

# Research on the Influence of Chinese Manufacturing Enterprises on European Direct Investment and Corporate Export

—Based on Propensity Score Matching Method

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**Abstract**—The proposal and development of the "Belt and Road" Initiative have brought China-EU capital and goods trade exchanges to a new height. On the basis of the company's micro-data in the "China Industrial Enterprise Database" and the "China Foreign Investment Enterprise (Organization) List", this paper defines the export intensity and matches the samples of the direct investment enterprises in Europe, finds that Chinese enterprises' investment in Europe has a significant positive causal relationship with the export intensity of enterprises through the adoption of the Propensity Score Matching method (PSM) based on the micro level and the average intervention effect, which indicating that Chinese enterprises' direct investment in Europe is conducive to the increase of the export probability of enterprises, which has reached 17%. Moreover, covariates have all passed balance test. Based on this, the purpose of investment was subdivided, and the impact of different investment on the export intensity of direct investment in Europe was explored. This paper hopes to provide useful insights for companies to expand the European market to use OFDI to consolidate the friendly partnership between China and Europe through empirical research at the micro level.

**Keywords**—Direct Investment in Europe; The "Belt and Road" Initiative; Export Intensity; Propensity Score Matching

## I. INTRODUCTION

Since the "the Belt and Road" initiative was put forward, under the strong leadership of the Party Central Committee with Comrade Xi Jinping as the core, we have thoroughly implemented new development concepts and deepened China-EU economic and trade relations in the new era. According to Eurostat data, the bilateral trade volume between the EU-27 countries and China reached 565.78 billion U.S. dollars in 2016, and China has become the EU's second largest export market and the largest source of imports. In the context of China's declining external investment last year, China's investment in Europe was as high as 81 billion yuan, an increase of 76 percentage points from 2016, and the closeness of Sino-European relations has continued to deepen. The EU-China investment in transportation, utilities, logistics, and infrastructure construction has increased by more than 10 times within two years. This is closely related to the development of

various countries along the "Belt and Road" and bilateral trade between China and the EU. As China gradually becomes the world's top trading power and the largest foreign investment country, research on China-EU bilateral trade as an important part of China's openness to Europe and its investment in Europe have certain practical significance. This paper starts from the Chinese manufacturing companies, and based on the theory of firm heterogeneity, uses the data obtained from the "Chinese Industrial Enterprise Database" and the "China Foreign Direct Investment Enterprises (Organization) Directory" to match the European direct investment enterprises. The Propensity Score Matching Method (abbreviated as PSM), based on the micro level, explores the impact of Chinese companies' investment in Europe on the increase in export intensity, and also examines the micro performance to explore how deeper the European investment can bring to Chinese companies in terms of foreign trade. The promotion effect.

## II. LITERATURE REVIEW

In recent years, the continuous increase of China's foreign investment has made it increasingly obvious that foreign investment has not significantly promoted the import and export trade. Weiss (1981) took US manufacturing companies as a sample to prove the complementary role of foreign investment and foreign trade. Domestic scholars have also begun to focus their research on this issue because of the rising tide of China's foreign investment boom [1]. Xiang Benwu (2005) used the sample data of China's foreign investment and total import and export volume for 49 trading partners and used gravitational models to regress the panel data to demonstrate that China's foreign investment played a catalytic role in China's exports [2]. Chai Qingchun and Hu Tianyu (2012) found that the trade effect of foreign investment is not very prominent because current Chinese foreign investment is very limited, and the trade effect that can be brought about is not so significant. Besides, they also study the differences and seek to implement a diversified and multi-structured foreign investment policy [3].

It can be found that most of the previous studies have focused on the macro impact and role of foreign investment in import and export trade. The research on the trade effects of micro-

enterprises is mostly limited to the period 2000-2006. There is no continuous development of Sino-European trade today. Related studies on the micro-level trade effects on European direct investment and the impact on the export probability of firms. The purpose of this paper is to provide reasonable suggestions on how the government can innovate in foreign investment and strengthen the development of China-European trade relations through the influence of Chinese manufacturing enterprises on the micro-trade effects of European direct investment on the export and export intensity of enterprises.

III. VARIABLE MODEL SETTING AND DATA PROCESSING

A. Data Selection and Processing

The corporate data selected in this paper are those of China's Industrial Enterprises Database and the Chinese Foreign Direct Investment Enterprises (Institutions) Directory. The direct investment enterprises in Europe are matched with each other in different years. Due to the missing of key variables and data in 2009 and 2010, so I selected the data that has the nearest 2011-2013 to match. Statistics of the Ministry of Commerce "Directory of Foreign Direct Investment Enterprises (Institutions) in China" includes names of foreign direct investment companies, their main businesses, investment years, and investment purposes. The enterprise matching process matches the European direct investment enterprises in the "China's Industrial Enterprise Database" and the "China's Foreign Direct Investment Enterprises (Institutions) Directory" through the public domain name in the database, and the 89,540 export manufacturing enterprises in Europe directly 218 investment companies.

B. Variable setting

The explained variable (Export) of this paper is set to the enterprise's export intensity, that is, the value of the enterprise's export delivery value in the total industrial sales of the company. Due to the differences in policy influence, total enterprise scale, and research and technological input between different companies in different years, the total export volume of the company fluctuates between different companies and different years, which does not reflect the impact of the core variable on the export status of the enterprise to calculate the average intervention effect, so I chose the export delivery value of enterprises in the company's total industrial sales accounted for, can be a good reflection of different companies' willing and the probability to export goods under the background of the company in a certain amount of total industrial sales. The changes of probability explained well the export status of

enterprises and the intervention under the influence of foreign direct investment.

1. The core variable of this paper is a dummy variable which is whether the enterprise *i* performs the FDI in year *t*. If the enterprise *i* performs FDI in year *t*, the value is 1, otherwise the value is 0. The data comes from the "China's Foreign Direct Investment Enterprises (Institutions) Directory" in which the European direct investment enterprises and the "China's Industrial Enterprise Database" were selected to match the selected experimental group variables.

2. The TFP of enterprises is the contribution of other factors (such as technological progress and other non-productive input factors) to the growth of the total output of the company, in addition to the elements of capital and labor. Because the total factor productivity of the company is difficult to quantify, with the gradual improvement of the company's micro-data, the micro-level analysis of TFP became more and more detailed. This paper uses the Cobb Douglas production function to estimate TFP.

3. Profitmargin is the ratio of operating profit to the value of industrial sales, that is, the ratio of operating profit to total sales.

4. Salary is the ratio of salary expenditures to the number of employees in the company.

5. The capital flow rate (Capital) is the ratio of the capital receivable to the value of industrial sales. It shows the flexibility of the capital of the company.

6. The control variable  $X_{it}$  mainly includes the company's working life (Year), company size (lnAsset), corporate debt ratio (Debt), corporate profitability, number of employees (Stuff), per capita fixed assets (Fix), and corporate capital composition (Foreign). Empirical Results and Analysis

IV. EMPIRICAL RESULTS AND ANALYSIS

A. Preliminary Estimation of Export Intervention to Foreign Direct Investment in Europe

Prior to the propensity score matching, the OLS regression is first performed on the following models to prevent heteroscedasticity, and the correlation between the independent variable and the dependent variable is determined,

$$Export_{it} = \alpha + \beta_1 OFDI_{it} + \beta_2 lnTFP_{it} + \beta_3 Salary_{it} + \beta_4 Capital_{it} + \beta_5 Profitmargin_{it} + X_{it} + \mu_{it} \quad (1)$$

TABLE I. PRELIMINARY ESTIMATES OF EXPORT INTERVENTION TO ENTERPRISES BY DIRECT INVESTMENT IN EUROPE

VARIABLES	Export
Year	-0.00272*** (0.000149)
lnAsset	-0.0647*** (0.00123)
Debt	0.0323*** (0.00620)
profitmargin	-0.0954***

	(0.0370)
Capital	0.00922
	(0.0114)
Stuff	1.19e-05***
	(1.34e-06)
lnTFP	0.00912**
	(0.00440)
OFDI	0.108***
	(0.0215)
Salary	6.00e-06***
	(1.29e-06)
Fix	-6.44e-07***
	(1.95e-07)
Foreign	-1.63e-05***
	(5.53e-06)
Constant	1.222***
	(0.0140)

Robust standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

As can be seen from Table 1, except for the company's capital flow rate variable, OFDI dummy variables, Year, lnAsset, Debt, Profitmargin, Stuff, Salary, Fix and Foreign are all significant at the 1% level of significance. The enterprise's total factor productivity (lnTFP) is also highly correlated with export intensity. Therefore, we tend to remove the corporate capital flow rate (Capital) variable in favor of score matching to make the result more accurate.

#### B. Propensity Score Matching (PSM) Estimation of Average Intervention Effect

In the above regression results, OFDI companies are higher in export intensity than non-OFDI companies, but because of the self-selection effect, OFDI companies may have more export intensity than non-OFDI companies before conducting direct foreign investment. It cannot be distinguished whether this difference is due to direct foreign investment or self-selection effect, so the result is not credible. To remove the influence of self-selection effect, this paper adopts propensity score matching method (PSM) to analyze whether there is a causal relationship between foreign direct investment and enterprise export intensity.

According to the results of the initial regression, the company's capital flow rate variable was removed, and OFDI was used as the intervention variable. The company's business lifespan, company size, corporate debt ratio, corporate profitability, number of employees, per capita salary of employees, per capita fixed assets, and corporate capital constitute Covariates, using the logit regression model, using the radius matching method and making  $r = 0.05$ , so the matching results are shown in Table 2.

TABLE II. OVERALL SAMPLE MATCHING RESULTS

Sample	Treated	Controls	D	S.E.	T-stat
Unmatched	.4707883	.4562530	.014535	.025169	0.58
ATT	.4707883	.3258857	.1449025	.033422	4.34***
ATU	.4532795	.6238144	.1705348		
ATE			.1704714		

The total sample number is 89546, including 218 individuals in the experimental group and 89328 individuals in the control group. Through Propensity Score Matching method, a total of 88140 individuals were matched, of which 218 individuals were in the experimental group, 87,922 in the control group, and 1406 were lost. Most of the observations were within the common value range, and the propensity score matching only lost a small amount. sample. From the data in Table 3, it can be seen that the difference between the export-intensive data of the European direct investment enterprise and the non-OFDI enterprise before the matching is 0.01453528, and the difference between the export-intensive data of the experimental group and the control group after matching is 0.144902594, passing 1% significance level test. In the experimental group and the control group, the average treatment effect ATE was 0.170471487. The difference between before and after the match was more than ten times. This indicates that after controlling other control variables affecting the export concentration, the company conducted direct operations to Europe. The investment is obviously beneficial to the promotion of the technical complexity of the export of the enterprise. The ATE figures indicate that the direct export of investment in Europe is about 17% higher than that of the non-foreign invested enterprise.

Prior to matching, Year, lnAsset, Debt, Profitmargin, Stuff, Salary, Fix and Foreign are higher than non-outbound investment companies, indicating that OFDI, an outbound investment company, does have a self-selective effect. After the match, the control variables of the experimental group and the control group were highly close to each other, indicating that the original hypotheses with equal mean values of the experimental group and the control group verified the validity of the propensity score matching.

*C. Impact analysis of OFDI under the difference of investment motivation*

After the propensity score matching method concluded that OFDI has a significant positive effect on the export intensity of firms. Due to the tedious nature of OFDI's corporate investment objectives and the differences in investment motives, OFDI's influence mechanism and current scope of influence are more clearly illustrated. According to the range of investment types in

the database of China's foreign direct investment enterprises (institutions), referring to the method of classification of investment motives by Ye Jiao et al. (2017)[4], this paper classifies OFDI into non-business category, sales category, manufacturing category, research and development category. The non-business category includes office organizations engaged in industrial consulting, information collection or marketing, and after-sales services; sales category are companies that sell products abroad or import and export trade of related products; manufacturing category are companies abroad engaged in the simple processing, assembly and manufacturing of products; research and development are companies of integrated services for overseas companies that specialize in new product R&D and design, promotion of technological advancement or investment and financing. The results of the propensity score matching and the balance test are shown in Table 3.

TABLE III. PROPENSITY SCORE MATCHING METHOD AND EQUILIBRIUM TEST UNDER DIFFERENT INVESTMENT OBJECTIVES

Variable	Export			
Classification	non-business category		sales category	
Sample	Unmatched	ATT	Unmatched	ATT
Treated	.476855	.476855	.472265	.472265
Controls	.456253	.318497	.456253	.328540
Diff.	.020602	.158357	.016012	.143724
S.E.	.043764	.058328	.030133	.039919
T-s	0	2***	0	3***
Variable	Export			
Classification	manufacturing category		research and development category	
Sample	Unmatched	ATT	Unmatched	ATT
Treated	.328562	.328562	.324330	.324330
Controls	.456253	.271181	.456253	.259870
Diff.	-.127690	.057380	-.131922	.064460
S.E.	.047937	.059457	.046415	.056847
T-s	-2	0	-2	1

Table 3 shows the result of the Propensity Score Matching method. The non-business OFDI and sales OFDI influence coefficients (ATT-Difference) are significantly positive, and the non-business's 0.158 is slightly larger than the sales category's 0.144. It shows the impact of non-business OFDI's export concentration to the company is even greater. The coefficient of manufacturing category, research and development category is also positive, but not significant. From this we can see that there

are significant differences in the impact of different investment objectives on the export intensity of firms, of which the promotion of non-business and sales category are more significant.

## V. CONCLUSIONS AND SUGGESTIONS

Based on the empirical research results of this paper, and under the “the Belt and Road” initiative, today’s enterprises have gradually grown and expanded. There are already many well-known companies among the top 500 in the world. First of all, China and European countries have more and more close links in capital flows and trade flows. This ultimately requires that our companies themselves as media to strengthen the investment and bilateral trade process in European countries. The government should increase the influence of policy factors. Business-to-European investment, through the encouragement and promotion of policies, plays an indispensable role in the micro-level of enterprises in international exchanges and cooperation. Second, Chinese enterprises must actively participate in the “the Belt and Road” initiative while basing themselves on their own. Particularly, companies with certain financial strength and high financial flexibility can use OFDI’s counter-effects gradually through direct investment in Europe. Increasing the skills and management capabilities that most Chinese companies lack may also be of great benefit to export trade. In addition, Chinese companies should make good use of the current trend of “going global” and companies with large scale and strength should cooperate with each other. In addition to strengthening investment and exchanges with developed countries in Europe, they can try to open new markets for small and medium-sized European countries as one way to strengthen their products to Europe. Finally, companies need to rationally optimize the investment results and the development of the company itself. Through better investment in Europe to open- the European export road, promote the harmonious development of enterprise innovation.

## REFERENCES

- [1] Jun-cong Chen: "The Impact of Foreign Direct Investment on the Technical Complexity of Service Exports: An Empirical Study Based on a Multinational Dynamic Panel Data Model", Issue 12 of 2015, *International Trade Issues*.
- [2] Qing-chun Chai and Tian-yu Hu: "Research on the Trade Effect of China's Outward Direct Investment - Based on the Differences in Investment in ASEAN and the EU", 6th edition of "World Economic Research", 2012.
- [3] De-wei Jian, Meng-jie Li, "Does Direct Foreign Investment Improve the Quality of Export Products?" based on the changing weights of propensity score matching, "International Trade Issues", Issue 8, 2015.
- [4] Hao Hu, Wei Jin, Jie Xie, "Analysis of the Efficiency of China's Outward Direct Investment and Its Influencing Factors", *World Economic Research* No. 10, 2017.
- [5] Xiao-dong Lu, Yu-jun Lian: "The estimation of total factor productivity of Chinese industrial enterprises: 1999-2007", in the second issue of "Economics Quarterly" (2012).
- [6] Xiao-dan Liu and Chang-jun Yi: "China's Foreign Direct Investment Micro-Performance Study - An Empirical Analysis Based on PSM", *World Economic Research*, 2017, Issue 3.
- [7] Yan-xi Li: "Analysis of China's Trade Effect on Argentina's Direct Investment," in "Market Weekly (Theoretical Research)", 2016, No. 12.
- [8] Hui-hua Nie, Jiang Da, Yang Xi: "The Current Situation and Potential Problems of the Use of Chinese Industrial Enterprise Databases", *World Economics*, 2012, Issue 5.
- [9] Xiang-ben Wu: "Research on the trade effect of China's foreign direct investment - cointegration analysis based on panel data", including "Finance and Trade Economics" No.4, 2009.
- [10] Ben-wu Xiang: "The Trade Effect of China's Foreign Direct Investment", "Statistics and Decision", No. 24, 2005.
- [11] Ye Jiao, Chuan-jiang Cui, and Shan: "Enterprise OFDI and Technology Improvement of Export Products: Research Based on Micro-Enterprise Data", *World Economic Research* Issue No.12, 2017.
- [12] Kojima. K, 1978: *FDI: a Japanese Model of Multinational Business Operations*. Groom Helm.
- [13] Mundell, R. A., 1957: *International Trade and Factor Mobility*. American Economic Review.
- [14] R. E. Lipsey, M.Y. Weiss, 1981: *Foreign Production and Exports in Manufacturing Industries*. *Review of Economic and Statistics*, Vol. 63, No.4.