Value Chain Position and Enterprise Innovation Based on Probit Model and Poisson Model

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Abstract: This paper is based on the Input-Output of 56 industries in 43 countries and China Industrial Enterprise Database. The identification of intermediate and final goods is carried out by using the ISIC industry codes from the World Input-Output Tables and the HS 8-digit product codes from the Chinese customs database, and finally the corresponding upstream degree index of industrial enterprises is calculated. In the econometric analysis, the Probit and Possion models are used to conduct benchmark regressions controlling for time and industry fixed effects. In order to clarify the path of action, the mediating effect models of human and material aspects are constructed at the micro level, and the moderating effect analysis of regional economy is conducted at the macro level. Afterwards, heterogeneity analysis by firm type and patent type further enriches the study. The final robustness test shows the reliability of the research in this paper.

Keywords: enterprise upstream degree; enterprise innovation; Dual Circulation

1. Introduction

From the end of the 20th century to the beginning of the 21st century, the average growth rate of global trade growth exceeded 7%, more than twice the economic growth rate over the same period. In the "wave" of global trade and production division, in order to adapt to the form of network division of commodity production, my country usually appears as a "manufacturing country". With the development of the economy and changes in trade methods, the growth rate of global trade has gradually slowed down. Some scholars have decomposed the global value chain and found that the proportion of purely domestically produced parts and final traded goods is gradually increasing[1]. Many industries led by the optical industry have a clear trend of retreating to their own countries for pure domestic production[2]. Therefore, this article combines world input-output data and micro-level enterprise import and export data to accurately locate the production location of Chinese enterprises, trying to clarify whether the impact of trade on enterprise innovation performance is really developing in the domestic and international markets, and A detailed study of the macro-environment and micro-mechanism

ICEMME 2022, November 18-20, Nanjing, People's Republic of China

DOI 10.4108/eai.18-11-2022.2326940

that affects enterprise innovation is carried out in an effort to promote enterprise innovation and development from both macro and micro aspects.

2. Literature review and hypothesis

Based on the above analysis, this article puts forward Hypothesis 1: The participation of enterprises in the global production sub-union brings the disadvantage of capture, and the retreat to domestic production is conducive to enterprise innovation.

The theory of internal and external dynamics of innovation believes that considering the "high investment and high risk" characteristics of innovation activities, the key to promoting enterprise innovation lies in the enterprise's internal subject consciousness and external innovation diffusion environment[4]. In terms of internal innovation power, Borensztein (1998) showed that FDI is an important factor to promote the technological progress of host country enterprises[5]. At the same time, after incorporating human capital into the analysis framework, they found that import and export trade will have a positive effect on the promotion of technological progress efficiency[6]. In "The End of Laissez-faire Liberalism", Keynes enthusiastically explained the importance of the government's support for trade freedom, emphasizing the role of enterprises themselves. However, most scholars' studies have shown that the government's innovation policy is an important driving force for enterprise innovation[7-9]. Based on the above analysis, this article also proposes the following hypotheses:

Hypothesis 2: Companies in different production divisions can influence corporate behavior through material and human channels, which in turn affect corporate innovation.

Hypothesis 3: In addition to the internal innovation motivation of the enterprise, the regional macroeconomic development level will affect the effect of the position of the production chain of the enterprise on the innovation of the enterprise.

3. Measurement model, data description and variable description

3.1 Model setting

This paper constructs the following measurement model to examine the relationship between the upstream degree of the enterprise and the innovation of the enterprise:

$$R_{it} = \alpha + \beta upstream_{it} + \theta X_{it} + +\lambda_{year} + \delta_{region} + \mu_{industry} + \varepsilon_{it} \qquad (1)$$

Among them, R is the agency variable of enterprise innovation, using whether to apply for a patent and the number of patent applications respectively represent innovation behavior and degree of innovation, and i and t represent enterprise and time respectively. The core explanatory variable upstream represents the export upstream degree, import upstream degree and net upstream degree of enterprise i in year t. X represents the control variables at the enterprise level, including enterprise age, enterprise size, capital labor ratio, per capita wages,

outsourcing factors, capital intensity, debt ratio, profit rate, Market competition(HHI), λ is the fixed effect of the year, and δ is the region Fixed effect, μ is the industry fixed effect, and ε is the random disturbance term of the model.

3.2 Variable description

3.2.1 Enterprise innovation and upstream index

In this paper, the innovation behavior of enterprises is measured by enterprise patents. The core explanatory variables are the export upstream degree, the import upstream degree and the net upstream degree of the enterprise. That is, from the perspective of the supply side, the import and export factors and the factors that are processed and produced in the country are measured from the final consumer goods. Distance, first measure the upstream degree of the industry level, the specific calculation process is as follows[3]:

$$U_i = 1 \cdot \frac{F_i}{Y_i} + 2 \cdot \frac{\sum_{j=1}^{N} d_{ij} F_j}{Y_i} + 3 \cdot \frac{\sum_{j=1}^{N} \sum_{k=1}^{N} d_{ik} d_{kj} F_j}{Y_i} + \cdots \quad (2)$$

Y represents the total output of the *i* industry, *F* indicates the end use of the *i* industry, *d* represents the value of *i* required to produce k worth 1 *USD*, and its value corresponds to the direct demand coefficient in the input-output table[10]:

$$d_{ij} = \frac{Y_i}{Y_i - X_i + M_i - NI_i}, \quad (3)$$

X is the total export of i industry, M is the total import of *i* industry, NI is Net inventory. *U* indicates the upstream degree of the industry. The larger the value, the farther the industry is from the final consumer goods in the industry chain.

The World Input-Output Table covers the input and output of 56 industries in 43 countries from 2000 to 2007, and the corresponding industry export upstream index is calculated in combination with this. After using the HS 8-digit product code in the Chinese customs database to identify intermediate and final products, match the ISIC industry code in the world input-output table to calculate the export value(X) of each company f in the industry i in year t, and the total export X of company f in year t, and further calculate the export upstream degree at the enterprise level U.

$$U_{ft}^{X} = \sum_{i=1}^{N} \frac{X_{fit}}{X_{ft}} U_i \quad (4)$$

$$U_{ft}^{M} = \sum_{i=1}^{N} \frac{M_{fit}}{M_{ft}} U_i \quad (5)$$

3.2.2 Control variable

Missing variables will cause endogenous problems. This article combines the results of other scholars' related research to introduce the following control variables:

In the regression, this paper takes logarithm of the above control variables to control the effect of heteroscedasticity on the effectiveness of the regression results (variables with zero values are added first and then the logarithm is taken), and the tail is narrowed at the level of 99%. deal with. The descriptive statistics of the main variables are shown in Table 1.

Table 1 Descriptive statistics of each main variable

Variables	Obs	Mean	Std. Dev.	Meaning
IF_IN	197 981	0.081	0.273	have a patent or not
PAT	197 981	0.125	0.500	Patent’s number
UX	197 981	1.068	1.112	Export upstream index
UM	197 981	1.153	1.224	Import upstream index
NET	197 981	0.085	1.704	Domestic upstream index
AGE	197 981	2.041	0.679	Enterprise age
SIZE	197 981	1.669	0.203	Enterprise scale
LABOR	197 981	5.543	0.887	Labor productivity
WAGE	197 981	2.270	0.565	Per capita wages
WB	197 981	0.506	0.105	Outsourcing factor
CAP	197 981	3.033	1.775	Capital intensity
PRO	197 981	0.064	0.069	Profit rate
DEBT	197 981	0.410	0.160	Debt ratio
HHI	197 981	5.657	1.135	Market competition
GDP	196 369	10.287	0.643	Per capita GDP
FDI	196 186	11.367	1.620	Foreign direct investment
INCOME	196 471	9.913	0.400	Per capita income

4. Regression analysis

Table 2 lists the use of the Probit model to study the impact of the company's production chain location on the company's innovation behavior, and Table 3 reports the use of the Poisson model to study the performance of the company's innovation intensity. Columns (1), (3), and (5) are the results of separate regression of upstream degree indicators and corporate innovation indicators. Columns (2), (4) and (6) indicate that the control variables and fixed effects of year, industry, and region are added. return. When participating in the division of production in the global value chain, each increase in the upstream export of a company reduces the probability of the company to participate in innovation activities by 0.71% and the company’s innovation intensity by 11.80%, and the regression result is significant at the 1% statistical level, indicating that the company When participating in the production and division

of labor in the global value chain, the farther away the exported goods are from the final consumer goods, the more unfavorable the development of enterprise innovation activities and the improvement of innovation capabilities. Each increase in the upstream degree of a company's import increases the probability of a company's participation in innovation activities by 0.31%, and increases the company's innovation intensity by 3.36%. Most of the enterprises with a high degree of upstream import import raw or unprocessed elements such as resources and materials. These primary products are susceptible to fluctuations in the supply and demand of the international bulk commodity market. In the short term, such enterprises have Momentum seeks technological innovation to reduce product costs. In the long run, companies will seek innovation to optimize their position in the global value chain. The net export index of a company reflects the number of steps a company has in domestic production. The regression results show that the domestic production process is conducive to company innovation. For each increase in the net upstream degree, the probability of a company participating in innovation activities increases by 0.44%, and the company's innovation intensity increases by 6.27%. From the perspective of control variables, the increase in the duration of the enterprise, the expansion of scale, the increase in labor productivity, the increase in the ratio of capital to labor, per capita wages, etc., and industry competition are all conducive to the development of innovative activities by enterprises. The export upstream degree and import upstream degree indicators from the perspective of global value chain confirm the status that companies currently participate in global value chain production and need to be improved. The return of net upstream degree from the perspective of domestic value chain shows that whether it is innovation behavior or corporate innovation intensity, companies Domestic production and value creation are conducive to enhancing innovation capabilities.

Table 2 The influence of the location of the production chain on the innovation behavior of enterprises

variables	(1)	(2)	(3)	(4)	(5)	(6)
UX	-0.021 9***	-0.007 1***				
	(0.000 6)	(0.000 6)				
UM			0.001 3*	0.003 1***		
			(0.000 5)	(0.000 5)		
NET					0.009 2***	0.004 4***
					(0.000 4)	(0.000 4)
CONTROLS						
Year	N	Y	N	Y	N	Y
Industry	N	Y	N	Y	N	Y

region	N	Y	N	Y	N	Y
Num	197 984	197 975	197 984	197 975	197 984	197 975

Note: 1) Standard errors in parentheses ; 2)* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. 3) Contains year/industry/region fixed effects.

Table 3 The influence of the location of the production chain on the intensity of enterprise innovation

	(1)	(4)	(2)	(5)	(3)	(6)
UX	-0.341 0***	-0.118 0***				
	(0.007 3)	(0.009 3)				
UM			-0.013 2*	0.033 6***		
			(0.005 2)	(0.007 2)		
UN					0.111 0***	0.062 7***
					(0.003 8)	(0.005 3)
CONTROL	N	Y	N	Y	N	Y
year	N	Y	N	Y	N	Y
industry	N	Y	N	Y	N	Y
region	N	Y	N	Y	N	Y
Num	197 984	197 984	197 984	197 984	197 984	197 984

5. Results and Discussion

5.1 Summary of Research Results

This paper uses the upstream degree of enterprise import and export to describe the position of the company participating in the international production division, uses the net upstream degree to describe the company's domestic production process, uses upstream degree indicators and patent variables that characterize enterprise innovation to conduct empirical tests, and draws the following conclusions: (1) Enterprises whose export products are farther away from final consumer goods will have less motivation for innovation, while enterprises that import raw materials for processing and production are more motivated to improve their innovation capabilities. The increase in the number of domestic production links promotes enterprise innovation behavior, thereby verifying enterprise participation The significance of both domestic and international markets. (2) The growth of the domestic production chain has strongly promoted the innovation of the three types of patents of enterprises. The position of the production chain of enterprises under different types of enterprises has differences in enterprise innovation, and the influence of private enterprises and foreign-funded enterprises is more significant than that of state-owned enterprises. (3) Macroeconomic policies will affect the effects of the above variables. The advanced economic level of cities can weaken the inhibitory effect of upstream exports on enterprise innovation and strengthen the promotion of domestic production on enterprise innovation. (4) Enterprises at different positions in the production chain influence their innovation performance through the channels of physical

capital and human capital.

5.2 Discussion

Based on the above conclusions, the following suggestions are made: First, for Chinese companies, participating in the division of labor in the global value chain is both an opportunity and a challenge, and the breakthrough to get rid of the "captured" dilemma lies in the formation of independent innovation of local companies and competition in the local market through domestic competition. After the positive interaction of the advantages, the effective control of the domestic market is used to strive for the expansion of the regional advantages by vigorously introducing FDI and improving the treatment of high-quality talents, so as to attract more innovative enterprises to settle down, and thus stimulate economic development. The economically developed macro environment will further promote the development of enterprises.

Acknowledgement: The research is supported by 2021 Tianjin Educational Science Planning Project A Study of the Collaborative Development of Higher Education Clusters in the Beijing–Tianjin–Hebei (BTH) Region (No.FIE210052).

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