by the United Nation website transcoding: convert the HS1996 codes in 2000 and 2001 to HS2002 codes. Finally, this article draws on the methods of Yu (2015) and Xu et al.

(2016) to match the both databases. The new database with sample size of 418213. Enterprise heterogeneity and export behavior characteristic variables are obtained from the new database. And product quality upgrading indicators are based on the corresponding search for quality honors, which comes from the “National Certification and Accreditation Information Public Service Platform”, “Well-known Trademark Network” and official websites of provincial governments, etc.

3.3. Empirical Analysis Results

Based on the matching data of the Chinese industrial enterprise database and the customs database, this article uses Stata15.0 to make Probit and fixed effects regression on models (14) and (15) respectively. Model 1 in Table 2 reflects the impact of product quality upgrading on export status, Model 3 in Table 3 reflects the impact of product quality upgrading on export scale, and Model 5 in Table 4 reflects the impacts of product quality upgrading at different levels on export scale. Of course, Table 2 to Table 4 also reflect the impact of enterprise heterogeneity characteristic variables on export behavior.

Table 1 Variable, symbol and meaning

Variable	Symbol	Meaning
Explained variable: Export status ^a	ex	Have export ex=1 or take 0
Export scale	export	Export delivery value
Explaining variables: 1. Product quality upgrading	qu	See note (1)
(1) High-level quality upgrading ^b	hqu	See note (2)
(2) Mid-level quality upgrading	mqu	See note (2)
(3) Low-level quality upgrading	lqu	See note (2)
2. Enterprise heterogeneity characteristic variables:	tfp	C-D production function
(1) Total factor productivity		
(2) Enterprise age	age	Business renewal time
(3) Capital intensity	cap	Net fixed assets/ employee numbers
(4) Enterprise performance: Return on total assets	roa	Total profit/Total assets
Profitability	pro	Ln (total profit +1)
(5) Enterprise size: Large-sized enterprise ^c	scale ₃	large-sized enterprise scale ₃ =1 or take 0
Medium-sized enterprise	scale ₂	Medium-sized enterprise scale ₂ =1 or take 0
Small-sized enterprise	scale ₁	Small-sized enterprise scale ₁ =1 or take 0
(6) Innovation capabilities: R&D intensity	RD	R&D expenditure/Sales income
(7) Enterprise costs: Financing costs	fc	Ln (interest expense +1)
Labor costs	ac	Total wages/Industrial added value
Debt ratio	dac	Total liabilities/Total assets
(8) Status of foreign capital ^d	for	foreign enterprises for=1 or take 0
Proportion of foreign capital	fi	Foreign capital/Enterprises capital

(9) Export subsidies: Subsidy status ^c	sub	Have subsidy sub=1 or take 0
Subsidy intensity	si	Subsidy/ total sales
(10) Industry characteristic variables: Industry competition	hhi	Herfindahl index
Technology product industry type: Low-tech product industry ^f	indus ₁	Low-tech product industry indus ₁ =1 or take 0
Medium-tech product industry	indus ₂	Medium-tech product industry indus ₂ =1 or take 0
High-tech product industry	indus ₃	High-tech product industry indus ₃ =1 or take 0
3. Control variable: State-owned enterprise ^g	sta	State-owned enterprise sta=1 or take 0
Enterprises directly under the central government ^h	cen	Enterprises directly under the central government cen=1 or take 0

Note: (1) obtained provincial well-known trademark (provincial famous brand product) qu=1, provincial government quality award qu=2; obtained china well-known trademark (Chinese famous brand product) qu=3, china world famous brand product qu=4, Chinese product quality certification qu=5, Chinese government quality award qu=6; obtained world famous brand (world famous brand product) qu=7, international product quality certification qu=8, world three quality award qu=9. (2) obtained provincial well-known trademark (provincial famous brand product) or provincial government quality award lqu takes 1, otherwise it takes 0; obtains Chinese well-known trademark (Chinese famous brand product, china world famous brand product) or Chinese product quality certification or Chinese government quality award mqu takes 1, otherwise it takes 0; to obtain the world famous trademark or international product quality certification or the world's three major quality awards hqu takes 1, otherwise it takes 0.

Referential standard: a non-export enterprise; b non-quality upgrading enterprise; c micro-enterprise; d domestic enterprise; e non-subsidies enterprise; f resource product industry; g non-state-owned enterprises; h local enterprise.

3.3.1. Product quality upgrading and export status

The regression results of Model 1 in Table 2 show that product quality upgrading has a significant positive impact on export status of enterprises. Product that achieve quality upgrading can improve consumer utility so that more foreign consumers are willing to buy it. Total factor productivity has a significant negative impact on export status, indicating that the higher the productivity, the smaller the export probability. This result is inconsistent with expectation, it may be a phenomenon of “productivity paradox”. The existence of a large number of processing trade enterprises in the Chinese market is the main reason for this phenomenon. In addition, capital intensity also has a significant negative impact on export status. The enterprise age has a significant impact on export status, and the change between the both is inverted U-shaped, indicating that the export probability will increase with the passage of time, but after a certain period of time, the enterprise age and export status will be opposite to change. Large, medium and small enterprises have a significant positive impact on export status, indicating that compared with micro enterprises, the export probabilities of large, medium and small enterprises are greater. It can also be seen from the regression coefficients in model 1 that the larger enterprise size, the greater the export probability. Enterprise performance has a significant positive impact on export status, the higher the enterprise

performance, the greater the export probability. In addition, the model 1 also shows that the export probability of state-owned enterprises and enterprises directly under the central government is lower than that of non-state-owned enterprises and local enterprises. Although enterprises within the system are supported by national policies, personnel mobilities are small, and they lack competitiveness. As a result, enterprises within the system do not have significant advantages in the export market.

The regression results of model 2-1 show that innovation capability has a significant positive impact on export status of enterprises, the higher the R&D intensity, the more the enterprise has the right to speak in the international market. The regression results of models 2-2 and 2-3 show that the status and the proportion of foreign capital have a significant positive impact on export status. Compared with domestic enterprises, foreign enterprises have advanced production technology and mature management experience, which are conducive to promoting the enterprise product quality upgrading and export expansion. The regression results of model 2-4 show that the regression coefficient of subsidy status is significantly positive at the 1% level, indicating that enterprises with subsidies are more likely to export. Model 2-5 illustrates the impact of subsidy intensity on export status, it shows that there is an inverted U-shaped relationship between subsidy intensity and export status, which may be due to the inefficiency caused by the unreasonable distribution of subsidies. The above conclusions support Hypothesis 1 and Hypothesis 3.

Table 2 Results about product quality upgrading and export status

Explaining	Model1	Model 2-1	Model 2-2	Model 2-3	Model 2-4	Model 2-5
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variables	(basic model)	(innovation capabilities)	(foreign capital status)	(foreign capital proportion)	(subsidy status)	(subsidy intensity)
qu	0.0044***	0.0051***	0.0058***	0.0049***	0.0030**	0.0042***
tfp	-0.0146***	-0.0145***	-0.0144***	-0.0153***	-0.0140***	-0.0145***
ln(cap)	-0.1005***	-0.1052***	-0.1019***	-0.1112***	-0.1036***	-0.1021***
age	0.0375***	0.0417***	0.0384***	0.0390***	0.0375***	0.0378***
age ²	-0.0008***	-0.0009***	-0.0007***	-0.0008***	-0.0008***	-0.0008***
scale ₁	0.0664***	0.0593***	0.0700***	0.0749***	0.0563***	0.0638***
scale ₂	0.2718***	0.2751***	0.2674***	0.2813***	0.2494***	0.2654***
scale ₃	0.4536***	0.4837***	0.4338***	0.4616***	0.4240***	0.4411***
pro	0.0176***	0.0123***	0.0171***	0.0121***	0.0126***	0.0171***
RD		2.6751***				
for			0.2769***			
fi				0.4450***		
sub					0.3515***	
si						60.7553***
si ²						-2,395.877***
sta	-0.1387***	-0.1393***	-0.0732***	-0.0675***	-0.1812***	-0.1520***
cen	-0.1331***	-0.0801	-0.1036**	-0.1291***	-0.1537***	-0.1377***
_cons	0.8091***	0.8196***	0.7308***	0.8028***	0.8046***	0.8020***
Pseudo R ²	0.0319	0.0347	0.0387	0.0383	0.0404	0.0350

Note: "**", "***", and "****" respectively signify that the regression coefficients are momentous at the level of 10%, 5% and 1%, the same as below.

3.3.2. Product quality upgrading and export scale

The regression results of Model 3 in Table 3 show that product quality upgrading has a significant positive impact on export scale of enterprise, indicating that the higher the product quality upgrading, the larger the export scale of enterprise. Total factor productivity has

a significant positive impact on export scale, indicating that the higher the productivity, the larger the export scale. Capital intensity has a significant positive impact on export scale, the higher the capital intensity, the larger the export scale.

Table 3 Results about product quality upgrading and export scale

Explaining variables	Model3	Model 4-1	Model 4-2	Model 4-3	Model 4-4	Model 4-5
	(basic model)	(financing cost)	(labor cost)	(debt ratio)	(industry competition)	(industry category)
qu	0.0050***	0.0052***	0.0044***	0.0050***	0.0038**	0.0062***
tfp	0.0371***	0.0391***	0.0342***	0.0367***	0.0339***	0.0380***
ln(cap)	0.1983***	0.1876***	0.1772***	0.2019***	0.1765***	0.2212***
age	0.0146***	0.0142***	0.0145***	0.0153***	0.0156***	0.0140***
age ²	-0.0007***	-0.0007***	-0.0007***	-0.0007***	-0.0007***	-0.0006***
scale ₁	0.9830***	0.9460***	0.9862***	0.9800***	0.9527***	0.9694***
scale ₂	2.1818***	2.1012***	2.1900***	2.1756***	2.1207***	2.1534***
scale ₃	3.5397***	3.4241***	3.5486***	3.5317***	3.3803***	3.4958***
roa	0.4765***	0.4928***	0.4217***	0.5446***	0.4763***	0.5067***
fc		0.0190***				
ac			-0.1878***			
dac				0.1361***		
hhi					0.0006***	
indus ₁						0.0451***
indus ₂						-0.3250***
indus ₃						0.0680***
sta	-0.5905***	-0.6094***	-0.5948***	-0.5972***	-0.5913***	-0.5513***

cen	-0.3709***	-0.3940***	-0.3603***	-0.3676***	-0.4974***	-0.3003***
_cons	7.2703***	7.2772***	7.4461***	7.1814***	7.4137***	7.2189***
adj-R ²	0.2938	0.2920	0.2954	0.2943	0.2826	0.3010

The Model 3 in Table 3 reflect the relationship between enterprise age and export scale also shows an inverted U-shaped. Compared with micro enterprises, large and medium and small enterprises have a significant positive impact on export scale, the larger the enterprise size, the larger the export scale. Enterprise performance (return on total assets) has a significant positive impact on export scale, the larger the return on total assets, the higher the export scale. It can also be found from Model 3 that export scale of state-owned enterprises and enterprises directly under the central government are significantly lower than that of non-state-owned enterprises and local enterprises. It is precisely because enterprises within the system are more prone to inertia in a safe environment. Problems such as lack of personnel mobility, lack of innovation awareness and competitiveness have inhibited the export scale. The Model 4-1 shows that financing cost has a positive effect on export scale, the higher the financing costs, the easier it is to obtain support from external capital. The regression results of Model 4-2 show that labor costs has a significant negative impact on export scale, labor cost is an important part of enterprise costs, Too high labor cost will squeeze the enterprise 's capital in other aspects, such as technology research and development, which will reduce the export delivery value. The Model 4-3 shows that the debt ratio has a significant positive impact on export scale, the higher the debt ratio, the smaller the financing constraint, so enterprises are more powerful to expand export scale. The Model 4-4 shows that the industry competition has a significant positive impact on export scale, the degree of industry competition is a potential source of power for enterprises, and enterprises will seek long-term survival ways in a fierce competitive environment. The results of Model 4-5 show that compared with the resource product industry, the export scale in the low-tech product industry and the high-tech product industry are larger, while the export scale of the medium-tech product industry is

smaller. The above research conclusions support Hypothesis 2.

3.3.3. Product quality upgrading at different levels and export scale

In order to further analyze the impact of product quality upgrading at different levels on enterprises export scale, this article introduces the low, medium, and high-level product quality upgrading into the model at the same time, to empirically study the specific impact of product quality upgrading at different levels on export scale. The regression results are as follows Table 4 show. Model 1 is a basic model of the impact of product quality upgrading at different levels on export scale of enterprises. The upgrading of low-level product quality has a significant negative impact on export scale, it may be that the main business of enterprises that only achieve low-level product quality upgrading is domestic sales rather than foreign, and product quality of those enterprises cannot meet the export standards. The quality upgrading of medium and high-level product has a significant positive impact on export scale, indicating that the higher medium and high-level products quality upgrading, the larger the export scale. Because the enterprises that achieve the quality upgrading of medium and high-level product have a relatively leading position, the product quality is more in line with international quality standards. Products at this level are easier to establish a good reputation in foreign market and then attract consumers, and expand export delivery value. The results of Models 6-1 and 6-2 show that consistent with the regression results of export status, the export scale of foreign enterprises can be significantly higher than that of domestic enterprises. The results of Models 6-3 and 6-4 also show that export subsidy has a positive impact on export scale, but there is an inverted U-shaped relationship between subsidy intensity and export scale.

Table 4 Results about product quality upgrading at different levels and export scale

Explaining variables	Model5	Model 6-1	Model 6-2	Model 6-3	Model 6-4
	(basic model)	(foreign capital status)	(proportion of foreign capital)	(subsidy status)	(subsidy intensity)
lqu	-0.0716***	-0.0069	-0.0259	-0.0862***	-0.0701***
mqu	0.0817***	0.1045***	0.0890***	0.0758***	0.0883***
hqu	0.0340***	0.0411***	0.0315***	0.0317***	0.0365***
tfp	0.0371***	0.0373***	0.0360***	0.0371***	0.0370***
ln(cap)	0.1988***	0.1963***	0.1837***	0.1971***	0.2019***

age	0.0147***	0.0156***	0.0158***	0.0149***	0.0149***
age ²	-0.0007***	-0.0006***	-0.0007***	-0.0007***	-0.0007***
scale ₁	0.9834***	0.9833***	0.9873***	0.9789***	0.9867***
scale ₂	2.1837***	2.1698***	2.1797***	2.1755***	2.1867***
scale ₃	3.5399***	3.5020***	3.5225***	3.5293***	3.5418***
roa	0.4799***	0.5179***	0.4756***	0.4778***	0.4836***
for		0.2816***			
fi			0.3966***		
sub				0.0895***	
si					4.5933
si2					-938.4249***
sta	-0.5872***	-0.5078***	-0.5204***	-0.5978***	-0.5615***
cen	-0.3743***	-0.3375***	-0.3644***	-0.3833***	-0.2800***
_cons	7.2674***	7.1673***	7.2423***	7.2599***	7.2615***
adj-R ²	0.2939	0.2999	0.2982	0.2944	0.2969

4. CONCLUSIONS AND POLICY IMPLICATIONS

4.1. Conclusions

Based on the theory of enterprise heterogeneity trade, this article designs the evaluation index of product quality upgrading, constructs a theoretical model of product quality heterogeneity, and reveals the mechanism of product quality upgrading on export behavior. Based on the matching 418213 microdata of the Chinese industrial enterprise database and the customs database from 2000 to 2013, the empirical study of the impact of product quality upgrading on export behavior, the following research conclusions and policy implications are obtained.

Conclusion 1: Product quality upgrading has a significant positive impact on enterprise export status; the better the enterprise performance, the stronger the innovation ability, and the larger the enterprise size, so the higher the export probability. The total factor productivity and capital intensity have a negative impact on export status. The results of the study found that the higher the product quality upgrading, the more opportunities for enterprises to export, because product quality upgrading can directly affect consumer utility, and high-quality export products have more consumers. The results show that compared with micro-enterprises, the large, medium and small enterprises' export probabilities are bigger. The larger the enterprise size, the larger the export probability, due to the economies of scale. Enterprise performance has a significant positive impact on export status, the better the enterprise performance, the greater the probability of export. Enterprise innovation capability has a significant positive impact on export status, the higher the R&D intensity, the greater the export probability. The results also show that total factor productivity and capital intensity have a significant negative impact on export status, which verifies the existence of the "productivity paradox" phenomenon.

The enterprise age has a significant impact on export status, and there is an inverted U-shaped between the both. The status of foreign capital and the proportion of foreign capital have a significant positive impact on export status of enterprises. Compared with domestic capital, foreign enterprises have a greater export probability, the higher the proportion of foreign capital, the greater the export probability. The subsidy status has a significant positive effect on export status, indicating that enterprises with subsidies are more likely to export. There is an inverted U-shaped relationship between the subsidy intensity and export status. The results also show that the export probability of state-owned enterprises and enterprises directly under the central government is lower than that of non-state-owned enterprises and local enterprises.

Conclusion 2: Product quality upgrading has a significant positive impact on export scale of enterprises; the higher the total factor productivity, the higher the capital intensity, the better the enterprise performance, and the larger the enterprise size, the larger the export scale. The results show that product quality upgrading has a significant positive impact on export scale. The higher the product quality upgrading, the larger the export scale. Total factor productivity has also a significant positive impact on it, indicating that the higher the enterprises productivity, the larger the export scale. Because the higher the enterprises productivity, the more capable they are to invest in technological research and development. Capital intensity has a significant positive impact on export scale, the higher the capital intensity, the larger the export scale. In addition, the enterprise age has a significant impact on the export scale, with an inverted U-shaped change between the both. Enterprise performance (profit on total assets) has a significant positive impact on export scale, the better the enterprise performance, the greater the export delivery value. Large, medium and small enterprises have significant positive impact on export scale, indicating that compared with micro enterprises, their export

scales are larger. Financing costs have a significant positive impact on export scale, the higher the financing cost, the larger the export scale. Labor costs have a significant negative impact on export scale, the higher the labor cost, the smaller the export scale. The debt ratio has a positive impact on the export scale; the degree of industry competition has a significant positive impact on the export scale. The export scale of enterprises can be expanded by improving the competitiveness of their own industries, compared with the resource product industry, the export scales in the low-tech and high-tech product industries are larger, while the export scale of enterprises in the medium-tech product industry is smaller.

Conclusion 3: Product quality upgrading at different levels have different effects on export behavior of enterprises. The results show that low-level product quality upgrading have a significant negative impact on export scale of enterprises. It may be because the main business of enterprises that only achieve low-level product quality upgrading is domestic sales rather than export sales, while medium-level and high-level product quality upgrading have positive impact on export scale, which shows that the higher the quality of medium-to-high product upgrading, the larger the export scale. Because enterprises that have achieved medium-to-high-level product quality upgrading are in a relatively leading position in domestic or international product quality, and the product quality is more in line with international quality standards for export products. The research results also show that the export scale of foreign enterprises is significantly higher than that of domestic enterprises. The higher the proportion of foreign capital, the larger the export scale. Export subsidy has a positive impact on export scale, but not significantly. And the relationship between subsidy intensity and export scale is an inverted U-shaped.

4.2. Policy implications

The above research results provide the following policy implications:

Firstly, we must actively participate in product quality certification and strive to do a good job in brand cultivation. The results of this article found that product quality upgrading has a significant positive impact on export behavior, and product quality upgrading at different levels have different levels of impact on export behavior. It shows that product quality standards are of great significance to the export behavior of enterprises. On the one hand, China should strengthen its understanding of international quality standards and train its own professionals to participate in formulation of international quality standard, actively participate in related activities of international quality standards actively; on the other hand, while paying attention to international quality standards, we cannot ignore the development of

domestic product quality standards. The government should formulate more complete certification and accreditation system and encourage enterprises to cultivate their own brands.

Secondly, it is necessary to increase capital in technological research and development to enhance the independent innovation capability of enterprises. The research results of this article show that the innovation ability of enterprises has a significant positive impact on the export of enterprises. However, in general, Chinese enterprises generally do not pay enough attention to innovation, their independent innovation awareness is relatively weak, independent innovation capabilities are relatively poor. The government should use various policies and measures to guide enterprises to increase product research and development, provide support in terms of capital needs, build a platform for mutual assistance and exchanges in technology learning, learn advanced technology and management experience from western countries, and actively build their own high technical product development team. Only by improving the ability of independent innovation, can enterprises effectively achieve product quality upgrading and gain a firm foothold in the international market.

Thirdly, we must actively introduce foreign capital and give full play to the advantages of economies of scale. The research results show that the proportion of foreign capital has a significant positive impact on export behavior of enterprises. Compared with domestic capital, foreign enterprises do better in export trade. Foreign enterprises and domestic enterprises will compete fiercely in the labor market, and most high-end talents can flow to foreign enterprises due to high salaries or development space. Therefore, the introduction of foreign capital can effectively promote product quality upgrading. In addition, the empirical results show that the enterprise size has a significant positive impact on export. The larger the enterprise size, the larger the export scale. We should rationally expand the enterprise size.

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