



The impact of market integration on the quality of export products: A study based on manufacturing enterprises

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Abstract

Since the reform and opening up, China's economic level has been continuously improved, and the manufacturing industry, as one of the three major industries, has also achieved rapid development. Since joining the World Trade Organization (WTO), China's foreign trade has also maintained rapid growth for many years. However, in recent years, China's manufacturing industry has been facing the problem of large but not strong. China's foreign trade also urgently needs to solve the problem of large volume but insufficient competitiveness. The covid-19 trade friction has been escalating, the globalization of globalization and the outbreak of the new crown pneumonia have affected the development of the global economy to varying degrees, and the uncertainty of the international environment has increased. Since 2020, China has proposed to gradually form a new development pattern with the domestic cycle as the main body and the domestic and international double cycles promoting each other, so as to cultivate China's new advantages in participating in international cooperation and competition under the new situation. In such a severe environment, to implement the instructions of the CPC Central Committee, realize the high-quality development of domestic industry and foreign trade, promote market integration and improve the quality of export products is the only way to improve China's comprehensive strength.

Based on this, this paper explores the impact of market integration on the quality of export products and analyzes the impact channels from the enterprise level, and calculates the level of market integration and the quality index of export products by using China Statistical Yearbook, China industrial enterprise database and China customs database. Based on the existing literature, this paper puts forward the following hypotheses: Based on manufacturing enterprises, (1) there is a nonlinear relationship between market integration and export product quality, which is first enhanced and then inhibited, showing an inverted "U" shape. (2) Market integration will improve the quality of export products by promoting human capital. (3) Market integration will affect the improvement of export product quality by promoting scientific research investment. (4) The impact of market integration on the quality of manufacturing export products is significant in non-state-owned enterprises. (5) the impact of market integration on the quality of manufacturing export products is more significant in eastern and western cities. In order to comprehensively test the impact of the above-mentioned manufacturing industry on the quality of China's manufacturing industry, this paper selects 4596 domestic manufacturing enterprises' benchmark and regression data in 2014, and makes an in-depth analysis of the impact of the above-mentioned manufacturing industry on the quality of China's manufacturing industry, In order to provide some theoretical support for improving the quality of China's export products through market integration.

Keywords: Market integration, market segmentation, manufacturing, export product quality, human capital, R&D investment

1. Introduction

1.1 background of topic selection

China is a big trading country with the largest export scale in the world for many years. However, China's exports are mainly based on quantity, while its quality and trade breadth are low (Qian and Xiong 2010). The price and quantity advantages of the "Made in China" label are more due to China's low-wage labor force and environmental resource consumption than

The competitive advantages in technology or product quality. This explains why China's exports are extremely vulnerable to external shocks. Even during the export boom, exports may experience the continuous deterioration of terms of trade (Qian *et al.* 2010), as shown in the United States. Sanctions imposed by the Ministry of Commerce on ZTE and Huawei. Sino-US trade frictions continue, and Chinese enterprises pay more and more attention to the quality of export products. Promoting a strong trade economy should improve the quality of export products. Therefore, it is imperative to enhance the international competitiveness of Chinese brands. As a new research topic in international trade, export quality is of great significance to study and measure the global trade pattern and economic growth.

Since the implementation of reform and opening up in 1978, China's market-oriented reform has made great progress in promoting economic development. At the same time, China's regional market integration has also achieved remarkable results. The Yangtze River Delta is the region with the highest degree of market integration in China (Ke, 2015). Market integration is the core of regional integration, and regional integration strategy has become an important policy tool to promote China's regional coordinated development (Zhang, 2018). In 2010, the Guiding Opinions of the State Council on Further Promoting the Reform, Opening-up and Economic and Social Development in the Yangtze River Delta Region was issued and implemented. This document regards the promotion of regional integration as an important development goal of the Yangtze River Delta region. Subsequently, the Yangtze River Delta region set up the Yangtze River Delta Regional Urban Economic Coordination Committee and other cooperation platforms to promote market integration. In 2018, Shanghai took the lead in Jiangsu, Zhejiang and Anhui provinces to set up the Yangtze River Delta Regional Cooperation Office, contributing to the promotion of high-quality integration in the Yangtze River Delta region.

In order to give play to the large market effect, promote the development of market integration, and promote the rational and free flow of various factors and commodities, the 19th National Congress of the Communist Party of China in 2017 clearly proposed to continue to implement the strategy of coordinated regional economic development in depth. If we want to promote coordinated regional development, we need to break the market segmentation and promote the development of market integration. At present, against the background that the global economy has been seriously impacted by the COVID-19, the economies of all countries have been affected to varying degrees, and the global economic development once stagnated. To a certain extent, this emphasizes the need to break down market segmentation and establish a unified national market, so as to promote the circulation of various factors and commodities and promote the further development of China's economy.

At present, the escalating trade frictions between China and the United States and the rise of anti globalization have made the international situation complex and changeable. Since the outbreak of COVID-19 in 2019, the global economy has been seriously affected. Under such a big environment, how to

improve the quality of export products of China's manufacturing industry with the help of the policies issued by China to promote the development of market integration? This is an important research issue in this paper. At the same time, this paper can not help thinking about the impact of the level of domestic market integration on the quality of export products of manufacturing enterprises? Is there heterogeneity? These problems are also the focus of this paper.

There are relatively few direct studies on market integration and export quality, and they are concentrated at the national level. Therefore, this study uses the data at the enterprise level to build a systematic quality measurement framework, calculates the export product quality at the enterprise level, and empirically analyzes the relationship between market integration and export product quality.

1.2 Research significance

In this paper, the export manufacturing enterprises are taken as the research object, and the influence of market integration on the export product quality of manufacturing enterprises is explored, which provides the experience and basis from China for the research in this field, which has certain theoretical significance. At the same time, according to the empirical results, this paper puts forward targeted policy suggestions, which also has certain practical significance.

1.2.1 Theoretical significance

From the main research content of this paper, based on the description, measurement and cause analysis of the current situation of market integration and export product quality in China, this paper not only considers the influence between market integration and regional disparity from the perspective of inter-region, industry and difference, but also analyzes the influence of market integration on export product quality from the perspective of property right nature difference and time heterogeneity, which enriches the present situation of single research perspective. To a certain extent, this provides many valuable theories for studying the coordinated development of regional economy in China. At the same time, in the research on the relationship between market integration and export product quality, there is often a lack of research and discussion on its theoretical analysis. Therefore, based on the framework of new-new trade theory, this paper puts forward a theoretical analysis of the relationship between market integration and export product quality, which helps to clarify the internal mechanism and influencing factors of China's current regional economic development imbalance, breaks through the limitations of previous studies, and provides certain reference value for related theories.

1.2.2 Practical significance

The report of the 19th National Congress of the Communist Party of China pointed out that China's economy has shifted from a high-speed growth stage to a high-quality development stage. In terms of foreign trade, we must constantly improve the quality of our export products to enhance our export competitiveness. However, in recent years, the international environment has become increasingly

complex and changeable, and the emergence of unfavorable factors such as the tension between China and the United States, the rise of anti-globalization, and the repeated outbreak of the COVID-19 epidemic have led to the restriction of international exchanges, the once-recession of the world economy, and the shrinking of international trade. Under this background, China has put forward a new development pattern with domestic circulation as the main body and domestic and international double circulation promoting each other. Market integration can play the role of the invisible hand of the market, promote the free flow of capital, labor and other factors of production, help promote China's internal circulation, and conform to China's policy requirements well. In view of this, this paper discusses and studies the impact of market integration on the quality of export products, and puts forward targeted policy suggestions to enhance China's export competitiveness by means of market integration. This is of great practical significance for realizing the strategy of strengthening trade power and economic transformation and development under the background of advocating double circulation and the critical period when China's economy is changing from high-speed growth to high-quality development.

In addition, considering that the manufacturing industry is the main body of the national economy, the foundation of building a country, the instrument of rejuvenating the country and the foundation of strengthening the country, building an internationally competitive manufacturing industry is an important starting point to enhance China's competitiveness and promote China to become a world power. Moreover, China has issued a series of relevant policies, emphasizing the importance of manufacturing a strong country and vigorously promoting the development of China's manufacturing industry. Therefore, this paper selects the manufacturing enterprises that export as the research object, which makes the research and policy suggestions put forward in this paper more targeted and practical.

1.3 Innovation and deficiency

1.3.1 Innovation

Within the framework of the new trade theory, this paper will start from the brand-new perspective of export product quality at the enterprise level, and try to analyze the relationship between China's market integration and export product quality in depth. On the basis of measuring the domestic market integration index and the quality of export products, this paper investigates the impact of domestic market integration on the quality of export products of enterprises and the impact mechanism. The possible innovations of this paper are as follows:

1. In the existing literature, few scholars study the impact of market integration on the quality of export products, and most of them study from the macro industrial level. This paper takes the domestic manufacturing enterprises that export as the research object, and systematically studies the impact of domestic market integration on the quality of export products of manufacturing enterprises. The impact from the macro level to the micro level is conducive to a more in-depth analysis of the impact of

market integration on the quality of export products, and further enriches and enriches the empirical evidence in this research field.

2. In order to ensure the rationality and reliability of the empirical results, this paper analyzes the heterogeneity of market integration and export product quality respectively. The scope of investigation is relatively comprehensive, which ensures the reliability and robustness of the conclusion, widens the research depth of the impact of market integration on export product quality to a certain extent, and provides a certain theoretical basis for improving the quality of China's export products with the help of market integration, This makes the policy recommendations put forward in this paper have more practical significance.

1.3.2 Shortcomings

1. The measurement of export product quality is mainly based on China's industrial enterprise database and China's customs database. Due to the limitation of years, the update of some necessary data is lagging behind, so this paper cannot use the latest year's data for research and analysis.
2. In recent years, with the escalating trade frictions between China and the United States and the outbreak of the COVID-19 epidemic, the uncertainty of the international environment has increased, and there is still room for improvement in standardizing and improving the model. At the same time, due to my limited research conditions and capabilities, I can not cover all aspects of market integration.

1.4 Research methods, ideas and technical road map

1.4.1 Research method

Considering the complexity of the problems studied in this paper, relevant theories such as market integration, regional economy and new trade theory will be comprehensively applied. In terms of research methods, the following methods are combined, and the specific contents are as follows:

1. Literature research method. This paper reviewed a large number of literature reviews related to regional development, especially from the perspective of market integration research, through combing and summarizing these documents, the existing research results on the relationship between market integration and export product quality are summarized, and the shortcomings of the existing research are excavated, which is the breakthrough point of this paper. At the same time, this paper combines the relevant theories involved in the previous scholars' research content, and also establishes the main theoretical basis and analytical framework of the content to be studied in this paper.
2. Qualitative analysis. This paper uses new trade theory, new trade theory, location advantage theory and so on the main theory, combined with the actual situation of China's economic development, analyzes the possible internal relationship between market integration and export product quality.
3. Quantitative research method. This paper uses the provincial panel data of 31 provinces in China to

measure the degree of market integration, and then refers to the indicators of export product quality at the enterprise level in relevant studies. Research methods, the main indicators of each province are integrated, and the main conclusions of the article are drawn.

1.4.2 Research Ideas

On the basis of the existing relevant academic research and theory, this paper takes the manufacturing enterprises engaged in export as the research object, deeply studies the impact of China's market integration level on the quality of export products, and puts forward targeted policy recommendations.

The first chapter is the introduction. This part first introduces the research background of this paper, explains the research methods used in this paper, then analyzes the practical and theoretical significance of this paper, points out the innovation and shortcomings of this research, and finally outlines the research content of this paper and makes a technical roadmap to show the research framework of this paper.

The second chapter is literature review. This paper sorts out the literature on market integration and export product quality, and focuses on the definition, influencing factors and measurement methods of market integration, as well as the factors and measurement methods that affect the quality of export products. At the end of this chapter, the literature review is carried out in order to find the breakthrough of this article.

The third chapter is theoretical analysis and research hypothesis. This chapter theoretically explains the influence of market integration on the quality of export products and the channels of influence. On the basis of theoretical analysis and existing literature, this paper puts forward three hypotheses to guide the setting of subsequent empirical models and the development of empirical tests.

The fourth chapter is the analysis of the current situation of market integration and export product quality. This chapter estimates and analyzes the market integration and the quality of export products. First of all, it introduces the measurement methods of the two. Secondly, it makes an overall analysis and classification analysis of their current situation.

The fourth chapter is the model setting, variable selection and description. This paper mainly explores the impact of market integration on the quality of export products. This chapter closely focuses on this theme. On the basis of existing literature, it sets up an empirical model according to the actual situation and the research hypothesis of this paper, introduces in detail the meanings and calculation methods of the explained variables, explained variables, controlled variables and virtual variables in this paper, and introduces the selection and processing methods of data. Finally, descriptive statistics are made on market integration and export product quality respectively.

The fifth chapter is empirical test and analysis. This chapter carries out a comprehensive and systematic empirical test. According to the model set in Chapter 4, it uses Stata statistical software to carry out an empirical analysis to test the research hypothesis proposed in Chapter 2. First, this paper carries out benchmark regression, then intermediary

mechanism test, then heterogeneity test on market integration and export product quality, and finally robustness test and endogenous test.

The sixth chapter is the conclusion and policy recommendations. Based on the empirical results in chapter five and the research hypotheses in chapter two, this chapter sorts out the research conclusions of this paper, and puts forward targeted policy recommendations.

2. Literature review

2.1 Literature review of market integration

2.1.1 Definition of market integration

The concept of "market integration" was first proposed by Vajda (1971) and Machlup (1976), who both believe that market integration means that any element in the market has appropriate liquidity, in which, in addition to the necessary transportation cost, appropriate liquidity refers to the cost beyond the necessary payment (such as the cost of trade barriers and bribery of local protection, market segmentation, concept differences and other transaction costs). Vajda and Machlup put forward the concept of market integration aiming at the flow of production factors between countries. Subsequently, a large number of domestic and foreign scholars limited the concept of market integration to a country (region).

Kumar was the first to study the process of China's market integration. He found that compared with the rapid increase of foreign trade, China's interregional trade volume has decreased, and concluded that China's Interregional market segmentation has increased. Yin Wenquan, Cai Wanru (2001) used the concept of "market segmentation" to define "market integration", but it is only the opposite of "market segmentation". The two are considered to be two different expressions of a problem, that is, they are opposite and related to each other. Yin Wenquan and CAI Wanru (2001) define market integration as the elimination of local market segmentation, in which local market segmentation refers to the behavior of local governments in a certain region of a country to restrict the entry of foreign factors and products into the local market or restrict the flow of local factors and products to other places through tariff adjustment, technical barriers, administrative control and other means in order to safeguard the interests of the region. The definition and connotation of market segmentation are relatively rare in China, and most people think that it is a concept opposite to market integration (i.e. market integration).

China's marketization index was proposed by Chinese scholar Wang and fan (2004). However, the academic community has not formed a unified answer to the measurement standard of market integration. At present, the more recognized definition of market integration in the domestic academic community is proposed by the research group of the development research center of the State Council (2005), that is, market integration refers to the process in which the behaviors of different market players are regulated by the same supply and demand relationship within a region, the market boundaries between regions gradually disappear, and goods and factors flow freely.

In addition, Yin Wenquan, Cai Wanru (2001) and other scholars use the concept of "market segmentation" to define

market integration. They combine the theory with the actual situation of China, and think that although market segmentation is the opposite of market integration, the two can be regarded as different expressions of the same problem, which is the relationship of unity of opposites, that is, the higher the degree of market integration, the stronger the connectivity of the market, and the smoother the flow of production factors. It means that the lower the degree of market segmentation; On the contrary, the lower the degree of market integration, the higher the degree of market segmentation. To measure the level of market integration from the perspective of market segmentation, the consideration is relatively comprehensive, the random impact is avoided, and the measurement result is stable and reliable, so it is widely used by the academic community (GUI qihan and Chen Min, *et al.*, 2006; Liu hongduo, *et al.*, 2013; Liu Qing, *et al.*, 2020; Peng Qiao, Xiao Yao and Chen Hao, 2021, etc.)

Most scholars believe that the core connotation of market integration is to reduce trade barriers, promote the free flow of production factors, and thus realize the rational allocation of resources.

2.1.2 Measurement method of market integration degree

In practical research, how to accurately measure the level of domestic market integration is the most important thing in the study of market integration. From the existing research literature, there are mainly five methods to measure market integration:

2.1.2.1 Production Method

Through literature review, this paper finds that scholars who use this method to measure market integration include Liu Peilin (2005) and Fu Qiang (2017). This method uses data such as output structure and production efficiency to construct indicators such as industry concentration to measure the level of market integration. Although this method is easy to operate and the required data are easy to obtain, there are some problems in this method, such as insufficient indicator representation and inaccurate evaluation results, so few scholars use the production method to calculate.

2.1.2.2 Trade flow Method

Poncet (2003) is the representative scholar who adopts the trade flow method, which reflects the degree of market integration by measuring the trade flow between regions. Compared with other methods, this method is easy to understand and operate, but because there are many factors affecting trade flow, such as economies of scale, government subsidies, etc., it is difficult to exclude the impact of these factors on interregional trade flow, so it is impossible to accurately calculate the level of market integration.

2.1.2.3 Business cycle method

This method takes into account the alternating phenomenon of economic expansion and economic contraction. Although the investigation is relatively comprehensive, in recent years, due to the continuous escalation of Sino US trade frictions and the rise of anti globalization, the world economy

fluctuates frequently, the uncertainty of the international environment increases, and the sudden outbreak of COVID-19 epidemic in 2019 makes the collection of data and the selection of indicators more complex and difficult. Therefore, few scholars have adopted this method in recent years.

2.1.2.4 Questionnaire survey method

The questionnaire survey method adopts the form of issuing questionnaires. Although it can collect first-hand data, it is difficult to collect data, and the amount of effective data obtained is small and subjective. Therefore, no scholar has adopted this method in authoritative journals in recent years.

2.1.2.5 Relative price method

The relative price method is based on the "iceberg cost" theory proposed by Samuelson (1954). This model believes that the goods will lose part in the transportation process, so the prices of the two regions will be different. As long as the ratio of the relative prices of the two regions fluctuates within a specific range, it can be considered that the markets of the two regions are integrated. Parsley and Wei (2001) improved the theory on this basis, used the fluctuation range of relative price to measure the trend of market integration, promoted the improvement of the relative price method, and made the method widely used by the academic community.

The core idea of the relative price method is to analyze the market segmentation situation by using the differences in commodity prices between regions (Sheng bin and Mao Qilin, 2011). This method makes better use of the economic data of price. Compared with the other four methods of measuring market integration, although there may be errors in the aggregation of samples, so that the impact of price differences is overestimated (Broda and Weinstein, 2008), However, the relative price method can more accurately measure the degree of market integration and truly reflect the situation of market integration. It can be considered as the best choice for measuring market integration in the academic community. Therefore, many domestic scholars also use the relative price method to measure the level of market integration in China, such as GUI qihan *et al.* (2006), Xu Baochang and Xie Jianguo (2016), Dou Jianmin and Cui Shuhui (2018) Li Xiaoping and Chen Kan (2018), Xie Shouhong *et al.* (2021), Shi Wei *et al.* (2021), etc.

2.1.3 Economic consequences of market integration

Market integration, as an important guarantee for the smooth circulation of various factors of production both inside and outside the region, has attracted scholars' attention for a long time. Through reading and combing a large number of documents, this paper finds that the economic effect brought by market integration is the research direction of many scholars. In the early literature, scholars have different views on the impact of market integration, which can be divided into the following three categories:

Some scholars believe that the impact of market integration is positive. For example, Zhao and Zhang(2009) ^[27] reached the conclusion that domestic market integration can significantly promote regional agglomeration of manufacturing industry through vertical examination and empirical test of regional agglomeration of manufacturing

industry in China; Qilin (2012) used empirical tests to conclude that domestic market integration has significantly and steadily improved China's export technology level; Huajun *et al.* (2018) believe that market integration helps bring comparative advantages into play, thus promoting coordinated economic development and narrowing the gap between regions.

Most scholars believe that the impact of market integration is not clear. Lu Ming and Chen Zhao (2009) used domestic data to study that market segmentation has an obvious inverted-U-shaped impact on the immediate and future economic development of the region; Based on the new economic geography theory, Wu San busy and Li Shan Tong (2011) concluded that the impact of China's domestic market integration on the geographical agglomeration of manufacturing industry presents an inverted U-shaped relationship; Xu Baochang and Xie Jianguo (2016) empirically concluded that there is an inverse U-shaped relationship between market segmentation and enterprise productivity by using the micro data of Chinese manufacturing enterprises from 1999 to 2007; Shuolin and Tingting (2020) used provincial panel data from 1998 to 2016 to study the impact of commodity market segmentation on regional productivity in an inverted U-shaped relationship.

Few scholars believe that market integration will have a negative impact through research. Xionglang and Guoping (2007) believe that market integration will lead backward regions to lock in traditional industries, thus increasing the economic gap between regions.

In recent years, with the strong support of national policies and the continuous advancement of the process of market integration, the research perspectives of the academic community on market integration have been constantly enriched and innovated. More and more domestic scholars recognize that market integration can have a positive and positive impact on enterprise innovation, export trade, economic growth and so on. Feng Yi and Lian Junhua (2020) concluded through research that the level of market integration has a significant positive effect on the technological innovation of enterprises; Lei Na and Lang Lihua (2020) used the panel data of 30 provinces (excluding Tibet) in China from 2003 to 2016 to study that domestic market integration can significantly promote the improvement of export technology complexity, and the effect is increasing with the passage of time; Wu Qunfeng *et al.* (2021) took market accessibility as the research perspective and concluded that domestic market integration would significantly improve the export probability and export value of enterprises; Gan Qinghua and Chen Shumei (2021) used panel data of 30 provinces in China from 2000 to 2018 to study that market integration can promote regional economic growth by improving the rationalization, upgrading and ecological level of regional industrial structure.

However, after consulting the literature in GF, this paper found that in the existing research, few scholars directly explored the impact of market integration on the quality of export products, and there was no completely consistent conclusion. Liu Xinheng (2020) from the perspective of market segmentation, using data from 2000 to 2006, explored the impact of market segmentation on the quality of export

products from the enterprise level, and concluded that domestic market segmentation is at the cost of giving up the scale effect of domestic market, and using the scale effect of foreign market to promote the upgrading of the quality of export products of enterprises. This conclusion is significant and stable; Qiang Yongchang and Yang hangying (2021) took cities in the Yangtze River Delta as research objects and empirically tested the data from 2006 to 2015 to conclude that market integration will have a U-shaped direct effect on the quality of export products in the region.

2.2 literature review of export product quality

2.2.1 Sorting of documents related to export product quality

The quality of export products is an important indicator of a country's international competitiveness and economic development level (Yu and Zhang, 2017). For a long time, China's exports have paid more attention to "quantity" than "quality". Testing the rationality of the export-oriented strategic development model and overcoming the "middle-income trap" depend on the rapid expansion of export scale, and the key to achieving this goal depends on the quality of export products (Zhang, Zheng and Zhai 2014). Most of the current literature focuses on how to accurately measure product quality (Feenstra and romalis 2014; Khandelwal, Schott., and Wei 2013) and how to study the influencing factors and improvement mechanisms of product quality from the perspective of Microeconomics (MANOVA and Zhang 2012; Zhang, Zheng., and Zhao 2014).

Early studies replaced product quality with product price (Li Wei and song 2014; short 2004). The logic is that the unit price of high-quality products is also high. However, this method ignores some influencing factors, such as the heterogeneity of enterprise productivity and production costs. The paper believes that price differences are caused by quality differences, but they do not separate price from quality (Yu and Zhang, 2017). Subsequently, some scholars use specific product characteristics to measure product quality and construct quality variables. A typical approach is to control product quality differences by introducing variables related to specific product characteristics, such as automobile engines (Chen and Juvenal 2018; Goldberg and verboven 2001). This method is more scientific and accurate in quantifying product quality, but it needs high-quality data, so it is difficult to expand. In recent years, scholars mainly use the regression reasoning method of demand information to measure product quality. By eliminating price and other non quality factors in demand, surplus equals product quality (Khandelwal, Schott., and Wei 2013; Xu, Mao., and Hu 2017). We also use this method to measure the export product quality of Chinese enterprises from 2000 to 2013. As for the research on the factors affecting the quality of export products and the promotion mechanism, the existing literature mainly focuses on OFDI (Jing and Li 2016), credit constraints (fan *et al.*, 2015), government subsidies (Zhang, Chen and Luo 2015), minimum wage (Xu and Wang 2016), trade Liberalization (fan *et al.*, 2015), RMB exchange rate fluctuations (Zhang and Ji, 2018) and other factors affecting the quality of export products.

For a long time, China has relied on its labor advantages to

occupy a position in the global value chain. However, with the continuous increase of labor costs, the appreciation of RMB and other factors, the price competitiveness of China's export products is declining day by day, so it is urgent to improve the competitiveness of China's export products. Therefore, more and more scholars begin to study how to improve the quality of our export products so as to improve our export competitiveness. Through literature review, it is found that many domestic and foreign scholars study the factors affecting the quality of export products. In this paper, the factors affecting the quality of export products are summarized as internal factors and external factors of enterprises or industries.

From the internal perspective of an enterprise or industry, R & D level, technological innovation ability, enterprise ownership and so on are important factors affecting the product quality of an enterprise. Shuolin, Tingting (2020) and other scholars have concluded through research that R & D level can significantly promote the quality of export products; Zhong and Wanqing (2021) obtained from empirical tests that independent innovation and imitation innovation have a significant promoting effect on the quality of export products of the manufacturing industry, and independent innovation promotes the quality of import and export products by optimizing the industrial structure and improving the level of service of the manufacturing industry; Fenglong and Kangning (2016) used econometric models to measure China's manufacturing export data, and found that the quality index of technology intensive industries was slightly higher than that of capital - and labor-intensive industries, and the quality ladder of technology intensive industries was longer and the quality ladder of labor-intensive industries was shorter.

From the external perspective of enterprises or industries, foreign scholars mostly carry out research from the perspective of export destination countries and tariffs. Hallak (2006) thinks through research that the improvement of the market size, per capita income and capital and technology intensive level of export destinations will help to improve the quality of export products; Amity and Khandelwal (2013) believe that tariff reduction can achieve "better than better" and "worse": that is, it can significantly improve the quality of export products of products with better quality, but can not help products with poor quality to improve the quality of export products; Maria and Vanessa (2015) found that the reduction of import tariffs led China to import more high-quality intermediate products and improve the quality of export products. Compared with the research of foreign scholars, domestic scholars mostly study from market scale, government subsidies, industrial agglomeration and other factors. Shi Benye and Wang Xiaojuan (2019) concluded that only when a country's economic freedom level reaches a certain threshold can the domestic market scale significantly promote the quality of export products; Zhang Yang (2017), Hu Guoheng and Yue Qiaoyu (2021) concluded through empirical research that government subsidies can only significantly improve the quality of export products of some enterprises, such as private enterprises, general trade enterprises and enterprises with high financing constraints, which can not significantly improve all enterprises; Su Danni

et al. (2018), Li Ruiqin and Wen Jun (2021), Wang Shengbo and Yan Xiaochang (2021) concluded that industrial agglomeration can significantly improve the quality of export products of Chinese enterprises through research at the enterprise level.

2.2.2 Measurement of export product quality

In the field of academic research, there are already relatively mature measurement methods for the quality of export products. Through literature review, it is found that there are four common measurement methods, each with its advantages and disadvantages and applicability. Details are as follows.

2.2.2.1 Unit value method

The unit value method takes the unit price of trade products as the measurement standard of product quality. Generally speaking, the price of products with higher quality is also higher, so hallak (2006) and others believe that the unit value of products can be used as a proxy variable of quality. Through literature review, it is found that Schott (2004) is the most influential one among the documents using the unit value method. This document uses the import decile data of the United States to measure the difference in the unit value of export products from various countries to the United States, and substitutes it for the product quality; Shi bingzhan, Wang Youxin and Li kunwang (2013) used this method to measure the quality of China's export products. In addition, scholars such as Hummels and Klenow (2005), MANOVA & Zhang (2009) ^[27], Liu Xiaoning and Liu Lei (2015) have adopted this method.

Although the unit value method is convenient, the use of this method must satisfy that the higher the quality of the product, the higher the price must be, that is, the impact of price and quality on product demand cannot be separated. However, in reality, prices not only reflect quality, but also include labor, transportation, storage and other costs. At the same time, the impact of exchange rate, government subsidies, market segmentation and other factors cannot be excluded. Khandelwal (2010) found that not all products are suitable to use the unit value method to measure the quality of export products. If the correlation between price and quality is low, it is not suitable to use price to measure the quality of export products.

2.2.2.2 Product feature measurement method

Product feature measurement measures the quality of a product by designing specific indicators according to its own performance. Auer and Chaney (2009) used the characteristic parameters of different brands of vehicles (such as engine horsepower, displacement, etc.) as the core indicators to measure the quality of vehicles. Chen and Juvenal (2016) used the ratings of various red wines as quality indicators.

Product feature measurement method sets specific indicators for specific products, which can reflect product quality more objectively and accurately. However, this method is only applicable to products with obvious characteristics, and it is difficult to collect data, so it is not universal. Therefore, few scholars use this method to measure the quality of export products.

2.2.2.3 Supply and demand information estimation method

The supply and demand information estimation method measures quality from the two perspectives of supply and demand, internalizes product quality, and considers it more comprehensively. It provides a new idea for measuring product quality. Feenstra and Romalis (2014) use the UN COMTRADE database, use the demand function under the constraint of budget minimization, and assume the cost function that depends on product quality and input cost. According to the principle of enterprise profit maximization, through the aggregation of supply and demand information, we can obtain the expression of quality at the national product level.

2.2.2.4 Demand information extrapolation method

Based on the theory that the demand for products is determined by quality and price, the demand information extrapolation method can reflect the quality after removing the influence of price. Therefore, it uses the optimization of consumer demand to extrapolate the quality and express the quality as a measurable variable.

2.2.3 Factors affecting export product quality

On the factors affecting the quality of export products. Many scholars have discussed the influencing factors of export product quality from the aspects of trade liberalization, foreign direct investment and government subsidies (MANOVA and Zhang, 2012^[21]; Shi Bingzhan and Shao Wenbo, 2014; BAS and Strauss Kahn, 2015). Sun Churen *et al.* (2014) used China's urban data from 2000 to 2006, and Liu Hongduo *et al.* (2016) used China's inter provincial panel data from 2002 to 2011. Both found that industrial agglomeration promoted the improvement of China's regional export product quality.

The production of high-quality products can be regarded as a prerequisite for export success and economic development (Amiti and Khandelwal, 2013). However, at the national level, there are direct studies on the quality of the system and the quality of export products. Berkowitz, Moenius and Pistor (2006) found that countries with relatively high institutional quality tend to export highly complex products, while imported products are less complex. Similarly, Nunn (2007) measured the contract strength of the industry and found that countries with higher system quality achieved more exports in industries with higher contract strength, reflecting comparative advantage. Ara (2013) found that northern countries with higher system quality accounted for a larger share in the export of system quality intensive products.

However, these documents all use macro aggregation data at the regional level of export product quality, ignoring the heterogeneity of export product quality among different enterprises, which may lead to aggregation errors. This paper improves the previous practice and uses enterprise level data to measure the quality of export products.

2.3 Literature review

In recent years, with the rapid growth of export trade, whether the quality of export products can be improved has become a hot issue for many scholars. In addition, Sino US trade friction and the outbreak of COVID-19 have led to instability in the international situation. Under this background, China has vigorously promoted dual cycle development, and market integration has also become a research hotspot of scholars. With more and more domestic and foreign scholars studying

market integration and export product quality, the research on these two aspects is becoming more and more comprehensive. Through combing the above documents, we can find that the academic community has a relatively comprehensive definition, research direction and measurement methods for market integration, and can use the opposite of market integration - market segmentation to measure the level of market integration in the region; For the study of export product quality, there have been extensive research and clear measurement methods in China. At present, some scholars have published research on the impact of market integration on the quality of export products in authoritative journals. The measurement method is scientific, and the conclusion of empirical testing is significant and stable. However, there is still room for improvement and improvement in the research on the impact of both. Based on the comprehensive literature review, this paper believes that the following aspects can be further supplemented:

Most of the scholars who study the quality of export products measure the quality of export products from the provincial level and the industrial level, and few scholars pay attention to the enterprise level.

Due to China's vast territory, there are indeed certain differences in the development of the East, the middle and the West. In addition, in 2018, the integration of the Yangtze River Delta became a national strategy and the state vigorously promoted the construction of the Guangdong, Hong Kong and Macao Bay area. Many scholars only focused on the market integration level of the Yangtze River Delta, the Pearl River Delta, Beijing Tianjin Hebei and other typical regions. Few scholars studied the overall integration level of China, and few scholars conducted comprehensive heterogeneity analysis.

There are relatively few literatures on the impact of market integration on the quality of export products, and the breadth and depth of exploration need to be further improved.

In view of this, based on the existing relevant academic research and theory, this paper further explores the impact of market integration on the quality of export products, in order to broaden the research perspective and add research ideas.

(3) Current situation analysis of market integration and export product quality

In this chapter, first of all, according to the research on the impact of market integration on the quality of export products in this paper, the data at the provincial level and the enterprise level are selected to measure the current level of market integration and the quality of export products in China, and the calculated results are analyzed in detail. Secondly, the calculated results are integrated and observed in terms of time, industry, nature of property rights and geographical range, so as to seek the possible theoretical relationship between them. When analyzing the measurement results of indicators, according to the scope of research, this paper integrates the measurement results of each province into indicators of the East, central and western regions, and presents them in the form of trend charts.

3 Measurement and current situation analysis of market integration

3.1 Calculation method of market integration

Based on the practices of Parsley and Wei (1996), Sheng Bin and Mao Qilin (2011), the relative price method is used to measure China's market integration level from 2006 to 2017. First, this paper constructs a three-dimensional model based

on the relative price method ($t \times m \times k$) panel dataset, where T represents year, M represents region and K represents commodity. This paper selects 10 years of data from 2006 to 2017, covering 10 categories of goods in 31 provinces, cities and autonomous regions across the country, that is, $10 \times 31 \times 10$ three-dimensional panel data is constructed. The data comes from the link price index (CPI) data in China Statistical Yearbook.

Due to the consideration of data consistency, availability and reliability of results, the data of Hong Kong, Macao and Taiwan are not sufficient in the selection of regions, so they are not taken into account in this paper. In the selection of commodity categories, the 10 categories of commodities selected in this paper are grain, meat and poultry and their products, aquatic products, beverages, tobacco and alcohol, clothing, shoes and hats, textiles, household appliances and audio-visual equipment, cultural office supplies, daily necessities and fuel. The data comes from China Statistical Yearbook over the years.

First, measure the relative price. Since the original data is the link index of the retail price of commodities, the relative price is measured in the form of logarithmic first-order difference of the price ratio, which is expressed as:

$$\Delta Q_{ijt}^k = \ln\left(\frac{P_{it}^k}{P_{jt}^k}\right) - \ln\left(\frac{P_{it-1}^k}{P_{jt-1}^k}\right) = \ln\left(\frac{P_{it}^k}{P_{it-1}^k}\right) - \ln\left(\frac{P_{jt}^k}{P_{jt-1}^k}\right) \quad (1)$$

Where i and j represent regions. In order to avoid affecting the relative price variance due to the different placement order of the two regions $\text{var}(\Delta Q_{ijt}^k)$, take the absolute value of the relative price to obtain:

$$|\Delta Q_{ijt}^k| = \left| \ln\left(\frac{P_{it}^k}{P_{it-1}^k}\right) - \ln\left(\frac{P_{jt}^k}{P_{jt-1}^k}\right) \right| \quad (2)$$

Based on the practices of Sheng bin and Mao Qilin (2011) and considering the situation of the whole domestic market, this paper pairs 30 provinces. According to formula (2), combining the data of 435 pairs of provinces and cities combined by 30 provinces and cities from 2006 to 2017 and the data of 10 categories of commodities, we can get x differential forms of relative prices $|\Delta Q_{ijt}^k|$.

Secondly, due to $|\Delta Q_{ijt}^k|$ can't simply reflect the changes caused by reasons other than the commodity itself, so we must eliminate these errors caused by fixed effects related to the characteristics of the commodity itself. In this paper, the de-mean method proposed by Parsley and Wei (2001) is used

for reference: suppose $|\Delta Q_{ijt}^k| = \alpha^k + \varepsilon_{ijt}^k$. α^k is the price change caused by some characteristics of the K-class commodity itself, while ε_{ijt}^k is related to the special market environment of i and j.

To eliminate the fixed effect α^k , we should calculate the average value $|\Delta Q_{ijt}^k|$ of the relative price $|\Delta Q_t^k|$ between 435 pairs of provinces and cities in a given year t and a certain kind of commodity k, and then subtract the average value from these 435 $|\Delta Q_{ijt}^k|$ respectively. From this, we can get:

$$q_{ijt}^k = \varepsilon_{ijt}^k - \bar{\varepsilon}_{ijt}^k = |\Delta Q_{ijt}^k| - |\Delta Q_t^k| = (\alpha^k - \bar{\alpha}^k) + (\varepsilon_{ijt}^k - \bar{\varepsilon}_{ijt}^k) \quad (3)$$

Among them, in formula (3), q_{ijt}^k represents the part of the relative price change, which is only related to market segmentation factors among regions and some random factors.

Firstly, calculate the variance $\text{var}(q_{ijt}^k)$ of the relative price

fluctuation q_{ijt}^k of 10 kinds of commodities between every two regions, then calculate the relative price variance of 435 pairs of provinces and cities in the sample period, and merge them according to the provinces and cities, so as to obtain the market segmentation index $\text{var}(q_m) = \frac{(\sum_{i \neq j} \text{var}(q_{ijt}^k))}{N}$ between

each province and the rest of the country, where n represents the region and N represents the number of merged provinces and cities.

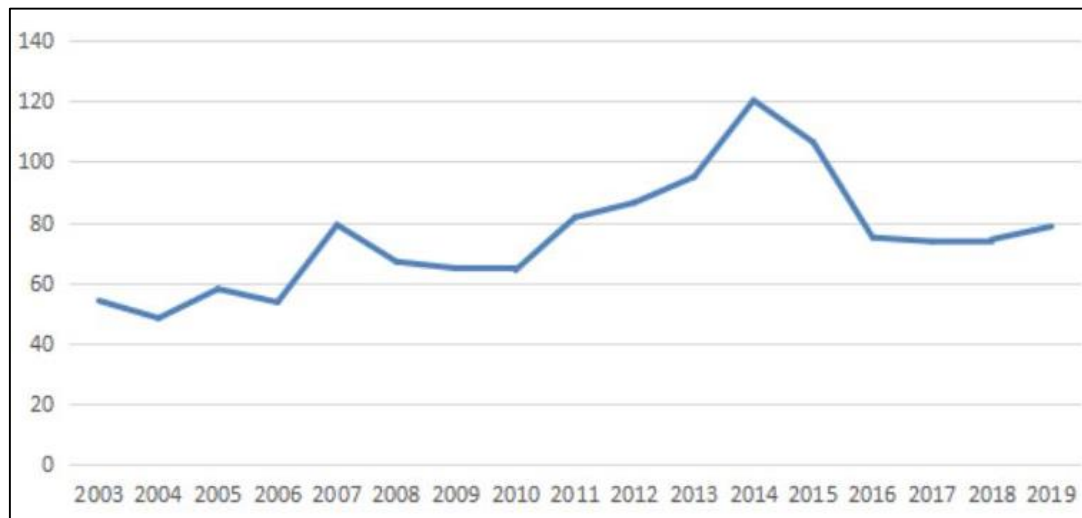
If $\text{var}(q_m)$ is smaller, it means that the fluctuation range of the relative price is smaller, indicating that the market is tending to integrate and the level of market integration is improving; otherwise, it means that the level of market integration is decreasing.

Finally, the market integration index is calculated. Market integration and market segmentation are opposite to each other, that is, they are in reverse change relationship. The market integration index integ is as follows:

$$\text{integ}_{it} = \sqrt{\frac{1}{\text{var}(q_{nt})}}$$

3.2 Analysis of the current situation of market integration

In this paper, the national market integration index can be obtained according to the market integration index at the provincial level. In order to analyze the trend of market integration in China, it is drawn in Figure 1.



Source: calculated by the author according to the matching between industrial enterprise database and customs database

Fig 1: China's market integration trend from 2003 to 2019

It can be seen from the above figure that the level of integration of China's product market is constantly improving. According to the development trend, it can be divided into two stages with 2009 as the boundary. Before 2009, the commodity market segmentation index fluctuated violently and obviously; After 2009, the commodity market segmentation index began to show a steady and gradual decline, and gradually stabilized. After 2012, it basically

fluctuated around 0.0002. From a local perspective, in 2001, the commodity market segmentation index reached the highest value of 0.0013, and then began to decline year by year. It only increased slightly in 2004, 2009 and 2015 (on the basis of the previous year). This shows that China's commodity market segmentation is improving, the market is gradually integrating, and the level of domestic commodity marketization has been greatly improved.

Table 1

Ranking of commodity market segmentation index by province from 2004 to 2013						
Province	2004-2013 average	Ranking	2004	Ranking	2013	Ranking
Fujian	0.000258	16	0.000182	31	0.000108	14
Jiangsu	0.000167	31	0.000216	30	0.000123	9
Heilongjiang	0.000221	23	0.000247	29	0.000117	11
Guangxi	0.000314	9	0.000253	28	0.000109	13
Gansu	0.000234	20	0.000253	27	0.000099	19
Hubei	0.000193	29	0.000255	26	0.000078	31
Sichuan	0.000292	12	0.000262	25	0.000461	1
Henan	0.000208	25	0.000268	24	0.000091	23
Ningxia	0.000253	17	0.000272	23	0.000155	4
Yunnan	0.000295	11	0.000282	22	0.000131	7
Jilin	0.000268	15	0.000282	21	0.000082	28
Shandong	0.000194	28	0.000292	20	0.000086	27
Beijing	0.000315	8	0.000301	19	0.000107	15
Anhui	0.000191	30	0.000303	18	0.000098	20
Liaoning	0.000230	21	0.000308	17	0.000100	18
Jiangxi	0.000198	26	0.000309	16	0.000120	10
Guizhou	0.000291	14	0.000312	15	0.000087	25
Shanghai	0.000398	3	0.000320	14	0.000102	16
Guangdong	0.000216	24	0.000321	13	0.000098	21
Hunan	0.000227	22	0.000375	12	0.000146	6
Qinghai	0.000409	2	0.000381	11	0.000152	5
Hebei	0.000196	27	0.000382	10	0.000093	22
Chongqing	0.000303	10	0.000401	9	0.000253	2
Shaanxi	0.000249	18	0.000442	8	0.000087	26
Shanxi	0.000243	19	0.000457	7	0.000101	17
Tibet	0.000345	7	0.000487	6	0.000079	30
Xinjiang	0.000361	4	0.000510	5	0.000088	24
Hainan	0.000354	5	0.000641	4	0.000110	12
Zhejiang	0.000292	13	0.000739	3	0.000128	8
Inner Mongolia	0.000349	6	0.000879	2	0.000081	29
Tianjin	0.000444	1	0.001385	1	0.000200	3

According to the average value from 2003 to 2013, the three regions with the most serious commodity market segmentation are Tianjin, Qinghai and Shanghai. Among them, Tianjin tops the list, ranking fourth, fifth and sixth respectively in Xinjiang, Hainan and Inner Mongolia. The reason is that geographical location is an important factor that determines the degree of integration of commodity markets. Qinghai, Xinjiang, Inner Mongolia, Hainan and other places have complex terrain, inconvenient transportation conditions, and the circulation of goods has been greatly hindered, resulting in a large market segmentation index. Therefore, the degree of market integration is low, and the factor resources have not been fully utilized. The three provinces with low market segmentation are Jiangsu, Anhui and Hubei, indicating that these provinces have a high degree of marketization. It is worth mentioning that Beijing, which is located at the intersection of the Beijing Tianjin Hebei Urban Agglomeration and the Bohai Sea economic circle, also ranks among the top in Tianjin's market segmentation index, which makes people suspect that geographical location is not the only factor affecting the market segmentation, and policy factors may also affect the market segmentation in the province. Further exploring the market segmentation of each municipality directly under the central government, we find that Beijing, Tianjin, Shanghai and Chongqing rank 8, 1, 3 and 10 in turn, which to a certain extent proves that while the special administrative status of municipalities directly under the central government gives these provinces a lot of convenience, it also inevitably causes the phenomenon of market segmentation.

Analyze the market segmentation of each province in 2003. Among the top provinces, Tianjin is a municipality directly under the central government, and Inner Mongolia, Hainan and Xinjiang are due to their relatively remote geographical location. The lower five provinces are Fujian, Jiangsu, Heilongjiang, Guangxi and Gansu.

Further analyze the market segmentation of each province in 2013. The top 5 regions in the market segmentation index are Sichuan, Chongqing, Tianjin, Ningxia and Qinghai. Among the top 5 cities, Chongqing and Tianjin are municipalities directly under the central government, while Sichuan, Ningxia and Qinghai are due to their relatively remote geographical locations. Therefore, the rationality of the above conjecture is verified again. Geographical location and policy advantages are factors that affect the segmentation of the commodity market. The lower ranking individual regions are Hubei, Tibet and Inner Mongolia.

It is concluded that, to some extent, as time goes on, municipalities directly under the central government, while enjoying the policy convenience, have also recognized the existence of market segmentation. Because the degree of market segmentation will lead to the low degree of market integration, these cities have taken some measures to improve this phenomenon. We found that except for Jiangsu, most of these lower ranking provinces are relatively backward in economic development and relatively remote in geographical location. This may be because these local governments have greater decision-making power in the degree of opening up of local commodity markets. In order to promote the development of industries in the province, they may take some measures to attract goods from outside the province, so that the market segmentation is weak. It can not be denied that the local governments of the top provinces are also facing the problem of economic backwardness, but instead of

opening up to promote development, they put the protection of industrial development in the province first, resulting in intensified market segmentation.

In conclusion, the production of high-quality products can be regarded as a prerequisite for export success and economic development (Amiti and Khandelwal, 2013).

3.3 measurement and analysis of export product quality

3.3.1 Measurement methods of export product quality

This paper derives the quality of export products by referring to the theoretical model of Hallak and Sivadasan (2009). Assuming that the utility function is in the form of constant substitution elasticity (CES), it is deduced that:

$$q_j = p_j^{-\sigma} \lambda_j^{\sigma-1} \frac{E}{P} \quad (1)$$

Where, λ_j and q_j represent the quality and quantity of product categories respectively, σ represents the substitution elasticity among product categories ($\sigma > 1$), and E is the consumer expenditure (1). Formula (1) indicates that in the vertically differentiated product market, consumption depends on product quality and price.

Referring to Gervais (2009), mark *et al.* (2012) and Joel (2011), the measurement model is constructed according to formula (1). For the HS code of a product under the customs octave code, the export volume of enterprise i to country m in year t can be expressed as:

$$q_{imt} = p_{imt}^{-\sigma} \lambda_{imt}^{\sigma-1} \frac{E_{mt}}{P_{mt}} \quad (2)$$

Take the logarithm on both sides to obtain the regression equation of export product quality at the product level:

$$\ln q_{imt} = \chi_{mt} - \sigma \ln p_{imt} + \varepsilon_{imt} \quad (3)$$

Where, $\chi_{mt} = \ln E_{mt} - \ln P_{mt}$ represents the importing country-year two-dimensional virtual variable, and $\ln p_{imt}$ represents the price of the enterprise's export products. ε_{imt} is the residual term containing product quality information. Since this paper measures the export product quality at the enterprise level, the formula for measuring the quality of a certain HS product exported by each enterprise in each market in each year is obtained by referring to the method of Bingzhan (2013):

$$quality_{imt} = \ln \lambda_{imt} = \frac{\varepsilon_{imt}}{(\sigma-1)} = \frac{\ln q_{imt} - \ln q_{imt}}{(\sigma-1)} \quad (4)$$

Normalize formula (4) to obtain the standardized quality indicators of each enterprise in each product, year and market:

$$r\text{-quality}_{imt} = \frac{quality_{imt} - \min quality_{imt}}{\max quality_{imt} - \min quality_{imt}} \quad (5)$$

Min and max represent the minimum and maximum values, respectively. Add the quality at the product level to the enterprise level, and finally get the export product quality at the enterprise level:

$$TQ = \frac{v_{imt}}{\sum_{imt \in \Omega} v_{imt}} \times r - quality_{imt} \quad (6)$$

Where TQ is the quality of export products at the enterprise level, and v_{imt} is the export value at the enterprise level.

3.3.2 Analysis of the quality of export products

The measurement of the quality of China's export products is mainly based on two databases: the Chinese industrial enterprises database and the customs database. Due to the limitation of years, the time span of most of the studies is 2000-2006. Yu miaojie and Zhang Rui (2017) used the supply and demand information aggregation method to measure that the absolute quality level of China's manufacturing exports increased by 15% from 2000 to 2006, and the quality level of exports to high-income countries was higher. Other scholars mostly adopt the demand information inference method and get different results. It is generally believed that the overall quality of China's manufacturing export products has improved (Shi bingzhan and Shao Wenbo, 2014; Shi bingzhan and Zeng Xiangfei, 2015).

China's rapid economic development and the rapid growth of its total foreign trade import and export volume have had little impact on the global trade pattern at the beginning. By 2013, China has become the "largest country in Global trade in goods". According to customs statistics, in 2014, China's total import and export value was 26.43 trillion yuan, an increase of 2.3% year-on-year; In 2015, the total import and export volume of goods trade was 24.59 trillion yuan, a decrease of 7.0% over the previous year, of which exports were 14.14 trillion yuan; In 2016, China's total import and export value of goods was 24.33 trillion yuan, down 0.9% from 2015. Among them, exports were 13.84 trillion yuan, imports were 10.49 trillion yuan, and trade surpluses were 3.35 trillion yuan. From the perspective of segmented industries, manufacturing is still the main force driving GDP growth (see Figure 3-2 for indicators in the sample period of this study). However, the specific export products and their quality can not be visually displayed in the existing official data. In fact, the quality of export products is a direct factor that determines the competitiveness of a country's export products. In terms of export product structure, we have gradually shifted from a single traditional manufacturing industry to a medium and high-tech industry, and our export products have realized the transformation from quantitative change to qualitative change. These achievements have a great relationship with the evolution of China's foreign trade policy and the enhancement of economic strength. In recent years, China has paid more attention to the transformation and upgrading of export trade, improved the international competitiveness of products, and realized the transformation from a "trading power" to a "trading power". Generally speaking, the quality of China's export products has shown an increasing trend.

3.3.3 Development status of China's manufacturing export

In recent years, China has paid more attention to the transformation and upgrading of export trade, improved the international competitiveness of products, and realized the transformation from a "trading power" to a "trading power". In the past few decades, China's manufacturing industry has made remarkable achievements. Since 2010, the total output value of China's manufacturing industry has always ranked first in the world. At the same time, China has formed a complete and competitive industrial cluster. Although China is now the largest manufacturing economy in the world, its manufacturing industry still depends on the import of technology and equipment. How to optimize the structure of manufacturing industry and cultivate innovation ability has become the key issue of sustainable development of manufacturing industry in China.

At present, China's manufacturing industry still relies on importing core technologies and equipment. The defects of industrial structure and the lack of high-quality talents are two major obstacles restricting the development of its manufacturing industry. How to optimize the structure of the manufacturing industry, cultivate innovation capabilities and improve the quality of export products (Lei, Liu, Qi and Zhang, 2019; Lei, Zhang and Qi, 2020) is a key issue for the sustainable development of China's manufacturing industry. Then, in the situation of intensified international competition, especially the contradiction between the rising cost of various domestic factors of production and China's current trade model, to make China occupy a favorable position in international competition and maintain the steady growth of export trade volume, improving the quality of export products will be the top priority. Therefore, it is necessary to further study the quality of export products. As the main component of China's export, the changing trend and influencing factors of export product quality of manufacturing industry will inevitably become the main content of discussion.

4. Theoretical analysis and research hypothesis

The influence of the degree of market integration on the quality of export products can be explained by the following theories. Foreign scholars have studied the quality of export products in theory.

Traditional international trade theory believes that natural resources, labor, capital and other factors give countries trade advantages. This in turn affects a country's trade volume, trade structure and trade benefit distribution pattern. However, the differences between countries are reflected in the quality of endowments and institutions. In addition to the rapid development of institutional economics, the impact of institutions on international trade has also received increasing attention. Existing studies believe that institutions play a role in trade volume and trade structure by reducing transaction costs and promoting technological innovation (Levchenko, 2007).

The new trade theory. It was not until the late 1970s that the new trade theory, represented by the Krugman model with increasing returns to scale and imperfect competition as the basic assumptions, came into being that the international trade literature combined the industrial organization theory with the international trade theory, and began to

systematically discuss the different welfare connotations and policy implications contained in different cost additions. The main assumption of the empirical model and normative model of the new trade theory is that a single factory is a national enterprise: an enterprise is a unit that produces a product at one place. In 1979, Paul R. Krugman's new trade theory proposed that the basis of intra industry trade of final products is enterprise scale economy and consumer preference diversification. The new trade theory of Krugman (1979) and the endogenous growth theory of Romer (1986) support the proposition that foreign trade promotes economic growth from a dynamic perspective.

Location advantage theory location theory was first proposed by Marshall and Weber. After its development, location advantage has been used by some scholars to explain the problem of "where" foreign direct investment. The location advantage theory believes that cities often originate from some unique geographical conditions, such as being close to rivers, ports or transportation hubs with convenient transportation. The advantage of transportation costs makes the region gather more economic activities and population.

Alfred Marshall, as a representative of the regional advantage theory, has made important contributions to the industrial agglomeration of the location theory: first, labor sharing; Second, the sharing of intermediate products; Third, technology spillover, and A. Weber further complemented the type of agglomeration, formation mechanism and competitive advantage. Paul Krugman and Michael Porter are the founders of the current location theory. Their main viewpoints are: industrial agglomeration is the focus of modern location theory, which can generate economies of scale and form huge Competitiveness: enterprises established in the early stage can have positive externalities for enterprises in the later stage, while enterprises with excessive "degree" may also have negative effects. The theory of location advantage holds that the important influencing factor of foreign direct investment is location factor. A country or region with better location advantage is more attractive to foreign direct investment

Melitz (2003) created a new trade theory, which emphasizes the heterogeneity of production efficiency among enterprises, and believes that only enterprises with high production efficiency can export. In recent years, some scholars have introduced the quality difference into the "new and new trade theory" (also known as the manufacturer heterogeneity trade theory), linking the productivity difference between manufacturers with the product quality difference of manufacturers, believing that manufacturers with high productivity are more able to bear the high cost of producing high-quality products, and will export higher quality products (quality sorting), and the export price is higher. Based on the new trade theory, enterprises with higher productivity will be able to overcome the fixed cost of imports and make international seeking decisions, while enterprises with lower productivity will choose domestic seeking more (Melitz, 2003). According to the new trade theory, only enterprises with high labor productivity and good profitability will choose to export, and the wages paid by these enterprises are often higher than those for domestic consumption. This paper will combine the new trade theory to analyze the decisive role of enterprise characteristics on the quality of imported products, and further study the micro mechanism of Chinese enterprises to improve the quality of imported products. According to the new trade theory, products are exported by

enterprises, and the factor intensity of a country's export products is mainly determined by the factors used by its export enterprises. The traditional trade theory does not consider the subject of trade, that is, enterprises, so it only analyzes international trade from the perspective of the country's factor endowment or comparative advantage, while the new trade theory further goes into the micro enterprise subject to analyze the impact of enterprise heterogeneity on international trade. Xinxin trade theory not only explains why enterprises export from the micro level, but also finds that international trade plays a significant role in the reallocation of resources among enterprises in the industry.

At present, more and more scholars begin to pay attention to the quality of export products, especially in the development stage of new and new trade theory. Thanks to the continuous optimization of mathematical models, many foreign scholars try to explain new phenomena of international trade and explore the internal mechanism of export product quality upgrading from the perspective of export product quality. Based on the new trade theory framework, this paper explores the influencing factors and determining mechanism of export product quality from the micro level. The quality of export products of enterprises has gradually become a frontier research field of new new trade theory.

This section uses the new trade theory and mathematical model to demonstrate that market integration affects the quality of export products. In terms of upgrading the quality of export products, the "new and new trade theory" mainly focuses on the quality of export products, the complexity of export technology, the measurement of export product types and influencing factors. Hallak, Sivadasan (2009), Krugler, Verhoogen (2012), Khandelwal (2010) and others, within the framework of the new and new trade theory, used the heterogeneous enterprise dynamic model to study the decision mechanism of the quality of export products of enterprises, and finally proposed a counterfactual reasoning method. This method assumes that both the quantity and quality of products can bring utility to consumers, and introduces quality into the constant substitution elastic utility function (CES), so as to measure the quality of export products.

When the degree of market integration is low, the market segmentation between regions is more serious. The flow of economic factors among regions is blocked, and the spatial mismatch of resources is prominent. Market segmentation intensifies competition among regions and makes it difficult to reach agreement on environmental laws and regulations. In order to stimulate economic growth, local governments do not hesitate to sacrifice the ecological environment and lower the threshold of environmental supervision and law enforcement. The low degree of market integration hinders the upgrading of product exports, resulting in the decline of export product quality.

Higher market integration is conducive to improving industrial specialization and division of labor among regions. Higher market integration also promotes the diffusion and spillover effects of technological innovation and regional technical cooperation. Local protectionism and market segmentation make it difficult for new energy-saving and emission reduction technologies to be applied and popularized in the market. This is conducive to the improvement of energy utilization efficiency (Chen and Huang, 2014), thus promoting the upgrading of export product quality and accelerating the interregional factor flow.

When the market integration appears extreme value, the market integration of a country or region is very large, which will bring certain disadvantages. The extremely high market integration makes countries and regions outside the region face higher barriers and greater protectionism, which makes it more difficult to enter the market. Or the original market share is transferred to other countries in the region where the production efficiency is not the highest in the world or the cost is not the lowest. This is called trade transfer. At the same time, the export of domestic products is hindered, resulting in the decline of the quality of exported products. The extremely high level of market integration has also placed the trade of developing countries in an even more unfavorable position. On the one hand, the relative competitiveness is weaker; On the other hand, some companies that want to enter the integrated regional market have changed the original way of investing in developing countries' production and re export trade into direct investment and production in the region in order to circumvent barriers. Extremely high market integration is not conducive to the construction of multilateral integration. In the WTO, the principle of multilateralism is not applicable to the trade policies of EU countries, that is to say, their mutual preferences are not enjoyed by other member states.

From the above documents, it can be seen that high or low market integration will inhibit economic development. Proper market integration can promote the quality of export products. Therefore, hypothesis 1 is obtained as follows.

Hypothesis 1: under the control of other variables, market integration has a promoting effect on the quality of export products, and with the strengthening of market integration, its promoting effect on export products of enterprises gradually weakens, that is, market integration has an inverse U-shaped relationship with the quality of export products of enterprises. Human capital is defined in the Oxford English dictionary as "the skills possessed by the labor force and regarded as resources or assets". It emphasizes investment in people (such as education, training, health) and the concept that these investments can improve individual productivity.

In industries with high human capital levels, employees in the industry must have high academic qualifications or must undergo strict professional training before taking up their posts, which is very important for upgrading the quality of export products. At the same time, a higher level of human capital can reduce the learning time of workers, improve the speed of technology adoption, and contribute to the deepening of labor division and the improvement of production efficiency. Therefore, human capital contributes to the improvement of the quality of export products. Chen Fenglong and Xu Kangning (2016) found that human capital and openness are conducive to improving the quality of export products. Qu Ruxiao and Zang Rui (2019) believe that independent innovation is the main driving force to improve the quality of export products, and human capital and technology spillover can improve the quality of export products to a certain extent, but the degree of financing constraint has an inverted U-shaped impact on product quality (Zhang Jie, 2015). The accumulation of "quantity" and the improvement of "quality" of human capital of enterprises lay a human capital foundation for the quality upgrading of export products by promoting the technological progress of enterprises. At the same time, a higher level of human capital can reduce the learning time of workers, improve the speed of technology adoption, and contribute to

the deepening of labor division and the improvement of production efficiency (costinot, 2009). Therefore, human capital contributes to the improvement of the quality of export products.

There are many literatures that show that the improvement of human capital of enterprises is conducive to the upgrading of the quality of export products of enterprises, and the degree of market integration will promote the improvement of human capital. This paper makes the following conjecture.

Hypothesis 2: Based on manufacturing enterprises, market integration will promote the quality upgrading of import and export products by enhancing human capital.

When the level of market integration is high, the flow of factors among regions will be more free, the degree of market integration and economic development dependence between regions will be higher, the degree of coordination of economic development among regions will be higher, and new energy-saving and emission reduction technologies can be rapidly promoted and applied across regions. Duanmu *et al.* (2018) believe that a high degree of market integration and market competition is conducive to the development of technology intermediary markets and the role of technological innovation in energy conservation and emission reduction.

The low level of market integration leads to problems such as insufficient product market competition and asymmetric information. Enterprises lack product innovation vitality and motivation, which is not conducive to quality improvement, thus inhibiting residents' willingness to consume. Enterprises are also unwilling to put more energy into R & D investment. However, a higher level of market integration can expand the potential scale of the market, stimulate the vitality of market competition, promote product innovation, bridge the gap between product supply and consumption preferences, and better meet the diversified needs of consumers. At this time, enterprises are very motivated to invest in scientific research. When the degree of market integration is high, because the market competition of domestic and foreign-funded products is very fierce, in order to survive, objectively it will strongly stimulate domestic enterprises to expand R & D investment to drive the improvement of export product quality.

The research of Shi bingzhan and Shao Wenbo (2014) shows that the increase of R & D investment can promote the upgrading of export product quality of enterprises. Li Huaijian and Shen Kunrong (2015) found that scientific and technological R & D investment had a positive impact on the improvement of export product quality through the inspection of transnational panel data. For every 1% increase in scientific and technological R & D, the quality of export products improved by 0.098% (Hu Lili, 2015).

A large number of documents show that the increase of R & D investment is conducive to stimulating innovation and improving the level of science and technology, which is conducive to the improvement of the quality of export products. To improve the quality of export products, it is necessary to increase R & D investment and improve the skill level of employees (Kugler & verhoogen, 2012). Many evidences show that the R & D investment of developed countries is far higher than that of China, and such a large R & D investment gap with developed countries is bound to greatly affect the quality level of China's export products. Therefore, China should invest a lot in scientific research and development to promote the quality of import and export products.

In short, market integration will lead to more intense

competition in the product market, thus prompting enterprises to increase R & D investment, so as to improve the difference between their own products and (foreign) competitors, and thus promote the improvement of the quality of export products of enterprises (Bastos and Straume, 2012). Hypothesis 3: Based on manufacturing enterprises, market integration will affect the improvement of export product quality by promoting scientific research investment.

5 Model setting and variable selection

5.1 Model setting

5.1.1 Benchmark model

In order to study the relationship between export product quality and domestic market segmentation, this paper builds the following econometric model with reference to the research of Liu Xinheng (2020):

$$TQ_{it} = \alpha + \beta \cdot \text{int} eg_{ijt} + \delta \cdot X_{it} + \eta_i + \varphi_j + \lambda_t + \varepsilon_{ijt}$$

Where, i represents the enterprise, j represents the province or city, and t represents the time. The explained variable represents the export product quality of enterprise i in period t . The core explanatory variable represents the integration index of each market. The core explanatory variable $\text{int} eg_{ijt}$ represents the integration index of each market. X_{it} is the control variable, η_i is the fixed effect of enterprises, φ_j is the fixed effect of provinces or cities, λ_t is the time fixed effect, and ε_{ijt} is the random error term.

5.1.2 Intermediary effect model

This paper uses the intermediary effect test method of Huang Shenlin and Yao Tingting (2020) for reference to test the intermediary mechanism of market integration affecting the quality of export products. The mediation mechanism test model is as follows:

$$TQ_{it} = \alpha + \beta \cdot \text{int} eg_{ijt-1} + \delta \cdot X_{it} + \eta_i + \varphi_j + \lambda_t + \varepsilon_{ijt}$$

$$M_{it} = \alpha + \beta \cdot \text{int} eg_{ijt-1} + \delta \cdot X_{it} + \eta_i + \varphi_j + \lambda_t + \varepsilon_{ijt}$$

$$TQ_{it} = \alpha + \beta \cdot \text{int} eg_{ijt-1} + \delta \cdot X_{it} + \theta \cdot M_{it} + \eta_i + \varphi_j + \lambda_t + \varepsilon_{ijt}$$

Where, i represents the enterprise, j represents the province or city, and t represents the time. It refers to intermediary variables, including human capital and R & D investment.

M_{it} represents an intermediary variable, including human capital and R & D investment.

5.2 Research design

In order to further explore the relationship between market integration and export product quality from an empirical perspective, this chapter will select the panel data of Chinese manufacturing enterprises from 2004 to 2013 to build relevant empirical models, and carry out benchmark regression, robustness test, intermediary mechanism and heterogeneity analysis in turn.

5.2.1 Variable description

1. Core variable

The explained variable of this paper is the quality of export products of enterprises, and the core explained variable is market integration. For the sake of robustness, during the benchmark regression, the export product quality is subject to a tailing treatment of 5%.

2. Mediating variable

This paper selects human capital and R & D investment as two intermediary variables.

Human capital: the human capital referred to in this paper is mainly at the level of education. Referring to Wang Jingwen and Wang Mingyan (2019), this paper defines human capital as the average number of years of Education (years) of employed people. Specifically, the illiterate, primary school, junior high school, high school, college, undergraduate, postgraduate, secondary vocational school and higher vocational school are assigned 0, 6, 9, 12, 15, 16, 19, 12 and 15 respectively. The proportion (%) of employed persons with no schooling, the proportion (%) of employed persons with primary school education, the proportion (%) of employed persons with junior high school education, the proportion (%) of employed persons with secondary vocational education, the proportion (%) of employed persons with higher vocational education, the proportion (%) of employed persons with high school education, the proportion (%) of employed persons with college education The percentage of employed persons with undergraduate education (%) and the percentage of employed persons with graduate education (%). The data of human capital is calculated according to the formula $H = (0h_1 + 6h_2 + 9h_3 + 12h_4 + 12h_5 + 15h_6 + 15h_7 + 16h_8 + 19h_9) / 100$, where h_i ($i = 1, 2, 3, 4, 5, 6, 7, 8, 9$) respectively represents the proportion of the total labor force of those who have not attended school, primary school culture, junior high school culture, secondary vocational education culture, high school culture, higher vocational education culture, college culture, university undergraduate culture and graduate culture.

Research and development investment (R & D): this indicator is expressed by the ratio of the industry's R & D expenditure to the industry's total industrial output value. Among them, the data of R & D investment comes from China Science and technology statistical yearbook, while the data of total industrial output value of the industry comes from China Industrial Economic Statistical Yearbook.

3. Control variable

The control variables selected in this paper include: ① the company scale is expressed by the natural logarithm of the company's total assets. ② The age of the company is expressed by the natural logarithm of the observation year minus the year of establishment of the company plus 1. ③ Return on assets (ROA). This is the relevant financial ratio reflected by the enterprise's financial data, which indicates the profitability of the enterprise's future cash flow and solvency. ROA refers to the return on assets, which is the net profit of the company in the previous year divided by the total assets at the end of the year above. ④ Financial leverage (rdebt) is measured by the company's total asset liability ratio.

⑤ Financing constraint (FIC) is measured by referring to the measurement method of Lu Shengfeng and Chen Sixia (2017), that is, expressed by the logarithm of the absolute value of the enterprise SA index. ⑥ Inventory intensity is the ratio of net inventory value to total assets.

5.2.2 Data sources

The rapid development of manufacturing industry has become the focus of China's economic transformation. This paper empirically analyzes the panel data of 31 provinces (cities) of Chinese manufacturing enterprises from 2004 to 2013, with a total of 594,596 research samples. The original data of market integration measured in this paper according to the needs are all from the consumer price index (CPI) in China Statistical Yearbook. This data completely covers eight categories of goods of residents in 31 provinces, autonomous regions and municipalities from 2006 to 2017. It

is a continuous data with three dimensions of time t , city i/j and commodity type K .

Among them, the enterprise level control variables such as R & D investment, company size, company age, return on assets and financial leverage are derived from China industrial enterprise database, China Statistical Yearbook and China Science and technology statistical yearbook.

5.2.3 Descriptive statistics and correlation analysis

The descriptive statistics of the data are shown in Table 3.1. The maximum and minimum values of standardized export product quality are 0.401 and 0.943, respectively, with a large difference. The minimum value and maximum value of market integration are 3.165 and 4.732 respectively, indicating that the gap of market integration between different cities is obvious. The correlation coefficient test (see Table 1) shows that there is no multicollinearity.

Table 2: Descriptive statistics

	(1)	(2)	(3)	(4)	(5)
Variable	Sample size	Minimum value	Maximum	Median	Standard deviation
Quality	594,596	0.401	0.943	0.714	0.107
Market	594,596	3.165	4.732	4.276	0.271
Scale	594,596	7.849	14.869	10.746	1.449
Age	594,596	0.000	3.850	2.122	0.648
ROA	594,596	-0.234	0.909	0.083	0.166
Rdebt	594,596	0.023	1.370	0.553	0.272
Fic	594,596	0.000	0.729	0.192	0.163
Humancapital	594,596	2.025	2.475	2.234	0.097
RD	594,596	3.165	7.305	5.859	0.923
Invint	594,596	0.000	0.744	0.199	0.161

Table 3: Correlation Analysis

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) quality	1.000						
(2) Market	0.192***	1.000					
(3) scale	0.217***	0.154***	1.000				
(4) age	0.097***	0.126***	0.264***	1.000			
(5) roa	0.025***	0.108***	-0.064***	-0.018***	1.000		
(6) rdebt	-0.011***	-0.012***	-0.011***	-0.026***	-0.228***	1.000	
(7) fic	-0.019***	0.018***	-0.047***	0.002	0.003**	0.132***	1.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

5.3 Empirical results and analysis

5.3.1 Benchmark regression results and related explanations

The regression results in Table 3 show that the larger the enterprise is, the older the enterprise is, and the two are significantly positively related to the quality of export products at the level of 1%. The higher the return on assets, the higher the quality of export products. The effect of financial leverage is not significant. Financing constraints show a significant level of positive correlation at the level of 1%.

After introducing the secondary term of export product quality (c.market # c.market), we find that the relationship

between market integration and export product quality is positively correlated in the primary term (0.0486 * * *) and negatively correlated in the secondary term (- 0.0061 * * *). That is to say, there is an "inverted-U" relationship between market integration and export product quality. That is to say, with the increase of market integration, the quality of export products will increase correspondingly, but after reaching a certain degree, the quality of export products will decline with the increase of market integration.

Generally speaking, with the strengthening of market integration, its positive impact on the improvement of export product quality gradually weakens, and turns into a negative impact.

Table 4: Benchmark regression estimation results (inverse U-test)

VARIABLES	(1)	(2)
Market	0.0486***	0.0534***
	(6.73)	(7.45)
c. Market# c. Market	-0.0061***	-0.0066***
	(-6.75)	(-7.37)
Scale		0.0169***
		(79.72)
Age		0.0039***
		(10.72)
ROA		0.0211***
		(27.50)
Rdebt		0.0008
		(1.57)
FIC		0.0202***
		(24.82)
Constant	0.5539***	0.3585***
	(38.25)	(24.67)
Observations	594,596	594,596
R-squared	0.247	0.260
Firm FE	YES	YES
Year FE	YES	YES
Hausman	0.0000	0.0000

T-statistics in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

5.3.2 Robustness check

Change measurement method

Chen Min *et al.* (2007) confirmed that the impact of market integration on macro-economy not only exists in the current period, but also in the future. This section examines whether the integration of market integration will have a long-term impact on the quality of export products by lagging explanatory variables in different periods. Refer to the practice of Lu Ming and Chen Zhao (2009). Columns (1) - (3) of Table 4 empirically test the explanatory variables in the following year, two years and three years respectively, and the control variables in the current period. It can be found from the table that the impact of market integration on the quality of export products lags behind by one year, two years and three years respectively, and the coefficient value is relatively stable, which also verifies hypothesis 1. The

significance of the market integration index has gone through a decreasing process, and has lost its statistical significance since the lag of the second period, but its coefficient direction has changed from positive to negative, further verifying the inverse U-shaped curve.

Then observe the control variables. The company size has statistical significance in the next one to three years, and the coefficient is positive, indicating that the influence of the company size on the quality of export products will still exist in the future. Company age and company size reached the same conclusion.

In a word, models (1) - (6) reasonably verify hypothesis 1 above, that is, market integration not only affects the quality of export products in the current period, but also affects the quality of export products in the future.

Table 5: Influence of explanatory variable lag on export product quality

	(1)	(2)	(3)	(4)	(5)	(6)
	Explanatory variable lag			All variables lag		
VARIABLES	L.quality	L2.quality	L3.quality	L.quality	L2.quality	L3.quality
L.Market	0.0004*			0.0008*		
	(0.56)			(1.15)		
L2.Market		-0.0005			-0.0001	
		(-0.69)			(-0.18)	
L3.Market			-0.0010			-0.0008
			(-1.16)			(-0.98)
scale	0.0122***	0.0090***	0.0060***			
	(47.32)	(29.26)	(16.21)			
age	0.0087***	0.0103***	0.0112***			
	(16.43)	(14.67)	(12.28)			
roa	0.0058***	-0.0003	-0.0012			
	(6.38)	(-0.32)	(-0.96)			
rdebt	-0.0017***	-0.0033***	-0.0041***			
	(-2.62)	(-4.42)	(-4.59)			
fic	0.0091***	0.0038***	0.0016			
	(9.47)	(3.35)	(1.21)			
L.scale				0.0159***		

				(64.39)		
L.age				0.0046***		
				(11.26)		
L.roa				0.0225***		
				(25.46)		
L.rdebt				0.0016***		
				(2.59)		
L.fic				0.0197***		
				(21.14)		
L2.scale					0.0161***	
					(55.30)	
L2.age					0.0054***	
					(11.91)	
L2.roa					0.0241***	
					(23.20)	
L2.rdebt					0.0030***	
					(4.16)	
L2.fic					0.0197***	
					(18.42)	
L3.scale						0.0151***
						(43.82)
L3.age						0.0052***
						(10.20)
L3.roa						0.0261***
						(21.14)
L3.rdebt						0.0033***
						(3.92)
L3.fic						0.0195***
						(15.87)
Constant	0.5070***	0.5407***	0.5721***	0.4725***	0.4736***	0.4864***
	(125.74)	(114.43)	(101.43)	(122.60)	(109.35)	(97.74)
Observations	414,819	311,251	238,764	414,819	311,251	238,764
R-squared	0.331	0.371	0.400	0.337	0.379	0.408
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

T-statistics in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

5.3.3 Impact mechanism analysis

5.3.3.1 Human capital

Market integration enhances the positive correlation with export product quality by increasing human capital.

Higher human capital can reduce the learning time of workers, improve the speed of technology use, and help to deepen the division of labor and improve production efficiency. Therefore, human capital helps to improve the quality of export products.

Developed countries are rich in human capital, high in labor productivity and high in wage level, so they have a comparative advantage in terms of higher production costs, higher labor productivity and higher quality products, so developed countries will tend to export high-quality products in large quantities. With the rapid improvement of science

and technology and the gradual weakening of production advantages, the quality of export products provided by developed countries will be constantly upgraded.

The test results of mediation mechanism are shown in Table 5. Column (1) shows the benchmark regression results. Looking at column (2) of the table, we add the intermediary variable of human capital, and find that human capital will reduce the degree of market integration, and the impact on the quality of export products is significantly positive. It indicates that market integration will suppress the quality of export products by suppressing human capital, and hypothesis 2 is verified.

With the continuous improvement of human capital in China, it is an inevitable trend to upgrade the quality of export products.

Table 6: Analysis of intermediary mechanism results - Human Capital

VARIABLES	(1) quality	(2) humancapital	(3) quality
Market	0.0534*** (7.45)	0.0303*** (129.99)	0.0566*** (7.89)
humancapital			0.0338*** (8.25)
c.Market#c.Market	-0.0066*** (-7.37)		-0.0069*** (-7.68)
scale	0.0169*** (79.72)	0.0025*** (31.80)	0.0168*** (79.24)
age	0.0039***	0.0012***	0.0038***

	(10.72)	(8.98)	(10.61)
roa	0.0211***	0.0029***	0.0210***
	(27.50)	(10.47)	(27.37)
rdebt	0.0008	0.0014***	0.0008
	(1.57)	(6.91)	(1.49)
fic	0.0202***	-0.0027***	0.0203***
	(24.82)	(-9.05)	(24.94)
Constant	0.3585***	2.2651***	0.2777***
	(24.67)	(1,816.57)	(15.85)
Observations	594,596	594,596	594,596
R-squared	0.260	0.844	0.260
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

T-statistics in prenteses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

5.3.3.2 R & D investment

Further, we introduce the second variable R & D investment into the intermediary mechanism. Column (2) of table 6

indicates that market integration will enhance R & D investment and thus promote the quality of import and export products. Hypothesis 3 is verified.

Table 7: Analysis of intermediary mechanism results - R & D investment

VARIABLES	(1) quality	(2) rd	(3) quality
Market	0.0534***	0.0804***	0.0524***
	(7.45)	(84.04)	(7.30)
rd			-0.0016
			(-1.59)
c.Market#c.Market	-0.0066***		-0.0065***
	(-7.37)		(-7.19)
scale	0.0169***	0.0079***	0.0169***
	(79.72)	(24.76)	(79.73)
age	0.0039***	0.0079***	0.0039***
	(10.72)	(14.53)	(10.75)
roa	0.0211***	0.0300***	0.0211***
	(27.50)	(26.05)	(27.54)
rdebt	0.0008	0.0000	0.0008
	(1.57)	(0.05)	(1.57)
fic	0.0202***	-0.0103***	0.0202***
	(24.82)	(-8.45)	(24.80)
Constant	0.3585***	4.1791***	0.3673***
	(24.67)	(817.64)	(23.63)
Observations	594,596	594,596	594,596
R-squared	0.260	0.976	0.260
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

T-statistics in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

5.3.4 Heterogeneity analysis

5.3.4.1 Heterogeneity of enterprise property rights

Due to the differences in resource allocation and organizational structure, market integration has different effects on the export products of manufacturing enterprises with different property rights. In order to verify the listing analysis, we identified the ownership of enterprises and constructed a sample of state-owned enterprises and a sample of non-state-owned enterprises (private enterprises, foreign-funded enterprises, Hong Kong, Macao and Taiwan enterprises, etc.), as shown in Table 7. By comparing the coefficient of export product quality in different groups, it is found that the coefficient of export product quality in the group of state-owned enterprises is -0.0028, and the coefficient of product quality in the group of non-state-owned enterprises is 0.0573 * * *. That is to say, the "inverted U" type is significant in non-state-owned enterprises, but not in state-owned enterprises. This is completely consistent with

the conclusion of model (1). That is to say, the impact of the degree of market integration on the quality of export products is most significant for non-state-owned enterprises, but not for state-owned enterprises. This also shows that most of the reasons for the high quality of export products of non-state-owned enterprises in China are not due to government policies or their own support, but due to the pressure of market competition faced by enterprises.

In general, with the strengthening of the degree of market integration, the positive impact of non-state-owned enterprises on the improvement of export product quality gradually weakens, and turns into a negative impact. In state-owned enterprises, this effect is not significant, which may be due to political factors. This may be because, on the one hand, non-state-owned enterprises are less restricted by macro-control in the process of production and operation, so as to adapt to the development of the market faster. This is the reason why the quality of export products of non-state-

owned enterprises is outstanding.

Table 8: heterogeneity of property rights

	(1)	(2)
VARIABLES	State-Owned	Non state owned
	quality	quality
Market	-0.0028	0.0573***
	(-0.07)	(7.86)
c.Market#c.Market	-0.0004	-0.0071***
	(-0.08)	(-7.73)
scale	0.0203***	0.0168***
	(13.28)	(78.74)
age	0.0019	0.0042***
	(1.27)	(11.12)
roa	0.0526***	0.0206***
	(6.91)	(26.89)
rdebt	0.0031	0.0008
	(0.84)	(1.50)
fic	0.0200***	0.0202***
	(2.72)	(24.83)
Constant	0.4090***	0.3522***
	(5.05)	(23.83)
Observations	22,340	572,256
R-squared	0.199	0.263
Firm FE	YES	YES
Year FE	YES	YES

T-statistics in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

5.3.4.2 Industry heterogeneity

We divide the industry into labor-intensive and capital intensive. Labor intensive industries mainly include the following industries: a agriculture, forestry, animal husbandry and fishery; B extractive industries; C 0 food and beverage; C 1 textile, clothing and fur; C 2 wood and furniture; D production and supply of electricity, gas and water; E construction industry; F transportation and

warehousing; H; L; M comprehensive.

Capital intensive industries include the following: C 3 paper making and printing; C 4 petroleum, chemistry, plastics, plastics C 6 metal and non-metal J real estate K social services.

It can be seen from table 8 that the impact of market integration on the quality of export products is significant at 1% in both labor-intensive and capital intensive industries.

Table 9: Analysis of industry heterogeneity

	(1)	(2)
Variables	labor intensive	Capital intensive
	quality	quality
Market	0.0595***	0.0443***
	(5.51)	(4.63)
C.Market#c.Market	-0.0074***	-0.0054***
	(-5.50)	(-4.53)
Scale	0.0149***	0.0185***
	(48.61)	(63.06)
Age	0.0036***	0.0043***
	(7.07)	(8.49)
Roa	0.0178***	0.0251***
	(17.07)	(22.57)
Rdebt	0.0007	0.0013*
	(0.89)	(1.74)
Fic	0.0217***	0.0187***
	(18.31)	(16.73)
Constant	0.3927***	0.3385***
	(17.93)	(17.42)
Observations	262,095	332,501
R-squared	0.255	0.266
Firm FE	YES	YES
Year FE	YES	YES

5.3.4.3 Time heterogeneity analysis

Further, we did heterogeneity analysis according to different time periods. It is divided into two samples: 2004-2007 and

2008-2013. It can be seen that the global financial crisis that broke out in 2008 had a significant negative impact on the world economy, and the global value chain trade system was

also affected, resulting in a change in the structure of export product quality.

Table 10: Time heterogeneity analysis

	(1)	(2)
	2004-2007	2008-2013
VARIABLES	quality	quality
Market	0.1085*** (10.68)	0.0065 (0.35)
c.Market#c.Market	-0.0145*** (-10.77)	-0.0006 (-0.26)
scale	0.0158*** (39.12)	0.0150*** (49.97)
age	0.0016*** (2.84)	0.0170*** (23.55)
roa	0.0266*** (18.62)	0.0195*** (20.10)
rdebt	-0.0005 (-0.57)	0.0023*** (3.27)
fic	0.0148*** (11.71)	0.0178*** (15.91)
Constant	0.2855*** (14.42)	0.5119*** (13.05)
Observations	226,942	367,654
R-squared	0.372	0.025
Firm FE	YES	YES
Year FE	YES	YES

5.3.4.4 Heterogeneity in different regions

There is no doubt that due to the objective existence of geographical location, infrastructure construction, factor of production investment and policies, there are huge differences in economic development between different regions. Whether these differences will have an impact on the relationship between market integration and the quality of export products of enterprises is also a question worth considering. Due to the differences in geography, history, culture, economic development and government intervention, China has a vast territory, which leads to great differences in the quality of institutions in different regions (Zhang, Li, and Liu 2010). Therefore, we must ask some questions: will the differences in system quality between regions affect the quality of export products?

In order to explore this problem, the dummy variable samples in the East, West and central regions were constructed respectively for regression. The estimation results are shown in the following table.

The results show that the enterprises in the West are larger

than those in the East and the middle. The performance of enterprises in Central China is the worst, showing no significance. This is because enterprises in the eastern region are close to the coastline, with developed water transportation facilities and a large number of ports. It has built a convenient transportation network, has a unique geographical location, and most of the eastern region implements the economic opening policy. In the face of domestic market segmentation, the convenience and feasibility of using foreign intermediate inputs are higher than those of enterprises in other regions, and enterprises in the central and western regions do not have these advantages. Therefore, the positive impact of market segmentation on the quality of export products of enterprises in these regions is not very obvious. And the central region not only lacks the advantaged geographical location and economic policy advantages, but also lacks the administrative advantages that the government vigorously supports the western region. By contrast, it is not enough in the impact of commodity market segmentation on the quality of enterprises' export products.

Table 11: Regional heterogeneity analysis

	(1)	(2)	(3)
	East	West	Central section
Variables	quality	quality	quality
Market	0.0552*** (7.58)	0.1660** (2.04)	0.1017 (1.08)
c.Market#c.Market	-0.0070*** (-7.60)	-0.0195* (-1.96)	-0.0120 (-1.08)
scale	0.0172*** (78.39)	0.0120*** (7.02)	0.0153*** (16.05)
age	0.0039*** (10.29)	0.0011 (0.45)	0.0042*** (2.96)
roa	0.0222*** (27.79)	0.0138** (2.25)	0.0112*** (3.74)
rdebt	0.0004 (0.71)	0.0001 (0.03)	0.0064*** (2.66)
fic	0.0203***	0.0070	0.0204***

	(24.63)	(0.92)	(4.66)
Constant	0.3564***	0.1557	0.2466
	(24.23)	(0.93)	(1.22)
Observations	539,022	16,821	38,753
R-squared	0.271	0.162	0.175
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

T-statistics in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

6 Research conclusions and policy recommendations

6.1 Research conclusion

This paper analyzes the impact mechanism of market integration on the quality of export products, and empirically tests the relationship between market integration and the quality of export products using the data of micro enterprises and provincial data in China. The results show that:

(1) market integration can promote the quality of export products, and with the strengthening of the degree of market integration, its role in promoting the export products of enterprises gradually weakens, that is, the relationship between market integration and the quality of export products of enterprises is inverted U-shaped. That is to say, higher market integration will promote the improvement of export product quality. However, extreme market integration (very high or very low) will inhibit the quality of export products. A new discovery of this paper is that when the degree of market integration is relatively low or too high, the agglomeration generated by market integration is relatively limited, which restricts the development of export product quality.

(2) Market integration will promote the quality upgrading of import and export products by enhancing human capital.

(3) Market integration will affect the improvement of export product quality by promoting scientific research investment. In addition, the impact of market integration on the quality of export products is not significant in state-owned enterprises. These conclusions lead to the following policy implications. First, the improvement of market integration has a positive effect on improving the quality of China's export products and building a powerful trade country to a certain extent. Therefore, we should pay full attention to the impact of market integration on the quality of export products, further deepen the reform of economic and political systems, and provide a good institutional environment for improving the quality of China's export products. And expand the positive impact of cost effect and competition effect on the quality of export products of enterprises. Second, the quality of institutions in different regions varies greatly. The degree of market integration of Shanghai, Beijing, Tianjin and Chongqing is far higher than that of other provinces. For those provinces that have reached a higher degree of market integration earlier, the policy must optimize the business environment in Central China at the same time, establish and improve market integration, stimulate the market role of enterprises, change the development mode, and fully realize the system dividend, so that there will be no great difference in the degree of market integration among central, Western and eastern China. Third, adhere to opening up and actively integrate into the global industrial chain. Since reform and opening up, China has actively participated in the global trade division system, and the scale of trade and the quality of export products have improved simultaneously. Many enterprises have changed from pursuers to leaders, and the

discourse power of the industry has been continuously improved. At the same time, with the deepening of the global value chain division of labor system, the trade between countries is no longer dominated by final products, and the international division of labor is increasingly refined. Under such circumstances, we should continue to open up to the outside world, integrate with international standards, and on this basis, promote enterprises to actively go out, actively integrate into the global industrial chain, and constantly improve the product quality of enterprises.

China is in the critical period of moving from a trading power to a trading power. In the context of the international situation full of uncertainty caused by the escalating trade frictions between China and the United States and the outbreak of the COVID-19 epidemic, it is imperative to promote the domestic cycle to drive the international cycle and improve the quality of export products. On the basis of combing the relevant literature and theories, this paper discusses the impact of market integration on the quality of export products, calculates the level of market integration in China by using the data from 2004 to 2013, calculates the quality of export products by using the data from China's industrial enterprise database and customs database, tests the impact of market integration on the quality of export products of manufacturing enterprises by building an empirical model, and further adopts the heterogeneity analysis Robustness test and endogenous test. Finally, the significance of mediating variables is tested by using the mediating effect model.

6.2 Significance

6.2.1 Theoretical Significance

These conclusions have important policy significance for promoting regional market integration and export product quality. First, when the degree of market integration exceeds a certain critical level, the quality of export products will change and produce side effects. Therefore, decision makers should further promote the process of market integration and strengthen the role of market integration in the optimization of factor space allocation. The government should strengthen the coordination of environmental policies, environmental regulatory standards, environmental legislation and industrial planning, and strictly implement the coordination and implementation of export product quality policies.

6.2.2 Practical Significance

In particular, in the process of promoting local market integration, we should also support and cooperate with the market integration of neighboring regions. Regional planning and inter regional industrial planning should be linked up to gradually eliminate the market segmentation effect.

6.2.3 Limitations

This study also has the following limitations: first, this study is based on market segmentation data at the provincial level,

and lacks research on a smaller spatial scale. However, from the perspective of space, China's market integration and market segmentation are also worth studying.

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