Research on the Impact of Product Quality Upgrading on Enterprise Performance

Jingshui Sun[a],[*], Guangli Liu [b]

Zhejiang Gongshang University, Hangzhou, Zhejiang Province, China
[a] hzsunjingshui@163.com, [b] 1395497220@qq.com
*corresponding author

ABSTRACT. This paper defines the connotation of product quality upgrading, constructs the evaluation index of product quality upgrading, and reveals the influence mechanism of product quality upgrading on enterprise performance. Based on the perspective of enterprise heterogeneity, this paper makes an empirical analysis of the impact of product quality upgrading on enterprise performance by using the micro data after matching between the database of Chinese industrial enterprises and the customs database from 2000-2013. The results show that: (1) Product quality upgrading has a positive impact on enterprise performance, and product quality upgrading at different levels has a significant difference in the impact on enterprise performance. Among them, low-level product quality upgrading has a greater impact on enterprise performance, followed by high-level product quality upgrading, and middle-level product quality upgrading has less impact. (2) Enterprise heterogeneity have significant impacts on enterprise performance. Among them, enterprise productivity, innovation ability, government subsidies, export scale and industry competition all have significant positive impact on enterprise performance. However, debt ratio, financing cost, capital intensity, institutional enterprise and capital mobility all have significant negative impact on enterprise performance. The above research results provide important policy implications.

KEYWORDS: Product quality upgrading, Enterprise performance, Enterprise heterogeneity

1. Introduction

Since the reform and opening-up, China has made remarkable achievements in foreign trade and has become a "major trading nation", but not yet a "trading power". The rapid development of China's export trade mainly relies on the increase of export quantity, ignoring the effective improvement of product quality. Therefore, the report of the nineteen emphasizes that China's economy has shifted from a stage of rapid growth to a stage of high-quality development. We must insist on quality first, promote the innovation, and build a country with strong quality. Product quality upgrading is an important factor influencing a country's economic growth, employment increase, export expansion and wage increase. Product quality upgrading has become the key to the survival and profitability of enterprises. How to define product quality upgrading? What is the status of China's product quality upgrading? Does product quality upgrading have a significant impact on enterprise performance? There are few relevant studies on it. Based on the trade theory of enterprise heterogeneity, this paper investigates the impact of product quality upgrading on enterprise performance from theoretical analysis and empirical research. It has some certain theoretical and practical significance for understanding the relationship between product quality upgrading and performance enterprise, discussing the motivation of enterprise to upgrade product quality, and for the government to formulate scientific and reasonable export trade policies.

2. Research Progress At Home and Abroad

The key for an enterprise to gain international competitiveness in the process of globalization is product quality. The higher the product quality, the more competitive the enterprise will be. As the direct competitiveness of enterprises participating in the international market, product quality not only has a direct impact on the market share and profit of enterprises, but also indirectly plays an important role in industrial upgrade and national technological progress through the spillover effect of technology and other mechanisms.

2.1. The Impact of Product Quality Upgrading on Enterprise Performance

Some scholars believe that the quality of export products is positively correlated with the productivity of enterprises, and enterprises with high productivity gain higher profits by producing high quality products and exporting products with higher prices[1]. The study finds that the quality of imported products of Chinese enterprises has improved, and it indicates that the quality of imported products has a positive impact on the import performance of enterprises[2]. Quality certification is the most direct way to measure the quality of products. It reflects whether the products produced by enterprises meet the quality standards to some extent. ISO 9000 has become one of the most popular standards in quality management systems, and enterprises use ISO 9000 as a tool to demonstrate their investment in quality upgrading and quality performance. Some scholars take ISO quality certification as a basis for measuring product quality upgrading of enterprises, and the research results show that product quality upgrading significantly promotes the improvement of enterprise sales, labour productivity and profit[3]. By studying the relationship between international standard certification and enterprise sales, production capacity, some scholars find that international standard certification improves enterprises' productivity and sales through efficiency improvement and quality signal. Furthermore, some scholars find that ISO 9000 certification promote the sales, export and employment of certified enterprises, help to improve organizational performance, bring greater customer satisfaction and improve financial performance[4].

2.2 The Impact of Characteristics of Enterprise Heterogeneity on Enterprise Performance

Enterprise heterogeneity refers to the significant differences between enterprises. In addition to the significant influence of product quality upgrading on enterprise performance, characteristics of enterprise heterogeneity such as enterprise productivity, factor intensity, innovation ability, size, age and ownership also have significant influence on enterprise performance. Technological innovation has an important impact on enterprise performance. Technological innovation promotes the improvement of labour productivity through product innovation and process innovation, and thus it has a significant positive impact on enterprise performance. Some scholars have verified that there is a U-shaped relationship between technological innovation and enterprise performance (labour productivity) in a short term[5]. Some scholars believe that the investment in R&D in high-tech industry has a positive lag effect[6]. Other scholars believe that the relationship between internationalization and enterprise performance has the characteristics of heterogeneity, and that both the theory of market imperfection and the theory of enterprises specific advantage all imply that internationalization improves the overall performance of enterprises. Some scholars also believe that the impact of heterogeneous ownership subjects on enterprise performance fluctuates to different degrees, and they find a significant positive correlation between ownership concentration and enterprise performance fluctuation. Some scholars believe that the rent seeking caused by government subsidies and the anti-surplus operation of enterprises will weaken enterprises performance. Some scholars also believe that capital cost significantly inhibits the improvement of business performance, while government subsidies contribute to the cost of production, R&D, management and effectively promote the improvement of enterprise profitability, and it is further found that the subsidies on cost have a more obvious impact than directly increasing enterprise revenue[7].

To sum up, based on the perspective of enterprise heterogeneity, domestic and foreign scholars have explored the impact of product quality upgrading on enterprise performance in detail, and have been obtained some important research results. However, there are still some unresolved problems. First, most of studies on product quality upgrading are based on the measurement results of product quality or quality certification. The connotation of product quality upgrading is still not clear, and there is no unified evaluation index for product quality upgrading. How to define product quality upgrading and how to establish the evaluation index system of product quality upgrading remain to be further discussed. Second, the existing research on the impact of product quality upgrading on enterprise performance mainly from the national level or the industry level, rarely involving the empirical test at the enterprise level, so the sample size will also be greatly limited. How to study the impact of product quality upgrading on enterprise performance from a micro perspective needs further discussion. Thirdly, enterprise heterogeneity has a significant impact on enterprise performance. However, which characteristic variables of enterprise heterogeneity can better illustrate the actual situation in China when establishing an econometric model. It is also an issue to further discussed in this paper.

Compared with the existing research, the contributions of this paper are as follows. First, this paper defines the connotation of product quality upgrading, divides product quality upgrading into different levels according to the quality standard level, and designs the evaluation index system of product quality upgrading, which is not involved in the existing relevant research. Secondly, based on the theoretical framework of trade of heterogeneous enterprise, this paper establishes a mathematical model to reveal the influence mechanism of product quality upgrading on enterprise performance. Third, this paper introduces the enterprise productivity, innovation ability, capital intensity, debt ratio, financing cost, enterprise size, government subsidies, foreign capital ratio and other characteristic variables of heterogeneity, and empirically studies the impact of product quality upgrading on enterprise performance, and draws different conclusions. It is also rare in existing relevant research.

3. Theoretical Model

The trade theory of enterprise heterogeneity proposed by Melitz breaks the tradition of enterprise homogeneity. The theory mainly refers to the heterogeneity of enterprises in productivity, but does not include the heterogeneity of products. The same kind of products produced by different enterprises are different in product quality in the real economic life. Even the products of the same enterprise will have differences in quality due to the differentiating strategy. Therefore, this paper attempts to introduce product quality as an influence variable into the trade model to analyse the relationship between product quality and enterprise performance.

On the demand side, assuming that enterprises in country i export to the market in country j, the traditional CES utility function is as follows:

$$U_j = \left[\int_{\upsilon \in V_j} \left(x_j \right)^{\frac{\sigma-1}{\sigma}} d\upsilon \right]^{\frac{\sigma}{\sigma-1}} (1)$$

In formula (1), U_j represents consumer effect in country j, υ represents export product category, V_j represents total types of product consumed in country j, x_j represents sales volume of products exported from country i to country j, and σ is the coefficient of product substitution elasticity $(\sigma > 1)$.

The traditional CES utility function is based on the assumption of product homogeneity, but product heterogeneity exists in fact and it has a practical impact on consumer utility. Therefore, the variable of product quality adds to the utility function, and formula (1) extends as follows:

$$U_{j(\lambda)} = \left[\int_{\upsilon \in V_j} \left(\lambda^{\delta} x_j \right)^{\frac{\sigma-1}{\sigma}} d\upsilon \right]^{\frac{\sigma}{\sigma-1}} (2)$$

In formula (2), λ represents product quality, while $U_{j(\lambda)}$ represents the consumer utility of country j after increasing product quality, δ is the elastic demand of product quality in country j. Formula (2) shows that the higher the product quality is, the stronger the market's preference for product quality is, and the higher the utility consumers get from the product.

Referring to the derivation process of Krugman, adding product quality and quality preference into the trade model, the product sales volume x_j of an enterprise in country i export to the market in country j is:

$$x_j = \left(\frac{p_j}{\lambda^{\delta}} \right)^{-\sigma} \frac{E_j}{P_j^{1-\sigma}} (3)$$

In formula (3), p_j represents the selling price in country j, which products exported by enterprises in country i. E_j represents the consumption expenditure in country j, and P_j represents the price index in country j. Formula (3) indicates that the higher the product quality, the stronger the market quality preference, and the greater the product demand under a certain price.

On the supply side, this paper refers to the approach of Elhanan et al.. It is assumed that there is only labour input in the production process, the amount of labour input needed to produce a unit product is l, and the enterprise wage rate is ω. Under the monopolistic competitive market structure, enterprises produce differentiated products. According to the marginal cost pricing, the ex-factory price of products produced by enterprises in country i is:

$$p_i = \frac{\sigma}{\sigma - 1} \omega l (4)$$

The higher the product quality is, the higher the labour cost will be. While the higher the productivity is, the lower the labour input will be. In addition, considering that the relationship between input cost of labour and product quality, enterprise productivity is not linear, we assume the relationship between labour input and product quality as an

exponential form:

$$l = e^{\lambda/\varphi} \quad (5)$$

In formula (5), σ is the enterprise productivity and it is a natural constant. Substituting formula (5) into formula (4), we can get the following:

$$p_i = \frac{\sigma}{\sigma - 1} \omega e^{\lambda/\varphi} \quad (6)$$

There is an iceberg cost τ in international trade. The ex-factory price of the exported products of country i has the following relationship with the selling price of country j:

$$p_j = p_i \tau \quad (7)$$

The income generated by exporting products from country i to country j depends on the ex-factory price p_i and the sales volume x_j in country j. According to Melitz, There is a fixed cost (F_j) for enterprises to enter export market. Enterprise profits $\prod$ are as follows:

$$\prod = p_j x_j - F_j \quad (8)$$

Substituting formulas (3), (6) and (7) into the above formula, and getting the following formula:

$$\prod = \mu \lambda^{\delta\sigma} e^{\lambda(1-\sigma)/\varphi} - F_j \quad (9)$$

The coefficient μ is:

$$\mu = \left(\frac{\sigma}{1 - \sigma} \right)^{1-\sigma} \frac{E_j \omega^{1-\sigma}}{P_j^{1-\sigma} \tau^{\sigma}} \quad (10)$$

Under the market equilibrium condition, the equilibrium quality of products exported from country i to country j is as following:

$$\frac{\partial \prod}{\partial \lambda} = 0 \quad (11)$$

By substituting formula (9), we can obtain:

$$\mu e^{\lambda(1-\sigma)/\varphi} \frac{\partial \left(\lambda^{\delta\sigma} \right)}{\partial \lambda} + \mu \lambda^{\delta\sigma} \frac{\partial \left(e^{\lambda(1-\sigma)/\varphi} \right)}{\partial \lambda} = 0 \quad (12)$$

From formula (12), product quality in equilibrium is as following:

$$\lambda^* = \frac{\sigma}{\sigma - 1} \delta\varphi \quad (13)$$

According to formula (13), the quality selection of the products exported by country i to country j depends on the quality preference δ of country j and productivity φ of enterprises. When quality preference δ is constant, the quality λ^* of export products increase with the increase of enterprise productivity φ.

When the product quality is λ^*, the enterprise profit is as follows:

$$\prod{}^* = \mu \left(\frac{\sigma}{\sigma - 1} \delta\varphi \right)^{\delta\varphi} e^{-\delta\sigma} \quad (14)$$

Therefore, when the quality preference is fixed, the quality λ^* of export products increases with the increase of enterprise productivity φ, the enterprise's product sales and profit will also increase.

Based on the above model analysis, this paper constructs the following econometric model:

$$Performance = \alpha_0 + \alpha_1 QU + \sum \beta_i \mathrm{firm}heter_i + \varepsilon \ (15)$$

where Performance is the profitability of enterprise (explained variable), QU is the index of product quality upgrading (core explaining variable), firmheter represents the characteristic variables of the enterprise heterogeneity (including enterprise productivity, innovation ability, capital intensity, debt ratio, financing cost, enterprise size, government subsidies, foreign capital ratio, etc.), and ε is a random error term.

4. Empirical Analysis

This paper argues that, it is called product quality upgrading when product quality of the enterprise within a certain range of time and space reaches or exceeds a certain standard (such as the national or international quality certifications), or gets a recognized quality reputation or honour (such as the national or international well-known trademarks and famous brand products, quality prizes). Otherwise, there is no upgrading. Product quality upgrading is a process of mutation, which can only be achieved when the quality changes to a certain extent[8].

4.1. Variables, Symbols and Definitions in the Model

According to the above theoretical analysis, this paper considers adding the characteristic variables of enterprise heterogeneity and controlling the characteristic variables at the enterprise level to study the impact of product quality upgrading on enterprise performance. There are many variables representing enterprise performance in the existing literature. In this paper, the profitability of enterprise represents performance. In the model estimation, the main explained variable is enterprise performance, the core explaining variable is product quality upgrading, and the characteristic variables of enterprise heterogeneity includes enterprise productivity, innovation ability, capital mobility, enterprise size, age, financing constraint, capital intensity etc.. The symbols and definitions of all variables in the model are shown in Table 1.

Table 1 Variable, Symbol, and Variable Definition

Variable	Symbol	Variable definition
Explained variable: Profitability	ROA	Profits / Total assets
Core explaining variable: Product quality upgrading	QU	See note (1)
Low-level product quality upgrading[a] (dummy variable)	LQU	See note (2)
Middle-level product quality upgrading (dummy variable)	MQU	See note (2)
High-level product quality upgrading (dummy variable)	HQU	See note (2)
Heterogeneity characteristic variable: Enterprise productivity	TFP	Obtained by using the C-D production function
Innovation ability (dummy variable)	INNOV	Have new product output value=1 or take 0
Enterprise age	AGE	Statistical year - Year of establishment of the enterprise
Enterprise size	SIZE	Ln (total assets)
Enterprise cost: (1) Debt ratio	DAC	Total liabilities / Total assets
(2) Financing cost	FINANCE	Interest expenditure / Sales revenue
Capital intensity	CAP	Net fixed assets / Workers
Capital mobility	CASH	Current assets / Total assets
Export subsidy: (1) Subsidy (dummy variable)	SUB	Have subsidy =1 or take 0
(2) The intensity of subsidies	SI	Total subsidy / Sales revenue
Export scale	EXPORT	Ln (Export delivery value)
Foreign capital ratio	FI	Foreign capital / Paid-in capital
State-owned enterprise[b] (dummy variable)	STO	State-owned enterprise =1 or take 0
Enterprises directly under the central	CEN	Enterprises directly under the central

government[c] (dummy variable)		government =1 or take 0
Intensity of industry competition	HHI	Enterprises sales / Industry sales

Note: (1) If enterprise has won provincial well-known trademarks or provincial famous brand products, QU values 1. If enterprise has won provincial government quality awards, QU values 2. If enterprise has won China well-known trademarks or China famous brand products, QU values 3. If enterprise has won China world famous brand products, QU values 4. If enterprise has won China product quality certifications, QU values 5. If enterprise has won China government quality awards, QU values 6. If enterprise has won the world well-known trademarks or world famous brand products, QU values 7. If enterprise has won international certifications of product quality, QU values 8. If enterprise has won three world quality awards, QU values 9. (2) If enterprise has won provincial well-known trademarks (provincial famous brand products) or provincial government quality awards, LQU is 1; otherwise LQU is 0. If enterprise has won China well-known trademarks (China famous brand products or China world famous brand products) or China product quality certifications, China government quality awards, MQU is 1; otherwise MQU is 0. If enterprise has won the world well-known trademarks, international certifications of product quality or the world three quality awards, HQU is 1; otherwise HQU is 0.

Referential standard: a Product Quality has not been upgraded; b Non-state enterprises; c Local enterprises.

4.2 Data Sources

The data selected in this paper are from the database of Chinese industrial enterprises and the customs database from 2000 to 2013. The sample data volume is rich, and its statistical indicators can comprehensively reflect the heterogeneity characteristics of enterprises. In order to ensure the validity of the data, the database of Chinese industrial enterprises is processed by referring to the data processing method used by Fan Haichao et al.. (1) Delete the samples with gaps or obvious abnormalities in the variables involved in this paper. (2) Samples with key indicator variables less than 0 are deleted, including export delivery value, industrial added value, wages payable, total enterprise assets, sales revenue, welfare payable, subsidize revenue and R&D expenses etc. (3) Delete the samples with less than 8 employees, less than 100,000 fixed assets and less than 5 million sales each year. (4) Samples with the ratio of industrial value-added to industrial sales value greater than 1 and the ratio of export delivery value to sales revenue greater than 1 are deleted. The customs database is processed as follows. (1) Delete samples that cannot reflect the real product quality of the enterprise, including samples containing import and export, foreign trade, foreign economy, economic trade, logistics and other key words in the name of the enterprise. (2) Delete samples with value of each trade less than $50 and samples with each trade volume less than 1. (3) The HS codes used around 2002 are not consistent. In order to maintain the consistency, we transcode the HS1996 codes in 2000 and 2001 into HS2002 codes according to the transcode table provided by the Website of United Nation. Finally, the database of Chinese industrial enterprises and the customs database are matched according to the name of enterprise and telephone postcode. Thus, the new database leaves only the data of manufacturing enterprises, with a total sample size of 427,693. The characteristic variables of enterprise heterogeneity and performance can be obtained from the new database. The index of product quality upgrading is based on the names of corresponding enterprises in the database to search quality honours, the exact sources include the National Certification and Accreditation Information Public Service Platform, well-known trademark website and official websites of each provincial governments, etc.

4.3 Analysis of Regression Results

The sample of this paper is unbalanced panel data. Mixed regression, fixed effect, random effect are used to estimate the model. It can be known that the latter should be chosen between mixed regression model and fixed effect model through F test in fixed effect model. Hausman test shows that the former should be chosen between the model of fixed effect and the model of random effect. The coefficients of explaining variables of each model are mainly significant at 1% level, and the regression results are relatively ideal.

4.3.1 Basic Model Analysis

It shows that the basic model (1) is the basic model of the impact of product quality upgrading on enterprise performance from Table 2. The coefficient of product quality upgrading is significantly positive at 1% level, and it shows that product quality upgrading has a significant positive impact on enterprise performance, and the influence is relatively large. The basic model (2) shows the impact of product quality upgrading at different levels on enterprise performance. Compared with enterprises without product quality upgrading, enterprises with low-level product quality upgrading, middle-level product quality upgrading and high-level product quality upgrading all have a significant positive impact on enterprise performance. Moreover, low-level product quality upgrading has a greater impact on enterprise performance, followed by high-level product quality upgrading, and middle-level product quality upgrading has a smaller impact. The basic model (1) also shows that the coefficient of enterprise age, size, enterprise productivity,

debt ratio, financing cost and capital intensity is significant at 1% level. Among them, the coefficient of enterprise age is significantly positive, but its square term is negative, which indicates that there is an inverted "U-shaped" relationship between enterprise age and enterprise performance. During a period of continuous operation, the products of enterprises open up the market and the reputation premium increases the performance of enterprises. However, as the age of the enterprise increases, the enterprise performance will decline. The impact of enterprise size on performance is significantly negative. The reason may be the enterprise's internal management efficiency is low due to the expansion of enterprise size, which affects the normal production and operation activities to a certain extent. The coefficient of enterprise productivity is significantly positive, indicating that the higher the enterprise productivity, the better the enterprise performance. The coefficient of debt ratio is significantly negative. Excessive debt ratios of capital mean that the borrowed capital has a large proportion and the ability to repay debt is poor, which will further affect the business performance of enterprises. The coefficient of financing cost is significantly negative, indicating that financing cost has a negative impact on enterprise performance. It means that higher financing cost will increase the expenditure of enterprises and reduce their investment in product quality upgrading and R&D, which is not conducive to the improvement of enterprise profitability. The coefficient of capital intensity is significantly negative, indicating that the current enterprises are still in labour-intensive mode of production. Enterprises adopting capital-intensive mode of production do not conform to the comparative advantage of labour, so capital-intensive production activities have a certain negative impact on enterprise performance.

Table 2 Regression Result One

Explaining variable	Model 1-1 basic model (1)	Model 1-2 basic model (2)	Model 2-1 Subsidy or not	Model 2-2 The intensity of subsidies	Model 3 foreign capital ratio
C	1.12615***	1.13475***	1.12815***	1.12391***	1.11933***
QU	0.00537***		0.00536***	0.00555***	0.00535***
LQU		0.04893***			
MQU		0.02374***			
HQU		0.04371***			
AGE	0.00308***	0.00305***	0.00309***	0.00318***	0.00308***
AGE^2	-1.60E-06***	-1.58E-06***	-1.60E-06***	-1.64E-06***	-1.59E-06***
SIZE	-0.08575***	-0.08664***	-0.08605***	-0.08563***	-0.08522***
TFP	0.00378***	0.00377***	0.00378***	0.00375***	0.00378***
DAC	-0.08360***	-0.08339***	-0.08363***	-0.08161***	-0.08333***
FINANCE	-0.12287***	-0.12290***	-0.12304***	-0.17381***	-0.12272***
CAP	-2.54E-05***	-2.56E-05***	-2.53E-05***	-2.44E-05***	-2.55E-05***
SUB			0.00540**		
SI				-0.08287*	
SI^2				0.01195	
FI					0.01119***
N	252,427	252,427	252,427	236,273	252,427

Note: ***, ** and * respectively indicate that the regression coefficient is significant at the confidence level of 1%, 5% and 10%. Due to the large number of variables, the t-statistic corresponding to the regression coefficient is omitted, the same as below.

4.3.2 Extended Model Analysis

Model 2 and Model 3 in Table 2 reflect the impact of government subsidies, the intensity of subsidies and foreign capital ratio to enterprise performance in turn. Table 3 reflects the impact of capital mobility, innovation ability, export scale, state-owned enterprises, enterprises directly under the central government, and intensity of industry competition on enterprise performance.

Model 2-1 shows that government subsidies have a significant positive impact on enterprise performance. It indicates that government subsidies, to a certain extent, provide financial support for technological innovation and accelerate product quality upgrading, which promote the improvement of enterprise performance. In model 2-2, the coefficient of the intensity of subsidy is significantly negative and the square term is positive, and it means that the intensity of government subsidy presents a "U-shaped" relationship with enterprise performance. When the intensity of government subsidy is within a certain limit, the subsidy is not enough to support enterprises to carry out production innovation. There are moral hazard problems for enterprises to obtain government subsidies and the imperfect distribution mechanism of government subsidy will lead to poor subsidy effect. Model 3 shows that the foreign capital ratio has a significant promoting impact on enterprise performance. It indicates that the participation of foreign capital

brings technical and management guidance to enterprises, which is conducive to the improvement of enterprise profitability.

Models 4 to 6 in Table 3 show in turn that the capital mobility has a negative impact on enterprise performance, while the innovation ability and export scale have a positive impact on enterprise performance. The greater the capital mobility, the smaller the capital investment in R&D and quality upgrading of products. There may be a certain degree of waste of capital resources and it has a negative impact on enterprise performance. The innovation ability of enterprises plays a positive role in promoting enterprise performance. It indicates that the innovation activities promote the quality upgrading of the old products to continuously meet consumer demand and further improve the reputation of the old products in the market, which can improve enterprise performance. The coefficient of export scale is significantly positive at the level of 1%. The larger the export scale of enterprises, the higher the share of its products in the foreign market, and the larger its sales and profitability.

Table 3 Regression Result Two

Explaining variable	Model 4 Capital mobility	Model 5 Innovation ability	Model 6 Export scale	Model 7 State-owned enterprise	Model 8 Enterprises directly under the central government	Model 9 Intensity of industry competition
C	1.15113***	1.15052***	1.13981***	1.12779***	1.12611***	1.12786***
QU	0.00514***	0.00458***	0.00514***	0.00537***	0.00536***	0.00560***
AGE	0.00293***	0.00255***	0.00299***	0.00309***	0.00309***	0.00320***
AGE^2	-1.52E-06***	-1.32E-06***	-1.55E-06***	-1.60E-06***	-1.60E-06***	-1.65E-06***
SIZE	-0.08639***	-0.08989***	-0.08817***	-0.08589***	-0.08573***	-0.08613***
TFP	0.00444***	0.00598***	0.00335***	0.00377***	0.00378***	0.00376***
DAC	-0.07992***	-0.08376***	-0.08330***	-0.08369***	-0.08361***	-0.08172***
FINANCE	-0.12365***	-0.11461***	-0.12385***	-0.12245***	-0.12229***	-0.17524***
CAP	-2.81E-05***	-2.47E-05***	-2.53E-05***	-2.54E-05***	-2.54E-05***	-2.45E-05***
CASH	-0.03902***					
INNOV		0.03961***				
EXPORT			0.00206***			
STO				-0.05015***		
CEN					-0.01902	
HHI						0.93279***
N	252,427	252,427	252,427	252,427	252,427	252,427

Model 7 and Model 8 in Table 3 successively show that state-owned enterprises and enterprises directly under the central government have a negative impact on enterprise performance, which the former is significant while the latter is not. Although enterprises within the system (state-owned enterprises and enterprises directly under the central government) enjoy unique policy support compared with other enterprises, their production and operation activities may not keep pace with consumer demand and it will lead to a decline in enterprise performance. Model 9 shows that the intensity of industry competition has a significant positive impact on enterprise performance. The greater the market share of enterprise products, the better the enterprise performance.

5. Conclusions

This paper constructs the evaluation index system of product quality upgrading, reveals the influence mechanism of product quality upgrading on enterprise performance. Based on the perspective of enterprise heterogeneity, this paper makes an empirical analysis of the impact of product quality upgrading on enterprise performance by using the micro data after matching between the database of Chinese industrial enterprises and the customs database from 2000-2013, and draws the following research conclusions and policy implications.

Conclusion 1: Product quality upgrading has a significant positive impact on enterprise performance, and different levels of product quality upgrading have a significant difference in the impact on performance. Among them, low-level product quality upgrading has a greater impact on enterprise performance, followed by high-level product quality upgrading, and middle-level product quality upgrading has less impact. The results show that the higher the level of product quality upgrading, the higher the cost of quality upgrading will be. On the contrary, the promotion effect of high-level product quality upgrading on enterprise performance is not as good as that of low-level product quality upgrading.

Conclusion 2: Enterprise heterogeneity has significant impact on enterprise performance. Among them, enterprise productivity, innovation ability, government subsidies, export scale and industry competition all have significant positive impact on enterprise performance. Debt ratio, financing cost, capital intensity, capital mobility, institutional enterprise (state-owned enterprises and enterprises directly under the central government) all have significant negative impact on enterprise performance. The results show that the support of government subsidies and the relaxation of government control can reduce the debt ratio and financing cost of enterprises. It reduces the financial burden for enterprises to upgrade product quality from the perspective of cost. Enterprises improve product production process by reducing cash mobility, investing more capital in the improvement of technological innovation ability, which improves enterprise performance to a certain extent. At the same time, product quality upgrading will stimulate the market competitiveness of enterprises, and promote the market expand from domestic to international, therefore the expansion of the export scale will further improve the enterprise performance.

The above research results provide important policy enlightenment, and product quality upgrading is conducive to the improvement of enterprise performance. Therefore, product quality upgrading is not only the key to improve China's economic competitiveness, but also an important guarantee to promote the sustainable and healthy development of enterprises.

First, enterprises should actively participate in international quality certification. The results of this study show that the high-level product quality upgrading has a significant promotion on enterprise performance. In the face of the increasingly fierce competition in the international market, enterprises should actively participate in product quality certification, consciously incorporate quality management into their business strategy, and ensure that quality management can implement in every link of their production and operation. Obtaining the international product quality certification is inseparable from the enterprise's technical investment in product quality upgrading, the improvement of internal management efficiency and the rational allocation of enterprise resources. Therefore, enterprises should not only actively participate in international product quality certification and quality award evaluation, but also learn from the successful experience of winning quality awards and the management strategy of carrying out remarkable achievements pattern. Enterprises should learn the advanced experience of quality management, achieve the product quality upgrading from the low-level to the high-level, so that they can constantly improve management level and enter the virtuous cycle in development.

Second, enterprises should strive to cultivate brand products. The results show that product quality upgrading has a significant positive impact on enterprise performance. With the construction of a strong country of quality, product brand has become the key point for enterprises to participate in market competition. The well-known trademarks and famous brand products as brand carriers are paid more and more attention by consumers, enterprises and countries. We should focus more on the identification of well-known trademarks and famous brand products, and accelerate the cultivation of enterprises' brand products, which send invisible signals of product quality upgrading to consumers and further promote the improvement of enterprise performance. The enterprise should take the creation and the cultivation well-known trademarks, the famous brand products as the direction of brand strategy. Give full play to the leading role of marketing strategy in brand effect, and combine with the service of enterprises' high-quality products to improve the brand awareness, so that enterprises can transform the technological advantages of enterprises into market competitive advantages.

Third, enterprises should increase investment in R&D to improve innovation ability. The results show that it is beneficial to improve the enterprise performance to improve the innovation ability and utilize foreign capital resources. In the process of economic globalization, Chinese enterprises have greater pressure and driving force to improve the quality of their products. Enterprises should continuously improve their independent innovation ability and promote product quality upgrading by increasing investment in R&D. Through the development of technology with independent intellectual property rights, enterprises can make the product quality fully meet the diversified and personalized needs of the market. Continuously expand product types, continuously enrich product functions and continuously improve the product value-added to improve product quality and overall competitiveness. Enterprises should not only improve their innovation ability, but also play an active role in the strategy of going out. On the one hand, enterprises introduce foreign advanced technology to improve their ability in R&D; on the other hand, they learn foreign advanced management ideas and management experience to improve internal management efficiency through communication.

The research results also show that reducing enterprises' cost burden can promote product quality upgrading and improve business performance by increasing government policy support and reducing financing costs, debt ratio.

Acknowledgement

References

[1] Fan H, Li Y A, Yeaple S R. Trade Liberalization, Quality, and Export Prices. Review of Economics and Statistics, vol.97, no.5, pp.1033-1051, 2015.

[2] Shi Bingzhan, Zeng Xiangfei. Quality Measurement and Facts of Imported Products by Chinese Enterprises. The Journal of World Economy, no.3, pp.57-77, 2015.

[3] Xin Daleng. Product Quality Upgrading and Firm's Performance. Review of Industrial Economics, vol.17, no.3, pp.146-165, 2018.

[4] Javorcik B, Sawada N. The ISO 9000 Certification: Little pain, big gain. European Economic Review, no.105, pp.103-114, 2018.

[5] Hatzikian Y. Exploring the Link between Innovation and Firm Performance. Journal of the Knowledge Economy, vol.6, no.4, pp.749-768, 2015.

[6] Tsung-chun C, Dong-Qiang G, Hsiao-Min C, et al. Effects of R&D Intensity on Firm Performance in Taiwan's Ssemiconductor Industry. Economic Research-ekonmskaIstrazivanja, vol.32, no.1, pp.2377-2392, 2019.

[7] Deng Chao, Zhang Endao, Fan Buqing, et al. Research on Government Subsidy, Ownership Structure and Performance of Small and Medium-Sized Innovation-Oriented Enterprises--An Empirical Test Based on the Heterogeneity of Enterprises. China Soft Science, no.7, pp.184-192, 2019.

[8] Liu Weilli. Research on Quality Economics. Beijing: Social Sciences Academic Press, 2018, pp.1-215.