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Study on the Impact of CAFTA Trade in Services Liberalization on the Servitization of Inputs in Chinese Manufacturing Industry

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Abstract

With Chinese deepening participation in international regional economic integration, the input of regional service intermediates has increasingly become an important factor driving the servitization development of Chinese manufacturing industry. Taking the upgraded liberalization of trade in services under the China-ASEAN Free Trade Area (CAFTA) as an example, this paper proposes a theoretical analysis and foundational hypotheses on how regional trade in services liberalization affects the servitization of manufacturing inputs from the perspective of production factor mobility and conducts an empirical analysis. The results show that reducing service trade barriers within the CAFTA region and expanding trade in services liberalization contribute to promoting the servitization of inputs in Chinese manufacturing sector. Mechanism testing reveals that CAFTA trade in services liberalization enhances the servitization of manufacturing inputs by facilitating the free flow of production factors such as physical capital, human capital, and technology. Based on this analysis, the paper suggests policy recommendations for enhancing the servitization level of Chinese manufacturing industry under the CAFTA 3.0 upgrade framework by deepening service trade cooperation and expanding openness.

Keywords

CAFTA; Trade in Services Liberalization; Servitization of Inputs in Chinese Manufacturing Industry; Production Factors.

1. Introduction

Currently, the "service-oriented economy" is gradually emerging as a new trend in global economic development, progressively replacing the traditional "industrial-oriented economy." An increasing number of firms are incorporating complementary service elements into their product supply processes to enhance product value. This practice of integrating service intermediates into the production process is referred to as "servitization."[1].The incorporation of service intermediates into production not only enhances the level of servitization but also significantly improves labor productivity in the manufacturing sector. This allows products to stand out in homogeneous competition, extend their life cycles, and help enterprises cope with intense market competition while creating new competitive advantages. Moreover, compared to physical goods, services typically offer higher profit margins and span the entire lifecycle of a product, providing enterprises with a long-term and stable stream of profits.

Although Chinese manufacturing industry is vast in scale, its overall level of development remains relatively low, and it has long been positioned at the lower end of the global value chain. Promoting the servitization of manufacturing has become one of the key pathways for its transformation and upgrading. Service intermediates used in manufacturing, especially those originating from regional sources, have become increasingly important as Chinese participation in regional economic integration deepens. According to calculations based on the EORA

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database, the annual growth rate of domestic service inputs in Chinese manufacturing industry is 9.55%, while the annual growth rate of foreign service inputs is 9.74%. Notably, the annual growth rate of service inputs from ASEAN reaches 12.56%, significantly higher than that of domestic and other foreign sources. This indicates that ASEAN's contribution to service inputs in Chinese manufacturing industry is growing rapidly, with its share steadily increasing and its importance gradually rising.

In the context of Chinese manufacturing industry urgently needing transformation, upgrading, and the promotion of servitization, the continued development of CAFTA trade in services has provided critical support for enhancing the level of servitization in Chinese manufacturing sector and will exert a profound impact. Currently, the CAFTA 3.0 upgrade negotiations are underway, with the deepening of trade in services liberalization being a key aspect. Accelerating the liberalization of CAFTA trade in services and reducing trade barriers will facilitate the freer flow of production factors such as capital, labor, and technology within the region. This will also accelerate the free trade of service intermediates across the region, providing Chinese manufacturing sector with a wealth of service intermediates from ASEAN to support its servitization transformation. Therefore, analyzing the impact of CAFTA trade in services liberalization on the servitization of inputs in Chinese manufacturing industry and exploring the pathways through the lens of production factors is of significant importance.

Compared to previous studies, this paper offers the following marginal contributions: First, from a research perspective, it explores the relationship between the inflow of ASEAN service intermediates within the CAFTA region and the servitization of Chinese manufacturing industry from the lens of production factors, against the backdrop of Chinese deep integration into international regional economic frameworks. This expands both the depth and breadth of the research perspective. Second, in terms of research content, the paper examines the effects of CAFTA's trade in services liberalization, addressing both theoretical and empirical dimensions. Specifically, it analyzes how the liberalization of trade in services under CAFTA accelerates the free flow of production factors such as physical capital, human capital, and technology within the region, thereby influencing the level and pathways of ASEAN service intermediates being incorporated into Chinese manufacturing sector. This introduces a degree of innovation to the research content.

Based on the above perspectives and content, this paper adopts the total consumption coefficient to measure the servitization level of inputs in Chinese manufacturing sector. It employs equivalent tariff and other quantitative methods to analyze the extent of Chinese trade in services liberalization with ASEAN. Additionally, it applies a mediation effect model to empirically examine the pathways through which CAFTA trade in services liberalization affects the servitization of Chinese manufacturing industry and the mobility of production factors.

The conclusions of this study hold not only significant theoretical value but also offer fresh insights and policy recommendations. These findings are particularly relevant in the context of Chinese deeper engagement in regional economic integration and the CAFTA 3.0 upgrade. They provide new ideas for leveraging CAFTA policies to further enhance the level of servitization in Chinese manufacturing industry.

2. Literature Review

The studies related to this paper primarily focus on three areas: the economic effects of trade in services liberalization, the factors influencing the servitization of manufacturing inputs, and the relationship between trade in services liberalization and the servitization of manufacturing inputs.

The liberalization of trade in services helps drive economic growth by attracting advanced foreign service providers into the market[2]. This influx brings a wider variety of higher-quality

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and more efficient service intermediates, while also stimulating innovation. As a result, it enhances total factor productivity in the manufacturing sector and strengthens its competitiveness[3].The liberalization of trade in services is closely related to international competitiveness. It alters the structure and competitive advantages of domestic industries, enabling enterprises to access higher-quality and lower-cost service inputs [4], improve the quality of export products [5], and enhance the position of manufacturing within the global value chain [6]. At the micro level of enterprises, trade liberalization in services effectively promotes innovation inputs and outputs through mechanisms such as intermediate goods trade, intra-product resource reallocation, and technological innovation [7].

There are various factors that influence the servitization of inputs in the manufacturing industry, which can be categorized into the enterprise, industry, and national levels. The servitization strategy of manufacturing enterprises is influenced by both external environmental factors and internal organizational factors. External environmental factors include resource constraints, market fluctuations, and technological changes, while internal organizational factors encompass top management attitudes, employee educational levels, and organizational specialization and division of labor[8].At the industry level, the servitization of inputs in manufacturing is influenced by factors such as resource dependence, fixed asset levels, and market competition intensity. The higher the level of market competition, the lower the degree of resource dependence, and the higher the fixed asset levels within an industry, the higher the level of input servitization in that industry[9].At the national level, the servitization of manufacturing inputs requires the involvement of service production factors and is influenced by the service sector. The relative productivity of the service sector has a positive impact on the servitization of manufacturing inputs. Opportunities for resource acquisition are also crucial influencing factors. The servitization of manufacturing inputs requires support from various resources, such as human resources, knowledge and technology, and infrastructure. A country's innovation capabilities and human capital play a significant role in promoting the level of servitization in its manufacturing sector (Huang Qunhui & Huo Jingdong, 2014)[10].In addition, external openness has also become a key focus in studies on the factors influencing the servitization of manufacturing inputs. Zou Guowei (2018) found that the reduction of barriers to trade in services can enhance the level of servitization in the manufacturing sector.[11].

There is limited academic research on how trade in services liberalization affects the servitization of manufacturing inputs. Existing studies primarily focus on aspects such as the price and competitive effects of service intermediates. As the degree of trade in services liberalization increases, the prices of imported intermediates decrease, while domestic intermediate prices also decline due to heightened competition in the service sector. To achieve economies of scale, firms may transfer non-core service production activities and focus on developing their internal comparative advantages and scale efficiencies, thereby optimizing resource allocation and promoting the servitization level of the manufacturing industry[12-13].Moreover, the liberalization of trade in services facilitates the cross-border free flow of service factors, allowing more and higher-quality service intermediates to enter the domestic market[14]. This results in both competition and demonstration effects (Li Jieyao, 2022)[15], which, in turn, enhance the development level of the domestic service industry and gradually improve the quality of domestic services.With the overall improvement in the quality and quantity of services offered domestically and internationally, manufacturing enterprises have access to a broader range of service products, which facilitates the enhancement of the servitization level of manufacturing inputs. Some scholars, taking an alternative approach, have examined this issue from the perspective of the depth of service integration. They argue that the liberalization of trade in services reduces the depth of service factor integration, enabling service factors to be more directly combined with manufacturing processes, thereby improving

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the level of servitization in the manufacturing industry[16].Existing research has discussed the impact of production factors; however, it often focuses on analyzing the effects of a single factor or remains at the level of service intermediates. For example, Wang Xin (2023) examined the issue from the perspective of technological factors, finding that trade in services liberalization significantly enhances the level of servitization in manufacturing by reducing R&D costs and incentivizing technological innovation in the manufacturing sector[17].

Overall, the existing literature has the following limitations: On the one hand, most studies focus on the impact of overall trade in services liberalization on the servitization of a country's manufacturing industry, while few explore the specific effects of regional trade in services liberalization on Chinese manufacturing servitization. As the first regional economic and trade cooperation organization China participated in, and given that China and ASEAN are significant trading partners, examining the impact of CAFTA on Chinese manufacturing industry is both necessary and meaningful. On the other hand, limited attention has been paid to the perspective of service factors. However, capital, human capital, and technology are essential influencing factors in the process of manufacturing servitization. Therefore, analyzing the mechanisms and pathways through which regional trade in services liberalization affects the servitization of inputs in Chinese manufacturing industry from the perspective of production factors holds theoretical and practical significance.

3. Theoretical Analysis and Research Hypotheses

With the reduction of service trade barriers within the CAFTA region and the continuous improvement in the level of trade in services liberalization, a substantial number of high-quality service products from ASEAN have been able to flow more freely into China as service intermediates, subsequently being utilized in the production processes of the manufacturing sector. This has contributed to enhancing the servitization of inputs in Chinese manufacturing industry. Promoting the liberalization of trade in services under CAFTA influences the level of servitization in manufacturing inputs by affecting the mobility of production factors such as human capital, physical capital, and technology. Therefore, it is essential to explore how these production factors-human capital, physical capital, and technology-mediate the effects of CAFTA trade in services liberalization on the servitization of inputs in Chinese manufacturing sector.

3.1. Physical Capital Effect

The liberalization of trade in services under CAFTA facilitates the free flow of physical capital among member countries by easing market access restrictions on capital factors, such as ownership and control regulations. This, in turn, promotes the use of capital-related service products as intermediate inputs, thereby enhancing the level of servitization in Chinese manufacturing industry.

CAFTA's trade in services liberalization reduces barriers to capital factor mobility and relaxes restrictions on its flow, such as lifting limitations on foreign investment sectors and foreign ownership shares. These measures attract a significant influx of high-quality foreign financial services and products into the Chinese market and encourage increased greenfield investments by multinational service enterprises in China.

The free flow of physical capital among regional countries substantially improves the servitization level of inputs in Chinese manufacturing sector. On one hand, the liberalization of CAFTA trade in services provides Chinese manufacturing firms with access to capital from ASEAN countries and opportunities to secure financing from these nations, enabling enterprises to obtain sufficient funding for servitization transformation. On the other hand, the growth of greenfield investments by ASEAN service enterprises in China supplies additional

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service intermediates to the manufacturing sector, thereby promoting the transformation and upgrading of Chinese manufacturing industry toward higher levels of servitization.

H1 : The liberalization of trade in services under CAFTA promotes the free flow of physical capital within the region, thereby enhancing the level of servitization of ASEAN-related inputs in Chinese manufacturing industry.

3.2. Human Capital Effect

The liberalization of trade in services under CAFTA lowers barriers to the movement of people between China and ASEAN, reduces restrictions on human capital, and promotes the free movement of human capital as a production factor within the China-ASEAN region. This facilitates the inflow of highly skilled technical and managerial talents needed by Chinese manufacturing industry for inputs from ASEAN service products, ultimately improving the servitization of inputs in Chinese manufacturing sector.

Reducing barriers to the movement of people and loosening restrictions on the entry and duration of stay for technical and managerial personnel helps attract foreign high-level human capital into China, which supports the servitization of inputs in Chinese manufacturing industry. The servitization of manufacturing requires higher capabilities from both manufacturing and service sector workers. The input of a range of high-end services, such as financial leasing, modern logistics, e-commerce, online maintenance, design, and legal services, not only requires manufacturing firms to be familiar with their product characteristics, production layouts, and project management, but also to grasp modern service concepts and service models. Additionally, the intangibility, non-storability, and simultaneity of services impose higher demands on service providers' awareness, communication skills, and practical operational abilities. The liberalization of trade in services under CAFTA encourages the free movement of experienced managers, high-level technical talents, and experts between China and ASEAN. This, in turn, provides more technical and managerial personnel from ASEAN countries for the input of service intermediates, thereby promoting the transformation and enhancement of the servitization level of Chinese manufacturing industry.

H2: The liberalization of trade in services under CAFTA will facilitate the free movement of human capital within the region, thereby enhancing the servitization of manufacturing inputs from ASEAN in Chinese manufacturing industry.

3.3. Technological Effect

The liberalization of trade in services under CAFTA reduces barriers to the flow of technology and promotes the free movement of technological elements within the region, facilitating the entry of ASEAN's technology-intensive service products into the Chinese market. This increases the proportion of technological factors in the intermediate inputs of Chinese manufacturing industry and contributes to the enhancement of the servitization of manufacturing inputs in China.

The liberalization of trade in services under CAFTA reduces barriers to the flow of technology and promotes the free movement of technological elements within the region. Barriers to the flow of technology can take various forms, each restricting technology movement from different perspectives. For example, a country may implement licensing systems to restrict foreign service providers from operating locally, or it may enforce closed policies in certain industries, prohibiting foreign companies from participating in competition, thus greatly limiting foreign technology access to the domestic market. After the reduction of such barriers, a large number of technological intermediates enter the domestic market. The free flow of technological elements between countries in the region will significantly enhance the servitization of manufacturing inputs in China. Technological elements can increase product value. Through forward linkages in industries, technology-intensive service intermediates incorporate

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advanced technological elements into production processes, thereby improving product quality, optimizing designs, and reducing costs.

H3: The liberalization of trade in services under CAFTA will promote the free flow of technological elements within the region, thereby improving the servitization of manufacturing inputs in China.

4. Model Construction and Data Description

4.1. Mediation Effect Model

To examine the impact of the mobility of production factors such as physical capital, human capital, and technology on the servitization of inputs in Chinese manufacturing industry promoted by CAFTA's liberalization of trade in services, this section establishes the following empirical model for analysis:

$$Ser_t = \rho_0 + \rho_1 Control_{it} + \gamma barrier_{ijt} + \varepsilon_{ijt} \quad (1)$$

$$M_t = \eta_0 + \eta_1 Control_{it} + \gamma barrier_{it} + \varepsilon_{ijt} \quad (2)$$

$$Ser_t = \sigma_0 + \sigma_1 Control_{it} + mM_t + \gamma barrier_{it} + \varepsilon_{ijt} \quad (3)$$

where Ser_t denotes the level of servitization of inputs in chinese manufacturing industry in year t; barrier_{ijt} denotes the level of service trade barriers in sector j imposed by China on ASEAN countries is inversely proportional to the level of openness. A higher value indicates greater service trade barriers and a lower degree of service trade liberalization. $Control_{it}$ denotes a series of control variables. M_t denotes the mediating variables, specifically the effects of physical capital (cap_t), human capital (lab_t), and technological level ($tech_t$) in year t; ε_{ijt} is the random disturbance term.

4.2. Indicator Measurement

4.2.1. The dependent variable

The dependent variable is the level of servitization of inputs in Chinese manufacturing industry from ASEAN. This study draws on methods from scholars such as Park (1994) and measures the level of servitization of manufacturing inputs by calculating the degree of reliance on services in the manufacturing production process. Indicators such as the total consumption coefficient are selected to measure the level of servitization of manufacturing inputs.

The total consumption coefficient refers to the direct and indirect inputs required from other sectors to produce one unit of final product by a specific sector. Based on the input-output table, the calculation formula is as follows:

$$Ser_{ij}^{complete} = a_{ij} + \sum_{k=1}^{n} a_{ik}a_{kj} + \sum_{s=1}^{n}\sum_{k=1}^{n} a_{is}a_{sk}a_{kj} + \ldots\ldots \quad (4)$$

where $Ser_{ij}^{complete}$ represents the total consumption coefficient of manufacturing sectorj. The first term on the right-hand side of the equation refers to the direct consumption of services from sector i by manufacturing sector j, while the second term represents the first round of indirect consumption, the third term represents the second round of indirect consumption, and so on. The (n+1)-th term represents the (n)-th round of indirect consumption. By summing these terms, the total consumption coefficient can be obtained. The total consumption

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coefficient provides a more comprehensive reflection of the production relationship between the manufacturing and service sectors. Therefore, this paper uses the total consumption coefficient as a quantitative indicator for the servitization of manufacturing inputs, based on the 56×56 sector world input-output table database from EORA, to calculate the level of servitization of manufacturing inputs in China from 2005 to 2021.

4.2.2. Core Explanatory Variable

The core explanatory variable is the level of service trade liberalization between China and ASEAN countries, represented by the service trade barrier index. A higher service trade barrier value indicates a lower level of service trade liberalization. Based on the methodology for measuring service trade barriers used by Lian Cong(2014), this study selects a sample of 30 countries/regions, including China and ASEAN countries, and 4 service sectors from 2005 to 2021[18]. An gravity model is constructed, and the predicted service trade flow is calculated. Then, the equivalent tariff is computed using a formula, with the equivalent tariff considered as the service trade barrier value. The 30 countries/regions include China, Malaysia, Singapore, the Philippines, Thailand, Indonesia, Brunei, Vietnam, Myanmar, Cambodia, Laos, Australia, Japan, South Korea, New Zealand, the United States, Hong Kong, Canada, the United Kingdom, Germany, France, Denmark, Switzerland, the Netherlands, Brazil, Belgium, India, Ireland, Spain, and Luxembourg. The 4 service sectors include transportation services, financial services, telecommunications services, and business services.

The formula for calculating the tariff-equivalent of service trade barriers is as follows:

$$-\sigma\, ln\left(1 + t_{ij}\right) = ln\left(M_{ij}^{a}/M_{ij}^{p}\right) - ln\left(M_{bj}^{a}/M_{bj}^{p}\right) \tag{5}$$

where b denotes the benchmark country; The trade elasticity of substitution across services sectors is represented by σ, and following Park (2002), a substitution elasticity value of 5.6 is selected; t_{ij} denotes the tariff equivalent of the service trade barriers imposed by country i on country j; M_{ij}^{a} denotes the actual value of service trade imported by country i from country j; M_{ij}^{p} denotes the predicted value of service trade imported by country i from country j; M_{bj}^{a} denotes the actual value of service trade imported by benchmark country b from country j; M_{bj}^{p} denotes the predicted value of service trade imported by the reference country, country b, from country j.The benchmark country is defined as the free trade country closest to full liberalization, where the actual trade import value exhibits the largest positive deviation from the predicted value, i.e., the greatest difference. By calculation, Switzerland is designated as the bilateral free trade benchmark country for China and Malaysia, Indonesia, Singapore, Thailand, Vietnam, Cambodia, Laos, Myanmar, and Brunei.

4.2.3. Factor Variables

The variables for production factors include physical capital (cap), human capital (lab), and technological level (tech). The physical capital (cap) indicator is measured by the logarithm of the actual foreign investment utilization amount, the human capital (lab) indicator is represented by the proportion of employees in Chinese service industry, and the technological level (tech) is measured by the logarithm of the number of foreign patent applications authorized in China.

4.2.4. Control Variables

The control variables selected include the labor quality in ASEAN countries (internet) and cultural distance (cul). The labor quality indicator for ASEAN countries is based on the proportion of the population using the internet in each country. The greater the proportion of a country's population using the internet, the higher the educational level of its citizens, making

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them more likely to become participants in multinational service industries, thus strengthening the country's service export capacity. Cultural differences can impact trade between two countries, subsequently influencing the servitization of manufacturing. The greater the cultural distance, the more significant the disparities in language, living habits, and value systems, leading to higher trade costs. The cultural distance indicator is constructed using data from the World Values Survey to create a composite cultural distance index, calculated as follows:

$$cul_i = \frac{1}{6}\sum_{i=1}^{6}\frac{(I_{ik}-I_{jk})^2}{V_k} \quad (6)$$

where cul_i denotes the cultural distance between China and country i; V_k denotes the variance of the scores of ASEAN countries on the k-th dimension; I_{ik} denotes the score of country i in the k-th dimension; I_{jk} denotes the score of China in the k-th dimension.

4.3. Data

The actual utilization of foreign direct investment, the number of foreign invention patent applications and authorizations in China, and the proportion of employees in Chinese service industry are sourced from the National Bureau of Statistics of China. The data for control variables comes from the World Bank and the World Values Survey database. The data spans from 2007 to 2020, and the sample countries selected are Singapore, Malaysia, the Philippines, Indonesia, Thailand, and Vietnam. Since the service trade barriers are composed of four sectors, the total number of samples used in this study is 336.

5. Empirical Results and Analysis

5.1. Mediation Effect Results

Table 1 presents the regression results of the model. According to Table 1, human capital acts as a complete mediating effect, while physical capital and technology serve as incomplete mediating effects. Column (1) shows the impact of service trade barriers on the servitization of manufacturing. The regression coefficient of the core explanatory variable, service trade barriers, is negative at a 1% significance level. This indicates that reducing service trade barriers imposed by China on ASEAN and liberalizing and deepening service trade between China and ASEAN will significantly have a positive impact on the level of servitization of inputs in Chinese manufacturing industry related to ASEAN.

Columns (2) and (3) present the regression results for equations (2) and (3) with human capital (lab) as the mediating variable. In column (2), the coefficient of the core explanatory variable is significantly negative at the 1% level, indicating that CAFTA trade in services liberalization has a significant positive effect on human capital. In column (3), the coefficient of the core explanatory variable is not significant, while the regression coefficient of the human capital variable is significantly positive at the 1% level, suggesting that CAFTA trade in services liberalization increases human capital, thereby enhancing the servitization of manufacturing inputs from ASEAN to China. Hypothesis H2 is supported.

Columns (4) and (5) present the regression results for the driving effect when physical capital (cap) is used as the mediating variable. In column (4), the coefficient of service trade barriers is significantly negative at the 1% level, indicating that Chinese relaxation of service trade import restrictions on ASEAN will significantly promote the inflow of foreign physical capital into China. In column (5), the coefficient of the core explanatory variable is significant, and the regression coefficient of the physical capital variable is significantly positive at the 1% level, suggesting that CAFTA trade in services liberalization increases physical capital accumulation,

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thereby enhancing the servitization of manufacturing inputs from ASEAN to China. Hypothesis H1 is supported.

Columns (6) and (7) present the regression results for the driving effect when technological level (tech) is used as the mediating variable. In column (6), the coefficient of service trade barriers is significantly negative at the 1% level, indicating that Chinese relaxation of service trade import restrictions on ASEAN will significantly improve Chinese technological level. In column (7), the coefficient of the core explanatory variable is significant, and the regression coefficient of the technology variable is significantly positive at the 1% level, suggesting that CAFTA trade in services liberalization enhances the technological level, thereby improving the servitization of manufacturing inputs from ASEAN to China. Hypothesis H3 is supported.

Table 1. Results of the Mediation Effect

	(1) Ser	(2) lab	(3) Ser	(4) cap	(5) Ser	(6) tech	(7) Ser
barrier	-0.020*** (-4.62)	-1.203*** (-4.46)	-0.001 (-0.85)	-0.035*** (-3.56)	-0.006** (-2.31)	-0.053*** (-2.99)	-0.009*** (-1.28)
lab			0.015*** (53.49)				
cap					0.387*** (22.11)		
tech							0.204*** (24.16)
control	YES	YES	YES	YES	YES	YES	YES
Constant term	0.497*** (29.69)	38.004*** (45.27)	-0.187*** (-15.69)	16.145*** (553.71)	-5.850*** (-20.59)	9.648*** (25.88)	-1.839*** (-19.55)
R2	0.342	0.341	0.939	0.269	0.760	0.222	0.726
N	336	336	336	336	336	336	336

Note: The values in parentheses represent the t-statistics, * p < 0.1, ** p < 0.05, *** p < 0.01.

5.2. Bootstrap Test

The bootstrap test method estimates the sampling distribution of a statistic by calculating it over multiple resampled datasets, thereby providing more accurate statistical inference results. The bootstrap method has relatively low requirements for assumptions about the sample distribution, making it suitable for small samples and non-normal data. Additionally, a key advantage of this method is its ability to intuitively decompose direct and indirect effects without the need for complex mathematical transformations or additional assumptions.

In this study, the bootstrap method was employed to obtain standard errors and confidence intervals, with 1,000 resampling iterations. Table 6 presents the mediation effect test results. Except for the direct coefficient of human capital, which is not statistically significant, all other coefficients are significant and consistent with theoretical expectations. Furthermore, none of the confidence intervals include zero, indicating the robustness of the mediation effect results. These findings confirm that reducing service trade barriers with ASEAN countries and promoting CAFTA trade in services liberalization can enhance the servitization level of Chinese manufacturing inputs by influencing production factors, thereby driving the transformation and upgrading of Chinese manufacturing industry. The theoretical analysis and hypotheses proposed earlier are thus supported.

The calculated indirect effects of production factors-physical capital, human capital, and technology-account for 60.0%, 90.0%, and 46.7% of the total effects, respectively. This

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indicates that among the three mediating factors through which CAFTA regional service trade liberalization affects the servitization level of Chinese ASEAN manufacturing inputs, the effect of human capital is the largest.

Table 2. Bootstrap Test Result

		coefficient	std.err.	z	p>|z|	[95% conf.	interval]
Physical Capital Effect	Indirect	-0.009	0.003	-2.88	0.004	-0.012	-0.001
	Direct	-0.006	0.003	-2.10	0.036	-0.015	-0.003
	Total	-0.020	0.004	-3.75	0.000	-0.023	-0.007
Human Capital Effect	Indirect	-0.018	0.004	-4.29	0.000	-0.027	-0.010
	Direct	-0.001	0.001	-0.88	0.380	-0.004	0.001
	Total	-0.020	0.004	-4.50	0.000	-0.028	-0.011
Technological Effect	Indirect	-0.007	0.003	-2.39	0.017	-0.012	-0.003
	Direct	-0.009	0.003	-2.84	0.005	-0.014	-0.001
	Total	-0.020	0.004	-2.69	0.000	-0.23	-0.007

As indicated above, the liberalization of trade in services under CAFTA facilitates the free flow of production factors within the region, thereby influencing the servitization of Chinese manufacturing industry, with human capital playing the most significant role among the production factors.

6. Conclusion and Recommendations

During the implementation of the servitization strategy in Chinese manufacturing industry, economic cooperation between China and ASEAN has been increasingly strengthened, with trade in services showing significant development potential. This study examines how the liberalization of trade in services under the China-ASEAN Free Trade Area (CAFTA) framework influences the level of servitization of inputs in Chinese manufacturing industry through the role of production factors. The findings are as follows:The reduction of barriers to trade in services under CAFTA and the promotion of service trade liberalization contribute to enhancing the level of servitization in Chinese manufacturing inputs. This effect is achieved through the free flow and optimal allocation of production factors such as physical capital, human capital, and technology, with human capital exerting the most significant impact.

Based on these conclusions, this study proposes the following policy recommendations in the context of the Belt and Road Initiative and the CAFTA 3.0 upgrade:

1) Continue to promote and deepen service trade cooperation between China and ASEAN by reducing barriers to service trade and expanding the scale of service trade between the two regions.

2) Improve intellectual property (IP) protection mechanisms by strengthening the protection of intellectual property rights, encouraging ASEAN enterprises to apply for patents in China to safeguard their interests, and cracking down on piracy.

3) Actively attract foreign direct investment (FDI) into Chinese manufacturing sector by formulating targeted liberalization policies, fostering a favorable business environment, and encouraging FDI inflows to drive industrial development.

4) Implement talent introduction programs by attracting high-level talent from ASEAN, particularly in fields such as advanced management, modern logistics, and financial services.

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