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The impact of import competition on TFP of manufacturing enterprises: A perspective of upstream-downstream linkages

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Abstract
From the perspective of industrial linkages, this paper uses the integrated data of the China Industrial Enterprise Database and the Customs Trade Database from 2000 to 2013 to investigate the impact of upstream and downstream import competition on the total factor productivity (TFP) of manufacturing enterprises. The findings are summarized as follows: (1) Import competition significantly improves the TFP of manufacturing enterprises through upstream and downstream industry linkages; (2) The upstream import competition can better promote TFP of manufacturing enterprises with weaker competition, and has a more significant promoting effect on non-state-owned enterprises and ones located to the east of the "Hu Huanyong line".

Keywords: TFP, Import Competition, Manufacturing Enterprises, Industrial Linkages

1. Introduction

Since the reform and opening up, China's per capita GDP has increased from $156.4 in 1978 to $12,720.2 in 2022[1], indicating that China has entered the ranks of middle-income countries. However, with the aggravation of aging and the gradual disappearance of demographic dividend, it is no longer sustainable to rely on capital, labor or other factors to improve productivity. China's GDP growth rate has dropped from 9.6% in 2011 to 3.0% in 2022[2]. Thus, the rise in manufacturing productivity is of great importance to China. From 2012 to 2022, the added value of China's manufacturing industry increased from $2.69 trillion to $4.98 trillion, ranking first in the world for many years[3]. Therefore, it is of great theoretical and practical significance to explore the influencing factors of total factor productivity (TFP) of China's manufacturing enterprises in the context of high-level opening-up to boost the high-quality development of China's economy and enhance China's international competitiveness.

With a series of measures since China's accession to the WTO, such as the drastic reduction of tariffs, the construction of free trade zones and the holding of import trade fairs, China's total import trade has increased from $243.553 billion in 2001 to $2,715.999 billion in 2022, with an average annual increase of 12.17%. Over the same period, China's global share of imports surged from 3.8% to 10.58%, securing its position as the world's second-largest importer for 14 consecutive years[4].

As import trade liberalization continues to deepen, import competition within the industry has been intensifying. Numerous studies have demonstrated that import competition plays a crucial role in enhancing the TFP of enterprises (Fernandes, 2007; Jian *et al*. 2014) [13, 20].

[1]Source: World Bank database，https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?end=2022&locations=CN&start=1960&view=chart
[2]Source: World Bank database，https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=CN
[3]Source: World Bank database，https://data.worldbank.org.cn/indicator/NV.IND.MANF.CD?locations=CN
[4]Source: 《China Import Development Report 2023: China Remains the World's Second Largest Importer of Goods for 14 consecutive Years》, https://economy.gmw.cn/2023-11/05/content_36942889.htm

For instance, the fierce competition effectively boosts the production efficiency of Chinese automobile enterprises, compelling them to expedite adjustments in product structure and increase investments in research and development (Gao and Wang, 2010) [15], which may illustrate an "escaping from competition effect" (Shu and Steinwender, 2019) [30]. Import competition also facilitates the optimal allocation of resources through market mechanisms (Qian and Gao, 2021) [26] and enhances the efficiency of surviving enterprises (Huang, 2020) [19].

Therefore, this paper focuses on the following questions: What is the impact of the upstream and downstream import competition on TFP of manufacturing enterprises, and how do they differ from each other? Are there heterogeneous effects on different firms?

2. Literature Review

Two categories of literature are closely related to this study. The first body of literature concerns the determinants of TFP. TFP, as a factor not directly observed in economic growth without the expansion of capital and labor factors, was initially discussed by Solow (1956) [31]. Kendrick (1961) [22] conducted a systematic analysis of TFP in theory, identifying that its changes primarily hinge on resource allocation and knowledge capital. Since then, scholars have conducted further research on these two influential factors. On one hand, resource misallocation hampers the free flow of factors, causing price distortions that impact the optimization of enterprises' production efficiency (Brandt *et al*. 2013) [4]. Moreover, state-owned enterprises have monopoly power and are prone to resource misallocation (Albornoz *et al*. 2014) [1]. If the capital and labor market distortions are improved, TFP of firms can be effectively improved (Gai *et al*. 2015) [14]. On the other hand, Research and Development (R&D) capital plays a significant role in promoting TFP (Madsen *et al*. 2010) [24]. However, R&D capital represents only one facet of intellectual capital and cannot fully capture the impact of other types of intellectual capital on TFP. Consequently, some scholars have incorporated human capital into the study of knowledge capital (Bodman and Le, 2013) [3] and compared its promoting effect with that of R&D capital. Additionally, scholars have examined the impact of knowledge capital spillover from different channels on TFP. They observed that the positive impact of knowledge spillover from Foreign Direct Investment (FDI) (Cheng and Chen, 2016) [5] and import (Coe *et al*. 2009) [6] on TFP contrasts with the negative impact from Outward Direct Investment (ODI) (Wang and Liu, 2008) [34].

The second body of literature focuses on the impact of international trade on TFP. Some scholars assert that both import and export trade can influence the TFP of a country's enterprises (Bai *et al*. 2017; Coelli *et al*. 2022) [7]. Export trade can enhance TFP not only by compelling enterprises to improve production processes and organizational management methods (Zhang *et al*. 2009) [37], but also by stimulating enterprises to invest in advanced technologies, thereby bolstering their innovation capabilities (Criscuolo *et al*. 2010) [9]. Regarding the impact of import trade on TFP of enterprises, existing studies mainly from the perspectives of import scale (Zhang *et al*. 2015) [38], import structure (Mo *et al*. 2021) and import quality (Zheng *et al*. 2017) [40], etc., find that importing intermediate goods can have a positive impact on TFP of enterprises through product quality (Liu and Qiu, 2016) [23], product category (Halpern *et al*. 2015) [17], technology spillover (Timmer *et al*. 2014) [33] and other channels. Additionally, the reduction of import tariffs appears to have a more substantial impact on productivity improvement for enterprises directly involved in imports compared to other types of enterprises (Defever *et al*. 2020) [10].

On the whole, the current body of literature rarely explores the impact of import competition on TFP of enterprises from the perspective of industrial linkages. However, it is an important form of knowledge dissemination and technology spillover. Consequently, this paper leverages data from the China Industrial Enterprise Database and the Customs Trade Database spanning 2000 to 2013, combined with the input-output tables in 2002, 2007 and 2012, and utilizes a multidimensional fixed-effect model to examine the impact of upstream and downstream import competition on TFP of manufacturing enterprises. The marginal contributions of this paper are as follows: First, the existing literature focusing on the impact of import competition on TFP of enterprises from the perspective of market competition and resource allocation, is expanded to the perspective of industrial linkages; Second, the impact mechanism and action mechanism of upstream (downstream) import competition on TFP are discussed, so as to provide targeted policy basis for promoting China's high-level opening up and high-quality economic development strategy.

3. Methodology

3.1. Total Factor Productivity of Enterprises

Currently, the prevalent methods for measuring TFP of enterprises include OP method and LP method. Based on non-parametric estimation, the OP method addresses the problem of simultaneity by using observed enterprise investment as a proxy variable influencing input decisions. It also tackles sample selection bias by introducing a binary variable indicating whether the enterprise exits. However, a drawback lies in the absence of investment data in the China Industrial Enterprise Database, resulting in numerous samples with values less than or equal to 0. Deleting these samples might lead to an issue of an excessively reduced sample size. On the other hand, the LP method replaces the investment variable in the OP method with the intermediate input index, resolving the problem of a small sample size under the OP method. Given the data availability, this paper opts for the LP method to measure TFP of enterprises, and the formula is as follows:

$$lnY_{it} = \alpha_0 + \alpha_1 lnL_{it} + \alpha_2 lnK_{it} + \alpha_3 lnM_{it} + \sum_m \delta_m Year_m + \sum_n \vartheta_n ID_n + \varepsilon_{it} \quad (1)$$

where Y_{it} represents the industrial added value of the enterprise; L_{it} is the free variable representing labor input, measured by the average annual number of employees; K_{it} represents the state variable for capital input, measured by fixed capital stock; M_{it} is the proxy variable representing intermediate input. $Year$ and ID represent time and individual fixed effect, respectively; ε_{it} is the residual term.

3.2. Import Competition

The import penetration rate, used as the proxy index for import competition, is calculated based on the research of Yu (2010) [36]. The specific calculation formula for the import penetration rate is as follows:

$$IMP_{jt} = \frac{Import_{jt}}{Output_{jt}+Import_{jt}-Export_{jt}} \quad (2)$$

Where $Import_{jt}$ represents the total import value of the three-digit industry *j* in year *t*; $Export_{jt}$ represents the total export value of the three-digit industry *j* in year *t*; $Output_{jt}$ represents the total output value of the three-digit industry *j* in year *t*. The higher the import penetration rate, the fiercer the import competition, and the vice versa.

In this paper, the method proposed by Jiang *et al*. (2020) [21] is used to construct the upstream and downstream import competition index. The specific calculation formula is as follows:

$$IMP\_Forward_{jt} = \sum_{j \neq u} Input_{jut} \times IMP_{ut} \quad (3)$$

$$IMP\_Backward_{jt} = \sum_{j \neq d} Output_{jdt} \times IMP_{dt} \quad (4)$$

Where $Input_{jut}$ represents the proportion of the intermediate inputs purchased by industry *j* from industry *u* in the total of the intermediate inputs purchased by industry *j* from upstream industry in year *t*, and $Output_{jdt}$ represents the proportion of the intermediate inputs provided by industry *j* to industry *d* in the total of the intermediate inputs provided by industry *j* to downstream industry in year *t*. Data are derived from the "intermediate input-intermediate use" matrix in the input-output tables for 2002, 2007 and 2012 provided by the National Bureau of Statistics.

3.3 Estimating Equation

This paper aims to investigate the impact of import competition on TFP of Chinese manufacturing enterprises, and the specific model is constructed as follows:

$$TFP\_LP_{ijt} = \beta_0 + \beta_1 IMP_{jt} + Control_t\gamma + \delta_i + \delta_j + \delta_t + \varepsilon_{it} \quad (5)$$

Where, *i*, *j* and *t* represent enterprise, industry and year, respectively. TFP_LP_{ijt} denotes TFP of enterprise *i* in industry *j* in year *t*. IMP_{jt} denotes the import competition of industry *j* in year *t*, including IMP_Inward_{jt} representing the overall import competition within the industry, $IMP\_Forward_{jt}$ representing upstream import competition and $IMP\_Backward_{jt}$ representing downstream import competition, respectively. $Control_t$ represents the control variables at the firm and industry level. The control variables are set as follows: (1) Enterprise age (AGE): Calculated by adding 1 to the difference between the most recent complete year (2022) and the year of the enterprise's establishment; (2) Enterprise size (SIZE): Following the approach of Han and Liu (2021), the logarithm of the number of employees is used to measure the size of the enterprise; (3) Capital intensity (CAPITAL): The ratio of the average annual balance of fixed assets to the number of employees is used to measure capital intensity, and the natural logarithm is taken; (4) Industrial concentration (HHI) : The Herfindahl-Hirschman Index (HHI) is employed to measure industrial concentration. In order to control the unobservable individual and industry factors that do not change with time, the firm fixed effect δ_i and the industry fixed effect δ_j are introduced. Considering the influence of time-varying macroeconomic shocks, the year fixed effect δ_j is introduced. ε_{it} Represents the individual random error term.

4. Results

4.1 Descriptive Statistics

The data utilized in this study originates from the China Industrial Enterprise Database and the Customs Trade Database. The raw data undergoes the following processing steps:

First, organize and match the data. This involves collecting enterprise information like the business name, zip code, and landline phone number in both the China Industrial Enterprise Database and the Customs Trade Database. The process includes filling in missing samples across the years and rectifying any inaccuracies in the business names. Subsequently, the import and export values at the product level for the same enterprise in the Customs Trade Database are aggregated to the enterprise level. This aggregation is based on enterprise information such as name, postal code, telephone number, and the indication of import or export. The matching principle for the database is outlined as follows: Enterprises with the same name are identified as the same entity. In cases where names differ, the matching process continues using a combination of zip code and the last 7 digits of the landline phone number.

Second, process key indicator data. This includes the completion of industrial added value (2004, 2008-2013) and industrial intermediate input (2008-2013). Additionally, industrial added value, gross industrial output value, industrial intermediate input, and capital input are deflated. Samples with missing import and export data are excluded, and the exchange rate is adjusted according to the average exchange rate between USD and RMB in the current year, with the unit standardized to "thousand yuan". Finally, adjustments are made to the industry sample and classification standards. Only manufacturing samples from the China Industrial Enterprise Database are retained. Concurrently, industry samples in 2000-2002 and 2013 are uniformly adjusted to GB/T4754-2002 standards. Descriptive statistics of variables are detailed in Table 1.

Table 1: Descriptive Statistics

Variables	Sample Size	Average Value	Standard Deviation	Minimum	Maximum
TFP_LP	661,356	7.257	1.171	-1.653	15.307
IMP_Inward	661,356	0.099	0.063	0.000	0.678
IMP_Forward	661,356	0.194	0.099	0.007	0.605
IMP_Backward	661,356	0.172	0.104	0.002	0.663
AGE	661,356	24.448	7.858	10.000	74.000
SIZE	661,356	5.393	1.130	2.079	12.316
CAPITAL	661,356	3.898	1.464	0.003	14.503
HHI	661,356	0.020	0.035	0.001	1.000

4.2. Baseline Results

Utilizing the multidimensional fixed-effects model, Table 2 presents the baseline results of the impact of import competition at distinct positions within the industrial chain on TFP of Chinese manufacturing enterprises. The coefficients of the core explanatory variables in columns (1)-(3) and (4)-(6) are all significantly positive at the level of 1%, indicating that import competition enhances TFP in manufacturing enterprises through industrial linkages. The inclusion of control variables does not alter the sign or significance level of the coefficients. Import competition serves a dual role: firstly, by intensifying competitive pressure, it propels enterprises to curtail costs and bolster efficiency; secondly, it fosters a heightened sense of competition, driving innovation and subsequently enhancing the production capacity and efficiency of enterprises.

When upstream import competition intensifies, imported intermediate products are often embedded with the leading technology and higher quality of exporting countries (Wu and Wei, 2022) [35]. Domestic upstream enterprises, in response, can engage in imitation and learning processes to enhance productivity (Tian and Yu, 2014) [32]. Simultaneously, owing to the uncertain adaptability of import spillover technology, these domestic upstream enterprises may undertake independent research and secondary innovation based on the original imports, employing methods such as reverse engineering (Han and Liu, 2021). Industrial linkages accelerate technology sharing among industries. As a result, downstream enterprises gain access to a diverse range of products or those with heightened technical complexity, enabling them to upgrade technology and production processes without significant Research and Development (R&D) investments (Ding and Song, 2020) [11]. This, in turn, enhances TFP of enterprises. In addition, the intensification of competition in upstream intermediates, coupled with an increase in upstream supplies allows downstream enterprises to obtain inputs of comparable quality at a reduced cost. This not only boosts enterprise profitability but also enhances product competitiveness, making it more likely to improve the overall production efficiency of enterprises. Therefore, upstream import competition has the potential to enhance TFP in downstream enterprises through both the technology spillover effect and economies of scale effect.

When downstream import competition intensifies, on the one hand, the final products from developed countries change the purchasing habits of consumers, paying more attention to product design and quality while ensuring the basic use attributes of products. The "competition promotion effect" makes downstream enterprises increase investment in research and development to improve the added value of products. It also puts higher requirements on intermediate products produced by upstream enterprises, forcing them to improve TFP in response to the upgrading of consumption structure and the pursuit of differentiation by downstream enterprises. On the other hand, as the variety of final products increases (Gu *et al*. 2020) [16], local multi-product enterprises tend to phase out marginal products, reallocating physical capital to core products to better cope with import competition (Qiu *et al*. 2020) [27]. Downstream production of higher quality core products, will require upstream enterprises to improve production technology and provide higher quality intermediates. For upstream enterprises with small scale or low productivity, they may not be able to meet the downstream demand and have to withdraw from the market (Eslava *et al*. 2013) [12]. The market selection mechanism of "survival of the fittest" will further improve the productivity of surviving enterprises. Therefore, downstream import competition may affect TFP of upstream enterprises through market feedback effect and product type effect.

Table 2. Baseline Results

	(1)	(2)	(3)	(4)	(5)	(6)
IMP_Inward	0.595*** (12.880)			0.493*** (10.959)		
IMP_Forward		0.238*** (7.847)			0.158*** (5.373)	
IMP_Backward			0.153*** (6.829)			0.086*** (3.939)
AGE				-0.000 (-0.239)	-0.000 (-0.096)	-0.000 (-0.108)
SIZE				0.322*** (156.250)	0.322*** (156.349)	0.322*** (156.359)
CAP				0.049*** (34.339)	0.049*** (34.490)	0.049*** (34.489)
HHI				-0.251*** (-4.389)	-0.248*** (-4.324)	-0.242*** (-4.219)
_CONS	7.230*** (1546.026)	7.244*** (1218.503)	7.263*** (1833.897)	5.305*** (303.272)	5.322*** (298.442)	5.338*** (307.965)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	615,251	615,251	615,251	615,251	615,251	615,251
Adjusted R^2	0.787	0.787	0.787	0.798	0.798	0.798

Note: t statistics in parentheses, *p< 0.1, ** p< 0.05, *** p< 0.01

Table 2 also lists the estimated coefficients of each control variable. The results show that the longer an enterprise is established, the less conducive it is to the improvement of TFP. The possible reason is that the longer an enterprise is established, the more likely the management of the enterprise is to be satisfied with the status quo and lack the motivation to improve production technology or integrate resources, resulting in a decline in productivity compared with other enterprises. Moreover, the findings reveal a positive correlation between enterprise scale and TFP improvement. Larger enterprises tend to attract high-quality talents and possess more capital, facilitating the replacement of production equipment and, consequently, enhancing productivity. Higher capital intensity is also associated with greater TFP improvement, likely due to the heightened technical content associated with the increased value of fixed assets per unit of labor. Interestingly, industry concentration demonstrates an inverse relationship with improvements in enterprise productivity. This suggests that as industry market concentration increases, market competition weakens, diminishing the motivation for enterprises to enhance TFP.

4.3. Robustness Tests

To ensure the accuracy and reliability of the baseline regression results, this paper conducted robustness tests in several aspects.

4.3.1. Replacing estimation method for the explanatory variables

The GMM estimation method is utilized in this paper to measure TFP. The regression outcomes are detailed in columns (1)-(3) of Table 3. Notably, the magnitudes of coefficients and the levels of statistical significance linked to import competition, as well as upstream and downstream import competition, closely resemble the estimation findings in columns (4)-(6) of Table 2.

4.3.2. Changing the estimation criteria for the core explanatory variables

Departing from the approach of using import-weighted tariffs as a proxy for import competition, a method adopted by some researchers involving the construction of industry-level import-weighted tariffs (Shao, 2021) [28], this study takes a different route. The rationale behind excluding this proxy variable is twofold: firstly, import tariffs inadequately capture the full intensity of import competition, as it hinges on both price and non-price factors, and import tariffs represents only a partial aspect of overall trade costs. Thus, it is considered biased as a proxy for import competition. Secondly, Qian and Gao (2021) [26] discovered that the trajectory of changes in import tariffs and import penetration within the manufacturing industry did not exhibit an opposing trend during the period from 2000 to 2014. Consequently, this paper opts to substitute the import penetration rate from the third quartile to the second quartile. The regression outcomes are presented in columns (4)-(6) of Table 3, indicating more robust results and significance levels for the core explanatory variables.

4.3.3. Adjustment of sample scope

The China Industrial Enterprise Database presents a slight variation in the sample statistics criteria. Specifically, for the years 1998-2006, the dataset encompasses all state-owned enterprises and non-state-owned enterprises with main business product sales revenue exceeding 5 million. For 2007-2010, it includes both state-owned and non-state-owned enterprises surpassing the 5 million sales revenue threshold. However, from 2011-2013, the focus narrows to enterprises with main business revenue exceeding 20 million. Considering the research timeframe spans from 2000 to 2013, with two disjointed segments in 2007 and 2011, this study exclusively retains enterprises with main business revenue surpassing 20 million as its sample. In columns (7)-(9) of Table 3, the coefficients of the core explanatory variables mirror those in the baseline regression model. They remain significantly positive at the 1% level, indicating robust results.

4.3.4. Sample tail reduction

To avoid the influence of outliers on the estimation results, this study sorted the estimates of TFP and import competition in ascending order. Subsequently, the 1% and 99% percentiles corresponding to these estimates were identified, and samples falling below the 1% threshold and exceeding the 99% threshold were excluded. The regression results, presented in columns (10)-(12) of Table 3, closely resemble the baseline regression outcomes.

Table 3: Regression Results of Robustness Tests

	GMM-Based TFP Measurement			1/2 Import Penetration Rate		
	(1)	(2)	(3)	(4)	(5)	(6)
IMP_Inward	0.507*** (11.280)			0.904*** (15.265)		
IMP_Forward		0.163*** (5.411)			0.154*** (5.427)	
IMP_Backward			0.087*** (4.004)			0.103*** (4.726)
_CONS	5.365*** (306.707)	5.383*** (301.834)	5.399*** (311.495)	5.262*** (293.051)	5.323*** (299.423)	5.334*** (306.755)
Observations	615,229	615,229	615,229	615,229	615,229	615,229
Adjusted R^2	0.642	0.642	0.642	0.744	0.744	0.744
	Adjustment of Sample Scope			Sample Tail Reduction		
	(7)	(8)	(9)	(10)	(11)	(12)
IMP_Inward	0.563*** (12.193)			0.541*** (12.312)		
IMP_Forward		0.221*** (7.228)			0.127*** (4.450)	
IMP_Backward			0.085*** (3.541)			0.035*** (1.488)
_CONS	6.126*** (324.302)	6.140*** (320.007)	6.166*** (328.641)	5.377*** (328.818)	5.415*** (324.297)	5.439*** (334.313)
Observations	483,024	483,024	483,024	589,448	589,716	589,245
Adjusted R^2	0.725	0.725	0.725	0.745	0.746	0.745

Note: ①t statistics in parentheses, *p< 0.1, ** p< 0.05, *** p< 0.01 ; ②Control variables are included and fixed effects include firm country and year

4.4 Heterogeneity Tests

4.4.1. Heterogeneity of industry competition degree

In order to analyze the influence of upstream and downstream import competition on TFP of enterprises under different industrial competition states, this paper utilizes the Lerner index to measure the degree of industry competition following Correa and Ornaghi(2014). In this paper, the quantile corresponding to 1/2 of the industry competition index in the sample is taken as the critical value, which is divided into two industry competition intensity levels, strong and weak, and regression is carried out according to the baseline regression equation.

The regression results are shown in columns (1) - (6) of Table 4. When industry competition is weak, import competition proves to be a catalyst for market competition, encouraging enterprises to enhance productivity. However, in the face of heightened competition from foreign products, domestic enterprises may exhibit a lack of motivation for innovation and research. The incentive effect generated by competition is significantly weakened, which may even demonstrate a

negative "escaping from competition effect".

4.4.2. Heterogeneity of enterprise ownership

Based on the classification of enterprise ownership in the China Industrial Enterprise Database, this paper divides enterprises into state-owned and non-state-owned categories based on the nature of ownership. The regression results from columns (7) - (12) in Table 4 indicate a negative impact of import competition on the TFP of state-owned enterprises. This effect may be attributed to the heightened susceptibility of state-owned enterprises to government policies. Specifically, in the pursuit of short-term GDP growth, local governments may intervene in resource allocation within the market mechanism, directing capital towards low-end traditional industries and enterprises. This can result in low production efficiency and the emergence of numerous zombie enterprises (Shao *et al*. 2022) [29]. Consequently, state-owned enterprises experience greater government intervention compared to non-state-owned enterprises, thereby weakening the productivity enhancement from import competition.

4.4.3. Heterogeneity of regional geographic location

According to the classification criteria outlined by Zhao and Zhang (2022), Chinese regions are categorized based on the "Hu Huanyong line". Examining the regression results from columns (13) - (18) in Table 4, the positive impact of import competition on enterprise productivity gradually diminishes as enterprises move from the eastern coast to inland locations. The effect of import competition on TFP for enterprises in eastern China is significantly positive at the 1% level. While it still exerts a positive influence on enterprises in the central and western regions, the effect is minor and lacks statistical significance. This disparity can be attributed to the fact that, in comparison to enterprises in the eastern region, those in the central and western regions face inherent challenges related to innovation input and human capital accumulation. Additionally, considering trade structure, enterprises in the central and western regions predominantly import low-tech mineral products such as mineral sands and mineral fuels, limiting the technological insights available for learning and imitation.

Table 4: Regression Results of Heterogeneity Analysis

	Weak Industry Competition			**Strong Industry Competition**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
IMP_Inward	0.605*** (8.291)			0.321*** (4.479)		
IMP_Forward		0.371*** (0.8155)			-0.115*** (-2.639)	
IMP_Backward			0.073* (1.842)			0.035 (1.111)
_CONS	5.661*** (207.701)	5.651*** (204.405)	5.068*** (178.353)	5.048*** (176.596)	5.101*** (176.135)	5.715*** (212.786)
Observations	294,568	294,568	294,568	289,955	289,955	289,955
Adjusted R^2	0.757	0.757	0.757	0.774	0.774	0.774
	State-Owned Enterprises			Non-State-Owned Enterprises		
	(7)	(8)	(9)	(10)	(11)	(12)
IMP_Inward	-0.021 (-0.110)			0.535*** (11.423)		
IMP_Forward		-0.170 (-1.355)			0.164*** (5.351)	
IMP_Backward			-0.317*** (-2.829)			0.107*** (4.757)
_CONS	6.436*** (57.034)	6.467*** (57.009)	6.490*** (57.711)	5.280*** (288.558)	5.299*** (283.938)	5.312*** (292.825)
Observations	25,184	25,184	25,184	588,100	588,100	588,100
Adjusted R^2	0.821	0.821	0.821	0.737	0.737	0.737
	East of the "Hu Huanyong Line"			West of the "Hu Huanyong Line"		
	(13)	(14)	(15)	(16)	(17)	(18)
IMP_Inward	0.514*** (10.671)			0.016 (0.101)		
IMP_Forward		0.153*** (4.941)			0.003 (0.027)	
IMP_Backward			0.088*** (3.928)			-0.121 (-1.151)
_CONS	5.247*** (280.579)	5.267*** (276.518)	5.282*** (285.552)	5.857*** (91.889)	5.858*** (89.725)	5.880*** (90.990)
Observations	555,799	555,799	555,799	42,790	42,790	42,790
Adjusted R^2	0.741	0.741	0.741	0.770	0.770	0.770

Note：①t statistics in parentheses, *p< 0.1, ** p< 0.05, *** p< 0.01；②Control variables are included and fixed effects include firm、country and year.

5. Discussion and Conclusion

From the perspective of industrial linkages, this paper uses the integrated data of the China Industrial Enterprise Database and the Customs Trade Database from 2000 to 2013, combined with the input-output tables in 2002, 2007 and 2012, and uses a multidimensional fixed-effect model to test the impact of upstream and downstream import competition on TFP of manufacturing enterprises. The results show that: (1) upstream (downstream) import competition of supply chain can promote TFP of downstream (upstream) manufacturing enterprises; (2) The upstream import competition can better promote TFP of manufacturing enterprises with weaker competition, and has a more significant effect on non-state-owned enterprises and ones located to the east of the "Hu Huanyong line".

Based on the research conclusions, this paper puts forward the following policy recommendations:

(1) Maintain moderate market competition for healthy enterprise development. The government, acting as a "visible hand" in the market, should actively contribute to optimizing the market competition environment. Timely efforts should be made to create an atmosphere of fair and healthy competition. For instance, establishing an assessment system for market competition, conducting evaluations systematically, and adapting the system based on experiences gained in the application process are essential. Regular adjustments to the evaluation system will help sustain orderly market competition. To counteract malicious competition and

discourage unhealthy monopolistic practices, the government should establish and enhance supervision and management mechanisms. Increasing the cost of distorting healthy market competition is crucial. The principle of treating all market entities equally should be upheld, ensuring the credibility and transparency of law enforcement.

(2) Promote the coordinated development of upstream and downstream industries. To leverage the potential technology spillover effect and enhance the synergy between upstream and downstream industries, the government should actively expand the intermediates import, and establish the inter-industry technical communication mechanism, actively carrying out technical communications between upstream and downstream industries. Moreover, the government should break the problem of information asymmetry, and actively build various forms of communication platforms such as symposiums and exchange meetings, so that upstream and downstream manufacturers can timely capture each other's demand information, and give full play to the industrial correlation effect between the upstream and downstream.

(3) Pay attention to the diverse impact of import competition associated with enterprise distinctions. First of all, prioritize the expansion of credit support for small and micro enterprises. This involves reducing financing costs, alleviating capital turnover challenges posed by import competition, and establishing a robust foundation for enterprise innovation and development. Second, deepen the mixed reform of state-owned enterprises and accelerate the optimization and structural adjustment of the state-owned economy to enhance the core competitiveness of enterprises. To counteract the negligible import competition effect observed in traditional state-owned enterprises due to government intervention, introducing social capital, innovating systems and mechanisms, and expediting the establishment of a modern enterprise system are imperative. Finally, increase support for enterprises in the central and western regions. The government will lower the corporate income tax rate for enterprises in the western region, and encourage them to embrace innovation in the face of import competition, creating new growth drivers and new advantages

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