

# *Green Transformation and Enterprise OFDI*

Jianing Li<sup>1,a,\*</sup>

<sup>1</sup>*China University of Political Science and Law, Beijing, China*

*a. lijianing609594247@163.com*

*\*corresponding author*

**Abstract:** Clarifying the impact effect and mechanism of green transformation on enterprises' OFDI helps to promote the upgrading of national industrial structure, the high-quality development of the regional economy, and the improvement of enterprises' market economic power, and plays a positive role in China's active integration into the world economy and the promotion of the road of reform and opening up. Based on the data of listed enterprises in the Cathay Pacific CSMAR database from 2005 to 2022 and the data on green transformation of each prefecture-level city, we constructed a fixed-effects regression analysis model to explore the impact effect of green transformation on enterprises' outward foreign direct investment. It is found that (1) green transformation has a significant promotion effect on enterprises' OFDI. (2) The conclusion still holds after conducting robustness tests. (3) Green transition promotes OFDI through green market development, green technological innovation, and alleviation of financing constraints. (4) Government green subsidies and openness to the outside world positively regulate the promotion effect of green transition on OFDI. (5) Green transformation has a stronger role in promoting OFDI from eastern and state-owned enterprises. This paper provides a micro-basis for promoting OFDI by relying on the policy background of green transition, which is an important revelation for improving the quality of green economy and realizing a high level of open economy.

**Keywords:** Green Transformation, OFDI, Government Green Subsidies, Openness.

## **1. Introduction**

At present, the world is in a situation of great change, the international environment is becoming more and more complicated. With the rise of populism, protectionism unilateralism, and frequent geopolitical turmoil, the global economy is facing downward pressure and the downturn of globalization, and enterprises face many risks and challenges.

Outward foreign direct investment (OFDI) is essential for China to accelerate the transformation of its economic development mode, and adjust and optimize the industrial structure. As an important condition for China's participation in economic globalization, the high-quality development of OFDI by enterprises is conducive to enhancing their international competitiveness, exploring the global market, and thus promoting the upgrading of the national industrial structure. OFDI has entered a new growth stage. According to the statistics, China's industry-wide OFDI amounted to US\$147.85 billion in 2023, up 0.9% year-on-year. Regarding China's new outward investment pattern, international comments have been mixed, and allegations of "dumping" of Chinese industries,

especially emerging industries, are common. The driving factors of OFDI by Chinese enterprises have become the focus of attention.

Domestic enterprises have responded positively to the government's call to "go global". With the rapid development of the economy, the deterioration of the domestic environment and environmental pollution in host countries have aroused concern. In recent years, there have been many reports about highly polluting and energy-consuming enterprises transferring to host countries through OFDI, which have caused great damage, seriously affecting people's physical and mental health, and hindering the development of OFDI. At present, China's ecological civilization construction has entered a new stage, and green development has become the consensus of the whole society. All regions emphasize the implementation of green transformation and actively play a leading role in contributing to the comprehensive green transformation. As an important micro-body of the social economy, the investment behavior of enterprises on the one hand has a bearing on domestic environmental protection and economic structure. On the other hand, their increasingly mature development mode also has a non-negligible impact on the structure of the host country's industrial market and even the structure of the international market through OFDI.

In summary, with the regional green transformation, China's enterprises' OFDI has entered a new stage of development, and its scale expansion is facing the diversification of influencing factors and the complication of its role mechanism. Actively playing the main role of government policy and promoting the comprehensive green transformation of the region have an important impact on promoting the healthy development of enterprise OFDI and enhancing the competitiveness of enterprises in the international market. Therefore, it is of practical significance to explore the impact of green transformation on enterprise OFDI. This paper focuses on the development pattern of enterprise OFDI in the context of regional green transformation and explores the role mechanism of green transformation affecting enterprise OFDI by taking domestic and foreign green markets, green technological innovation, and alleviation of financing constraints as the entry point. Compared with existing studies, this paper has the following innovations: first, the research on green transition on enterprise OFDI has not been fully studied in the academic world, and this paper helps to expand the scope of impact assessment of regional green transition and comprehensively present the economic effects of the green transition. Secondly, it focuses on the impact of government policies on the green market in OFDI, which provides a new perspective for analyzing the OFDI impact mechanism and makes up for the gaps in the current research field.

## 2. Literature review

OFDI by enterprises is influenced by a variety of factors, such as patents going overseas, the digital economy, export experience, and migrant networks. From the perspective of the parent company, Qu Ruxiao et al. believe that patents going global promote Chinese enterprises' OFDI through the technological leadership effect and reputation transfer effect[1]. Other scholars believe that the digital economy is an important influence on OFDI[2][3]. From the perspective of overseas subsidiaries, scholars believe that the immigration network promotes the quality of China's OFDI by reducing the impact of legal and cultural differences and lowering information asymmetry[4].

The impact of the green transition can be categorized into macro-level and micro-level. At the macro level, the green transition has had an impact on China's regional foreign direct investment and distribution economy. According to Yi and Yin, the new energy demonstration city policy in the green transition promotes the inflow of FDI by improving technological innovation and energy efficiency[5]. According to Ma and Lin, the green transformation of the logistics industry has an impact on the trade and circulation economy[6]. At the micro level, there are fewer studies on the impact of green transformation on enterprises, mostly focusing on the sub-level of low-carbon transformation[7].

However, the current literature on the impact of regional green transformation on corporate OFDI is very rare, and most relevantly, Liu argues that low-carbon transformation plays a facilitating role in corporate OFDI through marginal industry transfer, green technology innovation, and digitalized factor substitution[8]. However, there are major differences between that literature and this paper. Firstly, the two core variables of green transition and low carbon transition are QUITE different. Green transition emphasizes more on the transformation of the economic model through the coordination of the economy and ecosystem. Secondly, the estimation method and data used in this paper are also different. Finally, in terms of the impact mechanism, this paper discusses it from a different perspective. In addition to the perspective of common enterprises, this paper also takes into account the impact of the policy on domestic and foreign markets, studying the role of the mechanism more comprehensively.

In summary, extensive research on the impact of green transition and the influencing factors of OFDI has been carried out, providing theoretical support. This paper will utilize data of OFDI at the enterprise level for the first time to explore the impact of regional green transformation on OFDI of enterprises, and make certain supplementary expansion of the existing research in the following aspects: firstly, this paper comprehensively examines the impact of green transformation on OFDI of enterprises using the microdata in the CSMAR database; secondly, empirically examines the mechanism of this impact role. Second, it empirically tests the existence and effect of the mechanism of this influence and analyzes the moderating effects of government environmental subsidies and the degree of regional openness.

### **3. Theoretical foundations and research hypotheses**

#### **3.1. Impact of the green transition on OFDI by enterprises**

Enterprise behavior is not only influenced by the enterprise's factors but also closely related to the external environment. The paper suggests that the regional green transition may affect OFDI in several ways.

First, regional green transformation can promote the development of green markets to facilitate enterprises' OFDI. First of all, regional green transformation through the promotion of green market development gives enterprises a global competitive advantage. With the development of a green market, market competition promotes the improvement of enterprises' competitiveness. Secondly, the green transition influences the supply and demand relationship in the green market, prompting enterprises to choose to go global under the drive of interest.

Second, regional green transformation can promote enterprises' green technological innovation to facilitate the OFDI. Government-led environmental regulations penalize high-polluting enterprises, forcing them to improve. And the market benefit drive makes enterprises more active in green technological innovation. Combined with the significant positive impact of green technological innovation on enterprise competitiveness[9], it can be concluded that green transformation is conducive to the improvement of enterprise productivity and competitiveness. And enterprises with higher productivity are more inclined to engage in OFDI[10].

Finally, regional green transformation can effectively alleviate corporate financing constraints to facilitate enterprises' OFDI. With the expansion of green finance theory in various fields, the idea of considering environmental impacts in project financing has been supported by many financial institutions. This has led to corporate credit activities being directly influenced by the region's green transition. Empirical evidence also suggests that green transitions have been effective in alleviating corporate financing constraints. Regional green transitions alleviate corporate financing constraints through financial support effects[11]. The impact of financing constraints on corporate OFDI is also widely recognized in the academic community[12].

Accordingly, the following assumptions are made:

**Hypothesis 1:** The green transition has a catalytic effect on corporate OFDI.

### 3.2. The moderating role of policy and market environments

Enterprise behavior is influenced by complex internal and external factors, and investment behavior may be different in different policy and market environments. Therefore, this study also focuses on the moderating role of government environmental subsidies and the degree of openness.

The moderating role of government environmental subsidies is reflected in the positive impact of regional green transformation on OFDI. First, government environmental subsidies can promote the improvement of enterprise performance. Studies have shown that government subsidies can effectively improve enterprise efficiency and that green innovation can improve enterprise environmental performance[13]. Government green subsidies promote enterprise productivity and thus enhance enterprise performance[14]. Second, government environmental subsidies can promote enterprise development. Research shows that government subsidies can effectively stimulate the practice of enterprise innovation, and government subsidies have a promotional effect on enterprise innovation[15]. As a result, enterprises gain advantages in the international market, which promotes the OFDI.

**Hypothesis 2a:** The green transition has a more pronounced effect on the promotion of OFDI by firms in regions with higher government environmental subsidies.

The moderating effect of the degree of openness is reflected in the fact that it reinforces the positive impact of the region's green transformation on enterprises' OFDI. First, regional openness is conducive to the improvement of enterprise competitiveness. Openness reduces the cost of acquiring information, enabling enterprises to grasp more information. And it provides the conditions for fair competition, forcing enterprises to enhance their competitiveness. Secondly, the openness has lowered the threshold for enterprises to go global. The reduction of the high cost of cultural differences in OFDI improves communication efficiency and information quality.

**Hypothesis 2b:** The promotion effect of green transformation on OFDI by enterprises in regions with a higher degree of openness is more pronounced.

## 4. Research design

### 4.1. Modeling and Variable Selection

The previous paper analyzed the impact of green transformation on enterprises' OFDI, and to test the theoretical research hypotheses of the relevant 1, this paper constructs the following micro panel data model of green transformation affecting enterprises' OFDI, which is estimated by using the fixed effect regression analysis method.

$$OFDI_{it} = \beta_0 + \beta_1 DX\_city_{it} + \sum_{j=2}^T \beta_j control_{it}^j + \gamma_i + \mu_t + \varepsilon_{it}$$

where  $i$  denotes the enterprise code;  $t$  denotes the period; and the explanatory variable  $OFDI_{it}$  denotes the enterprise's OFDI in period  $t$ , calculated by adding 1 to the logarithm of the enterprise's current OFDI size.

Core explanatory variables  $DX\_city_{it}$  represents the degree of regional green transformation, using the sum of the frequency statistics of ten categories of green words in the government work report of prefecture-level cities as a proxy variable for the degree of regional green transformation.  $Control$  represents a series of control variables, and  $\gamma_i$  represents the time-fixed effect,  $\mu_t$  represents the individual fixed effect,  $\varepsilon_{it}$  is a random perturbation term.

To control the influence of other variables besides, control variables such as enterprise size (Size), gearing ratio (Lev), shareholding ratio of top five shareholders (Top5), and the degree of competition in the industry (HII) are selected at the enterprise level. Market openness (Openness) is selected as a control variable at the prefecture level. Among them, the degree of competition in the industry adopts the Herfindahl-Hirschman Index (HHI), which is calculated by the sum of squares of the shares of total assets of enterprises in the industry; and the openness of the market is measured by the logarithm of the amount of actual utilization of foreign capital.

Descriptive statistics for each variable are shown in Table 1.

Table 1: Descriptive statistics of variables.

variable	N	mean	p50	sd
OFFICE	38197.000	2.030	0.000	5.456
word sum	38197.000	0.606	0.606	0.133
Size	38197.000	22.114	21.911	1.317
Lev	38197.000	0.424	0.419	0.208
Top5	38161.000	0.540	0.544	0.154
HI	37928.000	0.155	0.100	0.151
Openness	33972.000	14.185	14.693	1.740

## 4.2. Description of data sources

The data on the green transformation of prefecture-level cities are obtained from the government work report of each prefecture-level city. 2005-2022 enterprise data are obtained from the database of Cathay Pacific CSMAR China Listed Company Affiliated Transaction Research Database, and the data of some control variables are obtained from the annual reports of listed companies, this paper excludes samples in which the host country is a tax haven.

## 5. Analysis of empirical results

The results of the benchmark model regression are shown in Table 2, in which the coefficients of the core explanatory variables in Columns (1)-(4) are all significantly positive, indicating that regional green transformation can significantly contribute to the increase in the scale of OFDI by enterprises. Among them, column (1) is the estimation result of double fixed effects of year and region, and columns (2)-(4) are the estimation results of robust standard error, clustering standard error, and bilateral shrinkage of tails at the 1% quartile in turn. From the overall regression results of the sample: after controlling for year and region fixed effects, there is a significant positive correlation between green transformation (GX\_city) and the scale of firms' outward foreign direct investment (OFDI), i.e., for every 1 percentage point increase in green transformation (GX\_city), the scale of firms' outward investment rises by 0.6028%, which is significantly positive at the 1% level. Overall, Table 2 shows that the green transformation of prefecture-level cities has a significant promotion effect on the outward investment of enterprises, and Hypothesis 1 is verified.

Table 2: Baseline regression results.

	(1)	(2)	(3)	(4)
	OFDI	OFDI	OFDI	OFDI
GX_city	0.6028*** (-2.8715)	0.6028* (-1.9528)	0.6028*** (-2.9323)	0.6112*** (-2.7918)

Table 2: (continued).

Size	0.3953*** (-7.5418)	0.3953*** (-4.5685)	0.3953*** (-7.2674)	0.4044*** (-7.6466)
Lev	0.8938*** (-4.0579)	0.8938** (-2.3763)	0.8938*** (-4.0489)	0.8889*** (-4.011)
Top5	0.1327 (-0.4406)	0.1327 (-0.3006)	0.1327 (-0.4123)	0.1101 (-0.3647)
HHI	0.0902 (-0.3752)	0.0902 (-0.2426)	0.0902 (-0.3574)	0.098 (-0.3949)
Openness	-0.1042** (-2.5665)	-0.1042* (-1.7194)	-0.1042*** (-2.6493)	-0.1123*** (-2.5800)
_cons	-6.5041*** (-5.4557)	-6.5041*** (-3.4646)	-6.5041*** (-5.4262)	-6.5774*** (-5.3840)
year	Yes	Yes	Yes	Yes
fe	Yes	Yes	Yes	Yes
N	33673	33673	33673	33673
adj. R <sup>2</sup>	-0.111	0.017	0.499	-0.111

t statistics in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  (below)

In this paper, we first shorten the time window to adjust the sample period to examine the robustness of the findings and the estimation results are shown in column (1) in Table 3. The sample period selected for the benchmark regression is 2005-2022, taking into account that the outbreak of the novel coronavirus in 2020 has brought persistent negative impacts on domestic and foreign economies, and cross-border investment activities have been significantly suppressed. To avoid this event from interfering with the empirical results, the sample is adjusted to 2005-2019, and the results show that the sample time interval does not affect the significance of the green transition estimator, and there is a significant promotion effect on enterprise OFDI. The robustness of the findings is further tested using the number of corporate OFDI to replace the OFDI scale, adding a dummy variable for corporate industry, and lagging the variable by one period, and the estimation results are shown in columns (2)-(4) of Table 3. After controlling for year and region-fixed effects, the results are highly similar to those of the benchmark regression, with the number of OFDI showing a significant facilitating effect on green transformation, effectively supporting the conclusions.

Table 3: Robustness test.

	(1) OFDI	(2) OFDI	(3) OFDI	(4) OFDI
GX_city	0.5246** (-1.9825)	0.1156*** (-4.4252)	0.5665*** (-2.7629)	0.5519*** (-2.6225)
controls	Yes	Yes	Yes	Yes
_cons	-6.2070*** (-4.5880)	-0.6727*** (-4.8251)	-9.3391*** (-6.5648)	-7.6000*** (-5.9961)
year	Yes	Yes	Yes	Yes
fe	Yes	Yes	Yes	Yes



Table 3: (continued).

industry	No	No	Yes	No
<i>N</i>	26614	33673	33673	32698
adj. <i>R</i> <sup>2</sup>	0.497	0.514	0.504	0.519

## 6. Mechanisms of action

### 6.1. Mediating effects

To verify whether green transition can promote regional green market development, corporate green investment (GI) is calculated as a proxy variable for the size of the regional green market. Column (1) of Table 4 shows that regional green transition can significantly enhance the scale of corporate green investment. It is verified that green transition has a significant promotion effect on corporate OFDI by promoting green market development.

To verify whether green transformation can promote enterprises' green technological innovation, the level of enterprises' green sustained innovation (OIP) is calculated as a proxy variable for enterprises' green technological innovation. To verify whether green transformation can alleviate corporate financing constraints, the SA index, a financing constraint variable designed by Hadlock and Pierce, is utilized as a proxy variable for the degree of corporate financing constraints. Table 4, column (2), and column (3) show that green transformation can significantly enhance the level of green sustained innovation of enterprises and alleviate their financing constraints. Combined with the literature research, green transformation significantly promotes OFDI through green technological innovation and alleviates financing constraints, and the enterprise effect is verified.

Table 4: Mediation effect test.

	(1) GI	(2) OIP	(3) SA
GX_city	0.5687*** (2.6012)	8.4116*** (-2.5994)	-0.0141*** (-3.5105)
controls	Yes	Yes	Yes
_cons	0.1489 (0.1100)	-71.5215*** (-4.8056)	-3.2441*** (-78.1982)
year	Yes	Yes	Yes
fe	Yes	Yes	Yes
<i>N</i>	29077	28450	33627
adj. <i>R</i> <sup>2</sup>	0.426	0.508	0.939

### 6.2. Moderating effects

The external environment of enterprises is influenced by social and economic development and government macro-control, and their investment behavior may also have different performances in different external environments. Therefore, in addition to examining the impact of regional green transformation on enterprises' OFDI, this paper also explores whether the external environment can play an effective regulatory role in the role of green transformation from the aspects of government environmental subsidies and the degree of openness to the outside world in the external environment of enterprises.

The percentage of green subsidies divided by total business revenue is taken as a measure of government environmental subsidies. The regression results are shown in Table 5, columns (1) and (2), which show that government environmental subsidies have a significant positive moderating effect on the promotion of regional green transformation on enterprises' OFDI. The total amount of imports and exports divided by regional GDP is used as a measure of the degree of regional openness to the outside world. The regression results are shown in Table 5, columns (3) and (4), which show that the degree of openness to the outside world significantly strengthens the promotion effect of regional green transformation on enterprises' OFDI.

Table 5: Moderating effects test.

	Government environmental subsidies		degree of openness to the outside world	
	(1)	(2)	(3)	(4)
	OFDI	OFDI	OFDI	OFDI
GX_city	0.6615*** (-3.0847)	0.6672*** (-3.1143)	0.4153** (-2.0004)	0.4377** (-2.0949)
moderator variable	0.8722*** (-2.7151)	0.9687*** (-2.8593)	0.7388*** (-5.5978)	0.7498*** (-5.6825)
M1		3.0312* (-1.6534)		1.0677** (-2.5302)
controls	Yes	Yes	Yes	Yes
_cons	-5.2441*** (-3.7893)	-5.2605*** (-3.8014)	-7.2240*** (-6.0069)	-7.2308*** (-6.0118)
N	30823	30823	33673	33673
adj. R <sup>2</sup>	0.521	0.521	0.5	0.5

## 7. Heterogeneity analysis

Based on the National Bureau of Statistics classification standards, OFDI enterprises are categorized into three types based on their location zones. Regressed sequentially, the results are shown in Table 6. The core explanatory variables of the central and western economic zones did not pass the significance test, and the core explanatory variables of the eastern economic zones have significantly positive coefficients, the GX\_city coefficient of the eastern enterprises is significantly higher, at 0.9181. The green transformation is not significant for enterprises in central and western China. Given that the OFDI of eastern enterprises has more obvious technological innovation-driven characteristics, and the incentive mechanism of green transformation on OFDI is highly consistent; while enterprises in central and western China depend more on resources the mitigating effect of green transformation on financing constraints can not be effectively played.

Enterprises are categorized into private enterprises and state-owned enterprises based on the nature of enterprise equity, and the regression results are shown in Table 6. The coefficient of the core explanatory variables of state-owned enterprises is significantly positive, and compared with private enterprises, the coefficient of GX\_city of state-owned enterprises is significantly higher, 0.9340, which may be because state-owned enterprises have a high degree of policy responsiveness, and their investment behavior is more policy-driven. While private enterprises are susceptible to a variety of environmental factors, the impact of a single regional policy is more limited; and it is subject to the



deployment of resource reserves, The green technology innovation cycle is longer, and the role of the green transformation mechanism is difficult to play an effective role.

Table 6: Heterogeneity analysis.

	Region			The nature of equity	
	(1) Western Economic Belt OFDI	(2) Central Economic Belt OFDI	(3) Eastern Economic Belt OFDI	(4) Private enterprise OFDI	(5) State-owned enterprises OFDI
GX_city	-0.0125 (-0.0284)	-0.2673 (-0.5889)	0.9181*** (-3.4245)	0.2755 (-0.9239)	0.9340*** (-3.3606)
controls	Yes	Yes	Yes	Yes	Yes
_cons	-6.6120*** (-2.6115)	-4.0967* (-1.8382)	-6.2590*** (-3.7364)	-8.0006*** (-4.5395)	-4.8248*** (-3.0685)
year	Yes	Yes	Yes	Yes	Yes
fe	Yes	Yes	Yes	Yes	Yes
N	3840	6184	23649	19280	14393
adj. R2	0.459	0.43	0.509	0.494	0.502
Empirical p-values	Prob > chi2 = 0.0049***			Prob > chi2 = 0.0000***	

## 8. Conclusions and recommendations

In the current strategic context of accelerating the construction of a domestic and international double cycle, OFDI by enterprises increasingly becomes a major driving force in boosting green development. The impact of regional green transformation on enterprises' OFDI and its path of action is both of theoretical value and capable of guiding Chinese enterprises to go out better.

To this end, based on the data of listed enterprises and regional green transformation data from 2005 to 2022, this paper utilizes fixed-effects regression analysis to explore the effect and path of green transformation on enterprises' OFDI. The empirical results show that green transformation has a significant promotion effect on the OFDI of enterprises; the estimation results are still robust after a series of robustness tests. The heterogeneity test shows that: regional green transformation has a significant incentive effect on the OFDI of eastern enterprises and state-owned enterprises. The mechanism test finds that the green transition realizes the promotion of OFDI using green technological innovation and alleviation of financing constraints. The moderating effect shows that government environmental protection subsidies and openness can positively regulate the promotion effect of regional green transformation on OFDI.

In response to the results of the empirical test, the article puts forward the following suggestions, to provide a reference for promoting enterprises' foreign investment and regional green transformation. First, the government should adhere to the comprehensive green transformation of the region, guide the green innovation of enterprises, and create a favorable external environment. Secondly, enterprises need to actively respond to regional green transformation policies, and give full play to the effect of green technological innovation, especially enterprises in the central and western economic zones, which should gradually shift from resource-dependent to technology-dependent. Third, financial institutions play the role of financial supervision and provide green financing channels for small and medium-sized enterprises. Fourth, the main bodies also need to work together

to build an environmental protection mechanism to provide long-term protection for the green development of the economy and society, and to explore more feasible paths for high-quality development under the new normal of China's economy.

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