

# Does FDI Boost China's real Economy? Based on Empirical Evidence at the Provincial Level

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**Abstract.** Based on the provincial panel data from 2003 to 2020, this paper studies the influence of foreign direct investment (FDI) on the development of real economy (REAL) by using the mediating effect and threshold effect model. The results are as follows: First, FDI has an obvious pulling effect on Chinese real economy, and this pulling effect shows obvious regional difference in the eastern, middle and developed areas. Second, the empirical analysis of the mediating effect of FDI shows that the influence of FDI on China's high-quality development is mainly caused by "market size (MS)", "innovation ability of real enterprises (IC)", "economies of scale (ECG)" and other factors, and ECG is more obvious. Third, through the in-depth study of the "threshold" effect, the results show that: The promotion effect of FDI on China's REAL is different due to environmental regulation (ER), government intervention (GI) and other factors. The reason is that there is an irrational government behavior in China at present, which leads to the wrong allocation of resources. However, when China's policies are too involved, the pulling effect of FDI on REAL will be weakened. And as for the regions with better talent resource, FDI's promotion on REAL of our country is relatively remarkable, which may be due to the fact that local governments have issued a lot of favorable policies to solicit talents.

**Keywords:** FDI; REAL; Mediating Effect; Threshold Model.

## 1. Introduction

It is generally acknowledged that REAL refers to the actual material production sector. The basis of a country's economy and the source of its wealth is REAL[1] (Huang, 2017). After the 19th National Congress, general secretary Xi Jinping placed the development and consolidation of China's REAL in a very prominent position, and made a series of major decisions to boost the development of China's REAL. The Fifth Plenary Session of the 19th middle Committee proposed to "focus on the REAL, modernize the industrial base and industrial chain, and improve quality and core competitiveness." Therefore, in the development strategy of the 14th Five-Year Plan and 2035, it is very important to make the REAL bigger and stronger. At present, through the government's strong policy support, China's REAL has achieved an increasingly large scale, and the level of development has been continuously improved. After the 19th National Congress, the General Secretary put the development and consolidation of China's REAL in a very prominent position, and made a series of major decisions to boost the development of China's REAL. China's production efficiency has been continuously improved, and has reached the forefront of the world in some important areas, which has played a great role in promoting the expansion of employment, high-quality economic development, and the growth of our country's modernization and comprehensive national strength.

Attracting FDI is the direction of China's opening up. Looking back at the past decade, China's pace of opening up has never stopped. Since January 1, 2020, the Foreign Investment Law of the People's Republic of China has been implemented nationwide to ensure the continuous expansion of opening-up and the continuous growth of FDI through legislative provisions. In addition, the legitimate rights and interests of foreign investors are protected and the investment environment is optimized by law, which lays a solid foundation and provides legal guarantee for improving open progress and promoting the healthy development of the REAL. China is the world's second-biggest FDI country. In China, FDI has replaced foreign debt as the main channel of capital inflow. According to the China

Foreign Investment Development Report 2022, China's actual utilization of FDI rose from US \$111.716 billion in 2012 to US \$173.48 billion in 2021, a growth of over 55 percent, ranking first among developing countries for 30 consecutive years, and the cumulative used FDI exceeded US \$1.2 trillion in ten years. The structure of utilizing FDI has been gradually optimized and upgraded, and the quality and level of FDI have been significantly improved. The proportion of FDI in high-tech industries has more than doubled from 14.1 percent in 2012 to 30.2 percent in 2021.

The healthy development of China's REAL and FDI are closely related. Wu [2] (2008) pointed out that FDI not only enables China's economy to better integrate into the international economy, but also promotes the marketization of China's economy, market system and legal system in a certain sense, and plays an important role in promoting industrial structure, improving technological progress, expanding foreign trade and increasing employment quality. Antonietti et al. [3](2023) believe that domestic institutions are an important factor in attracting FDI and promoting the economic development of host countries, and more evidence shows that FDI will influence and shape domestic institutions in turn, and the increase of FDI will have a significant short-term impact on the institutional quality of host country economy. The relationship between FDI and economy and domestic institutions is discussed. Since the reform and opening up, China has carried out the policy of opening up to the outside world, and made use of the inflow of foreign capital and international capital to alleviate the shortage of investment in China and accelerate the accumulation of capital; the absorption and introduction of FDI has introduced advanced science and technology and management experience to China, made up for China's technological gap in some fields, saved a lot of research funds and time, and gradually optimized China's industrial structure, playing an active role in the development of the REAL.

The marginal contribution of this paper may be as follows: First, in terms of the topic, there are few literatures on the promotion of FDI to the REAL. Starting from the current economic development situation in China, this paper innovatively explores the relationship between FDI and boosting China's REAL; from various perspectives by using provincial panel data, and explores the regional heterogeneity of FDI's impact on the REAL on this basis. Second, in terms of perspective, this paper not only studies the direct effect of FDI on the REAL, but also studies whether FDI can boost China's REAL, from the perspective of influence mechanism and threshold effect, so as to make up for the shortcomings of the study on the influence mechanism of FDI on the REAL and provide abundant evidence for us to understand the relationship between FDI and the REAL. Third, in terms of content, this paper not only considers the theoretical and empirical analysis, but also provides enlightenment on how to combine FDI to promote the healthy development of the REAL from the perspective of policy inspiration, and provides practical suggestions for China to further deepen opening-up and promote the domestic and international dual circulation.

## **2. Literature Review and Theoretical Analysis**

The literature related to this paper mainly includes two aspects: first, the impact of FDI on the REAL at the macro level; In the 1960s, Chenery proposed the famous "double gap model", which believed that economic development is based on the continuous optimization and adjustment of economic and industrial structure, and the economic development of developing countries is mainly due to structural rigidity and insufficient domestic demand. The introduction of FDI can effectively fill the savings and foreign exchange gap of developing countries, thus promoting economic development and industrial transformation. In China, in view of the impact of FDI on industrial structure optimization, Liu et al.[4]focused on how the quality of FDI improved the production environment of the middle and western regions, thereby enhancing regional production capacity and efficiency, and strengthening regional scale effects to promote the migration of the eastern manufacturing industry to the middle and western regions. The study shows the influence of FDI on the industry especially the manufacturing industry in the middle and western regions. Xu et al. [5] analyzed by VAR model that FDI has a relatively weak role in promoting the upgrading of Chinese industrial structure.

Chuang et al. [6] found that trade with developed countries was conducive to China's acquisition of new technologies, new information and the development of the REAL. Wen and Xie's empirical analysis based on China's provinces also shows that the introduction of FDI is beneficial to China's economic development, because FDI can not only bring us a large amount of capital, but also bring us advanced technology and management experience, thereby increasing our employment and tax revenue to a certain extent [7]. Sang et al. [8] believe that in order to improve China's development in the new era, it is essential to improve the quantity and quality of FDI and develop social productive forces to promote our economic development. Mao [9] put forward the spillover effect of FDI on service industry.

The second is the micro-impact of FDI on the REAL: the role of FDI has been widely discussed by academics and policy makers. Economic and management literature on this topic all mention that in the host country, local enterprises can improve their production level by learning advanced technology and management knowledge [10]. However, the current empirical conclusions are mixed. Some scholars believe that FDI promotes the entry of innovation and entrepreneurship [11]. Some people find that companies innovating through knowledge use are more affected by FDI than those innovating through knowledge creation [12]. Other scholars believe that FDI has less impact on new companies in a short period of time [13].

According to the research conclusions, relevant empirical studies can be divided into two types: The first type believes that FDI promotes the improvement of total factor productivity at the macro level through the effects of technology and management, and promotes the development of the host country's REAL and the upgrading of industrial structure [14]. It can also promote enterprise performance and innovation at the micro level, which has a positive impact on the development of R&D strategies and R&D intensity of local companies operating in emerging markets [15]. The second type believes that FDI does not have a significant effect on the development of the host country's REAL and the upgrading of its industrial structure [16], and may also increase the opportunity cost of new enterprises being unable to enter the market.

### **3. Theoretical Analysis**

By combing relevant literature at home and abroad, this paper finds that under the condition of open economy, FDI can not only have a direct impact on REAL, but also promote REAL through indirect effects such as technological innovation, demand expansion and economic growth.

#### **3.1. Direct Effects of FDI on the REAL**

On the one hand, the direct impact of FDI on the REAL has both positive and negative aspects. First of all, as China is a developing country, China's investment, consumption and other aspects are developing rapidly, while China's effective capital supply is relatively small, therefore, absorbing and using FDI can provide a new road for China's economic development, accelerate China's capital formation and promote China's economic development. Secondly, the advanced technologies introduced by FDI greatly make up for China's technical shortcomings, enrich China's business philosophy and provide advanced technical support for the development of Chinese enterprises [17]. In addition, FDI will also introduce advanced clean production technology to the host country, so that it can better use clean production technology in the production process, better play its role in energy saving and emission reduction, and improve the ability of domestic enterprises in environmental protection [18]. Finally, FDI improves the level of non-agricultural production investment and the proportion of products, thus promoting the optimization and upgrading of industrial structure. However, FDI can have adverse effects on the REAL. The economic security risks brought by FDI cannot be ignored, because foreign-funded enterprises have strong strength, master advanced technology, and in order to attract FDI, China has adopted a long-term inclusive policy, which makes the development of foreign-funded enterprises in our country has a unique advantage, especially they have an absolute competitive advantage in our traditional industries. They have already been in a key

control position in certain industries of our country and will intensify the competition of the industries, bringing negative effects to the REAL of our country[19].

### **3.2. Indirect Effects of FDI on the REAL**

FDI can promote the development of REAL through various mechanisms such as technological innovation effect, demand expansion effect and economic growth effect.

#### **3.2.1. Technological Innovation Effect (IC).**

FDI will affect IC, improve the production process of enterprises, promote enterprises to update equipment, make up for China's technological defects, enhance the ability of scientific research and innovation, thus supporting the development of the REAL. For example, Liu and Song [20] put forward the idea of "innovation-driven", that is, "innovation-driven" can promote the transformation of "old and new kinetic energy" in a region, and then promote regional economic development. According to Kay-alvizhi[21], FDI will increase with the improvement of technology absorption and innovation ability, thus affecting the status of local economic development. Therefore, this paper holds that, first, while foreign-funded enterprises make use of local technologies, local enterprises can also imitate and learn from technologies similar to those of foreign-funded enterprises, thus stimulating local enterprises to innovate independently on the basis of local technologies, new technologies and processes of independent innovation have entered the Chinese market, prompting local enterprises to upgrade equipment and promoting the rapid development of the REAL. Second, in recent years, China has paid great attention to the development and consolidation of the REAL. As the industrial structure is being adjusted and upgraded, the role of "people" has been sublimated into "talent strategy", which has become the key to national development and played an important role in intellectual support. Domestic companies acquire technology and knowledge by hiring skilled workers who previously worked in foreign companies, which is the acquisition of relevant technology through employee mobility. Therefore, FDI can bring technical talents to China and cultivate a group of technological innovation groups composed of scientific and technological personnel. Through the recruitment and transfer of skilled workers, China optimizes the innovation environment, uses new technologies to transform and upgrade traditional industries, and relies on IC to drive the development of the REAL.

#### **3.2.2. Demand Expansion Effect (MS).**

In the late industrialization period, people realized more about the role of consumption in promoting REAL. Osterhaven and Linden et al. [22] conducted a series of empirical analyses in continental Europe, and the results showed that at this stage, consumer demand was the most important reason to promote national economic development. Many Chinese scholars also believe that insufficient consumption is detrimental to the long-term, stable and sustainable development of China's economy [23]. From the theory and logic of economics, promoting the improvement of market demand is the key to promote the sustainable development of the REAL. First, foreign companies often bring new, high-quality products to the host country, which in turn promotes market demand in their downstream industries. Secondly, foreign-funded enterprises have relatively high technical level and relatively high product quality, and their entry will bring higher quality goods and services, thus stimulating consumption, expanding domestic demand, and boosting the REAL. In general, while increasing the demand for domestic goods, foreign-funded enterprises have also promoted the expansion of the MS, making the market demand continue to grow and the development momentum is strong, which has played a positive role in promoting the REAL.

#### **3.2.3. Economies of Scale Effect (ECG).**

China's economic growth has entered the "high-quality" stage, and the quality of FDI and the return on ECG have a significant positive effect on China's economic development mode. In other words, with the continuous improvement and expansion of the quality and scale of FDI, its positive impact on the transformation of economic development mode is gradually strengthened [24]. ECG are

closely related to the development of the REAL. Through ECG, we can create more wealth and improve our economic and investment environment, thus providing a good external environment for the development of the REAL. Specifically, through the guidance of FDI industries and regions, the flow of factors between industries and regions is promoted, so as to achieve balanced economic development between regions. In economically underdeveloped regions, a high level of FDI can not only bring profits to enterprises, but also bring more tax revenue to local governments. By increasing fiscal revenue, the government can improve the level of infrastructure, thereby attracting high-quality FDI, thereby promoting the growth of local ECG, and thus achieving the purpose of narrowing regional development disparities and increasing returns. FDI has a strong export strength, which can help promote the cross-border flow of production factors, thus further expanding the scope of opening up, accelerating the accumulation of capital, improving the export product structure and industrial structure, and promoting high-quality economic development. Simultaneously, the management of foreign-funded enterprises with higher management level is more likely to make management decisions to take the initiative to assume environmental responsibility, which can bring a good example effect for local enterprises, and then promote economic growth, and also encourage more enterprises to take the initiative to assume environmental responsibility, which brings a good development space for the REAL.

#### 4. Research Design

##### 4.1. Model and Method

###### 4.1.1. The Model of FDI Promoting the Development of REAL

The setting idea of the empirical model in this paper is mainly to test whether

FDI will have an impact on China's REAL. The basic measurement model equation is specified as follows:

$$REAL_{it} = \beta_0 + \beta_1 FDI_{it} + \sum \beta_2 X_{it} + \eta_i + \sigma_t + \varepsilon_{it} \quad (1)$$

Where, *i* and *t* represent provinces and years respectively, the explained variable  $REAL_{it}$  represents the development level of the REAL, and  $FDI_{it}$  represents FDI.  $X_{it}$  is a series of control variables at the provincial level over time,  $\eta_i$  and  $\sigma_t$  are province fixed effects and year fixed effects, respectively, and  $\varepsilon_{it}$  is a random disturbance term.

###### 4.1.2. Mediating Effect Model

In order to empirically test the transmission mechanism of FDI's impact on REAL, this paper will focus on the mediating effect of MS, IC, ECG. On the basis of formula (1), combined with Wen et al.'s mediating effect model and its testing steps [25], this paper carries out further analysis. The specific model is as follows:

$$REAL_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 X_{it} + \eta_i + \sigma_t + \varepsilon_{it} \quad (2)$$

$$Z_{it} = \alpha_0 + \alpha_1 FDI_{it} + \alpha_2 X_{it} + \eta_i + \sigma_t + \varepsilon_{it} \quad (3)$$

$$REAL_{it} = \mu_0 + \mu_1 FDI_{it} + \mu_2 Z_{it} + \mu_3 X_{it} + \eta_i + \sigma_t + \varepsilon_{it} \quad (4)$$

Further, in order to investigate the possible constraint mechanism of FDI in the process of affecting the growth of REAL, that is, whether there is non-linear influence and threshold conditions of FDI on the development of REAL, this paper further builds a nonlinear model. Based on Hansen's panel threshold regression model[26], the corresponding threshold value is estimated, and then the relationship between FDI and the development of REAL in different intervals is studied. Panel threshold regression model is set as follows:

$$REAL_{it} = FDI_{it}\beta + (1, FDI_{it})\delta 1\{q_{it} > \gamma\} + \mu_i + \varepsilon_{it}, i = 1, \dots, n; t = 1, \dots, T, \quad (5)$$

In formula (2), (3) and (4),  $Z_{it}$  is the mediating variable, which is used to reflect the MS effect, IC effect, and ECG effect. According to the mediating effect test procedure,  $\beta_1$  measures the impact of FDI on the growth of REAL,  $\alpha_1$  measures the impact of FDI on the MS, IC, ECG of the mediating variables, and  $\mu_1$  measures the direct effect of FDI on the growth of REAL when the mediating variables are controlled.  $\mu_2$  measures the influence of mediating variables on REAL's growth when FDI is unchanged.

In equation (5),  $REAL_{it}$  is the dependent variable,  $FDI_{it}$  is the vector of time-varying regression,  $1\{\cdot\}$  is the indicator function, and  $q_{it}$  is the threshold variable.  $\gamma$  represents the threshold parameter,  $\delta$  represents the slope parameter, and  $\varepsilon$  consists of the error component.

## 4.2. Description of Variables and Data

### 4.2.1. Dependent Variables

Real economic growth (REAL). How to choose the appropriate indicators to measure the development of the REAL, there is a great dispute in the academic circle. For example, Liu and Zhang (2020) [27] used per capita GDP to measure REAL's development of a region, which lacks sufficient authority. There are also scholars who have studied the Fed's practice of using parts of the REAL that are excluded from the housing and financial markets [28]. After improvement by domestic scholars, this measurement method has been widely used to measure the growth of REAL. On this basis, according to the actual needs of the research, this paper intends to choose the regional gross output value after excluding the financial industry and real estate industry and then divide it by GDP to measure the growth of the REAL in the region.

### 4.2.2. Independent Variables

FDI is the key explanatory variable of this study. FDI refers to the behavior of direct investment in China in the form of physical goods, technology and cash in accordance with relevant policies and regulations of China. In this paper, the proportion of actual use of foreign capital to regional GDP is used to measure the level of FDI. FDI is the actual amount of foreign investment (in tens of thousands of US dollars) utilized by various provinces in China. We convert the annual average exchange rate released by the People's Bank of China over the years into RMB in hundreds of millions.

### 4.2.3. Control Variables

In addition to the influence of FDI, the development of REAL also needs to consider the influence of other factors. Studies have shown that environmental regulatory factors [29], human capital factors [30] and government intervention degree [31] have an impact on the development of the REAL, so these variables are taken as control variables.

- (1) Environmental regulation level (ER). Choose the proportion of industrial pollution control investment and industrial added value to measure.
- (2) Government intervention level (GI). Choose the proportion of fiscal expenditure to GDP to measure.
- (3) Trade factors (TF). Choose the proportion of import and export trade and GDP to measure.
- (4) Technical Factors (TEF). Choose the proportion of RD internal expenditure and GDP to measure.
- (5) Industrial structure (IS). Choose the proportion of added value of secondary industry to measure.
- (6) Human capital (HC). Choose the number of college students to measure.

### 4.2.4. Mediating Variables

- (1) Market size (MS). The consumption amount of social retail goods is selected to measure.

(2) Entity enterprise innovation capability (IC). Innovation ability is closely related to the internal expenditure of patent funds of industrial enterprises. This paper selects the internal expenditure of R&D funds of enterprises in 30 provinces to represent the innovation ability of entities.

(3) Economies of scale (ECG). Take GDP per capita. Previous studies have shown that countries with economies of scale do better in REAL development.

#### 4.2.5. Threshold Variable

In order to improve the accuracy of experimental results, six control variables are selected as threshold variables.

#### 4.2.6. Data Specification

Taking into account the completeness of the data, this paper uses the panel data of 30 Chinese provinces (excluding Hong Kong, Macao, Taiwan and Tibet) from 2003 to 2020., and the data used in the research come from China Statistical Yearbook, China Science and Technology Statistical Yearbook, Statistical Yearbook of each province and city over the years, National Bureau of Statistics, etc. During the empirical analysis, All variables were logized. The descriptive statistics for each variable are given in Table 1.

**Table 1.** Descriptive statistics of variables

Variable name	Sample size	Mean value	Standard deviation	Minimum value	Maximum value
FDI	540	0.0257	0.0197	0.0001	0.1051
REAL	540	0.5577	0.2360	0.0991	1.3382
ER	540	0.0039	0.0033	0.0001	0.0285
GI	540	0.2173	0.0979	0.0792	0.6430
TF	540	0.3048	0.3694	0.0076	1.7215
TEF	540	0.0145	0.0109	0.0017	0.0644
IS	540	0.4521	0.0854	0.1580	0.6150
HC	540	757590.9	492909	26124	2492185
MS	540	7075.5320	7528.411	102.6614	42951.8
IC	540	2268628	3764638	1356	2.50E+07
ECG	540	40954.98	28548.87	3603	164889

## 5. Empirical Analysis

### 5.1. Benchmark Estimate Results

Table 2 shows FDI and REAL baseline regression results. To facilitate comparative analysis, this paper adopts the method of stepwise regression to test the robustness of the research conclusions. In columns (1) to (4), by gradually adding control variables, the coefficient of FDI on the growth of REAL is always significantly positive after comprehensive consideration of the control variables that may promote the development of REAL, such as the level of ER, the level of GI, TF, TEF, IS, HC. It shows that FDI can significantly promote the development of China's REAL. FDI has brought technical and financial support to China and introduced advanced management concepts and methods, which can effectively improve the supply of capital, thus promoting economic growth, improving economic vitality, promoting the development of foreign trade, and thus playing a positive role in promoting the better development of REAL.

From the perspective of control variables, the coefficient of ER is negative but not significant, and the coefficient of TF is positive but not significant, indicating that ER and TF have not had a

significant impact on the growth of China's REAL. The coefficients of GI, IS and HC are significantly positive, indicating that the growth of China's REAL cannot be separated from the government's macro-control, the upgrading of industrial structure and the high-quality development of labor force. The coefficient of TEF is significantly negative, indicating that it has a negative impact on the growth of China's REAL.

**Table 2.** Results of baseline regression

	REAL(1)	REAL(2)	REAL(3)	REAL(4)
FDI	0.0630*** (3.31)	0.060*** (3.18)	0.043** (2.10)	0.048*** (2.61)
ER		-0.036* (-1.78)	0.043** (2.10)	-0.019 (-1.04)
GI		0.455*** (3.90)	0.437*** (3.75)	0.556*** (5.19)
TF			0.087** (2.16)	0.021 (0.58)
TEF			0.027 (0.41)	-0.135** (-2.22)
IS				0.674*** (5.51)
HC				0.523*** (5.89)
Time effect	Yes	Yes	Yes	Yes
Regional effect	Yes	Yes	Yes	Yes
Constant term	-0.845*** (-10.16)	-0.171 (-0.68)	0.010 (0.03)	-6.582*** (-5.24)
R2	0.481	0.500	0.503	0.594
Obs	540	540	540	540

Note: \*\*\*, \*\* and \* are significant at the significance level of 1%, 5% and 10% respectively; The t statistic is in parentheses. The same is true below.

## 5.2. Heterogeneity Analysis

To examine whether there is regional heterogeneity in the influence of FDI on REAL development, this paper first divides the whole sample into three sub-samples of eastern region, middle region and western region according to geographical location, and then divides the entire sample into two sub-samples of economically developed region and underdeveloped region according to economic development.

It can be seen from the results in Table 3 that FDI has a significant promoting effect on REAL growth in the eastern and middle regions, which is the same as the research conclusion of Wang et al., who believe that FDI can bring positive effects on REAL in the eastern region [32]. However, its coefficient in the western region is significantly negative, which indicates that FDI can better promote the growth of the REAL in the eastern and middle regions. This may be due to the higher degree of economic opening to the outside world in the eastern and middle regions, and the higher quality of FDI, which can better use FDI to promote the growth of the REAL; However, the quality of FDI in the western region is low, and the REAL is rarely utilized, thus failing to support the development of the REAL. For developed regions, there is an obvious positive correlation between FDI and the

development of REAL. This is because developed regions have better quality of labor force and higher degree of opening to the outside world, which can better attract FDI. However, in less developed areas, the impact of FDI on the REAL is not obvious, which may be because the level of utilization of foreign capital is still relatively low, and the technology transfer and spillover effect of FDI on the western region is relatively weak.

**Table 3.** Results of heterogeneity analysis

	Eastern region	Middle region	Western region	developed	undeveloped
FDI	0.184*** (3.53)	0.126*** (2.96)	-0.035* (-1.82)	0.247*** (4.66)	-0.001 (-0.07)
ER	-0.026 (-0.86)	-0.101*** (-2.82)	-0.011 (-0.45)	-0.016 (-0.39)	-0.024 (-1.44)
GI	0.688*** (2.73)	0.262 (1.24)	0.046 (0.33)	0.732** (2.45)	0.054 (0.54)
TF	-0.329** (-2.31)	0.086 (1.16)	0.060* (1.69)	-0.407*** (-3.48)	0.058* (1.77)
TEF	0.223 (1.41)	0.418*** (3.62)	-0.218*** (-3.28)	-0.155 (-0.89)	-0.028 (-0.52)
IS	1.799*** (6.43)	-0.340** (-2.04)	0.282 (1.36)	0.645** (2.07)	0.065 (0.55)
HC	0.022 (0.09)	-0.780*** (-3.23)	0.428*** (3.58)	1.862*** (6.55)	-0.169* (-1.92)
Time effect	Yes	Yes	Yes	Yes	Yes
Regional effect	Yes	Yes	Yes	Yes	Yes
Constant term	2.580 (0.71)	11.406*** (3.18)	-6.873*** (-4.70)	-23.682*** (-5.69)	1.054 (0.91)
R2	0.532	0.840	0.804	0.659	0.753
Obs	198	144	198	144	396

### 5.3. Analysis of the Influence Mechanism

Table 4 reports the test results of the effect of the rapid development of FDI on regional innovation activities through the mediating transmission mechanism of MS, IC, ECG by using the model framework of sequential recursive regression. The estimated results of regression model (1) in Table 4 indicates that the regression coefficient of the FDI variables is significantly positive at 1% statistical level. The estimated results of regression model (2) show that the regression coefficient of FDI variable is significantly positive at the 10% statistical level, and the regression coefficient of MS variable is significantly positive at the 1% statistical level. Moreover, it can be found that the regression coefficient of FDI variable in regression model (2) is lower than that in regression model (1), and the significance level is also decreased, which indicates that MS plays a partial mediating role, thus indicating that the rapid development of FDI can be achieved through the mediating transmission mechanism of MS. It will further promote the development of the REAL in various provinces in China. Similarly, the estimated results of the regression model (3) show that the regression coefficient of FDI variable is significantly positive at the 5% statistical level; the estimated results of the regression model (4) show that the regression coefficient of FDI variable is significantly positive at the statistical level of 5%; the regression coefficient of IC variable is significantly positive at the 1% statistical level. This shows that the rapid growth of FDI can play an active role in China's

REAL through the mediating transmission mechanism of the improvement of IC. The estimated results of the regression model (5) show that the regression coefficient of FDI variable is significantly positive at the statistical level of 1%; the estimated results of the regression model (6) show that the regression coefficient of FDI variable is not significant, and the regression coefficient of ECG variable is significantly positive at the 1% statistical level of, which indicates that ECG plays a full mediating role. Thus, it can be shown that the rapid development of FDI can have a positive impact on the development of China's REAL fully through the mediating transmission mechanism of ECG.

**Table 4.** Results of mechanism analysis and estimation

	IC(1)	REAL (2)	MS(3)	REAL (4)	ECG(5)	REAL(6)
FDI	0.060*** (4.19)	0.030* (1.65)	0.020** (2.30)	0.038** (2.12)	0.031*** (4.03)	0.023 (1.30)
IC		0.302*** (5.25)				
MS				0.501*** (5.24)		
ECG						0.826*** (7.94)
ER	0.019 (1.37)	-0.025 (-1.39)	0.019** (2.26)	-0.029 (-1.60)	0.003 (0.40)	-0.022 (-1.25)
GI	-0.618*** (-7.51)	0.742*** (6.74)	-0.704*** (-14.23)	0.909*** (7.32)	-0.438*** (-9.95)	0.917*** (8.29)
TF	0.023 (0.81)	0.014 (0.40)	-0.002 (-0.11)	0.022 (0.62)	-0.005 (-0.31)	0.025 (0.72)
TEF	1.114*** (23.76)	-0.471*** (-5.40)	0.045 (1.60)	-0.158*** (-2.65)	-0.140*** (-5.58)	-0.020 (-0.33)
IS	0.863*** (9.17)	0.414*** (3.21)	0.247*** (4.36)	0.551*** (4.53)	0.710*** (14.13)	0.088 (0.64)
HC	0.193*** (2.82)	0.465*** (5.33)	0.351*** (8.57)	0.347*** (3.74)	0.386*** (10.59)	0.204** (2.20)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Regional effect	Yes	Yes	Yes	Yes	Yes	Yes
Constant term	14.541*** (15.07)	-10.969*** (-7.41)	1.816*** (3.13)	-7.492*** (-6.07)	3.515*** (6.83)	-9.487*** (-7.67)
R2	0.978	0.616	0.984	0.616	0.983	0.641
Obs	540	540	540	540	540	540

#### 5.4. Marginal Effect Analysis

In order to improve the accuracy of the experimental results, all the control variables were tested by threshold, and the regression analysis was carried out on the development of FDI and REAL.

As shown in Table 5, the effect of FDI on REAL varies in the two intervals where the degree of ER is lower than and higher than the threshold value -4.932. When the degree of ER is lower than the threshold value, FDI has a significant promoting effect on the development of REAL; when the degree of ER is higher than the threshold value, the promoting effect of FDI on the development of

REAL is reduced, indicating that the positive impact of FDI on the growth of the REAL will worsen with the improvement of the degree of ER. This may be due to China's increasingly high environmental regulatory standards, raising the entry barriers for foreign low-quality, high-pollution, high-energy enterprises, thereby reducing the promotion of REAL's growth. The influence of FDI on the growth of REAL is also different in different threshold ranges of GI. When the level of GI is lower than the threshold value -1.163, FDI has a significant positive impact on the growth of the REAL; when the level of GI is higher than the threshold value, FDI has no significant positive effect on the growth of the REAL. With the increase of GI, the impact of FDI on the growth of the REAL decreases. This may be due to the unreasonable administrative intervention of the Chinese government, which leads to resource misallocation and distorts the efficiency of resource allocation, thus worsening the promotion effect of FDI on the growth of the REAL in places with high GI. The above results also show that when the TF is higher than the threshold value -1.360, FDI has a significant effect on the development of China's REAL. This shows that, along with the transformation of China's trade from low quality to high quality development, at the same time, the entry of high-quality FDI also makes the quality of China's industrial development has been improved, and then promoted the transformation and upgrading of industrial structure, so that the modernization of the economy has been promoted, and provides strong guarantees for the development of our REAL. When the TEF exceeds the threshold value -4.442, the promotion effect of FDI on the REAL decreases somewhat, but the amplitude is small. This shows that the introduction of continuous, stable and high-quality technology can gradually shorten the technological gap between enterprises. In this process, by learning high-quality advanced technology, we can enhance the technical innovation ability of China's REAL enterprises, and at the same time, we should make full use of foreign capital to focus on the high-quality development of the REAL. When the level of IS is higher than the threshold value of -0.807, the impact of FDI on the development of the REAL weakens and deteriorates, which may be due to the unbalanced regional economic development exacerbated by the transformation and upgrading of industrial structure.

**Table 5.** Results of marginal effect analysis

	D=ER	D=GI	D=TF	D=TEF	D=IS	D=HC
L1.REAL	0.558*** (15.17)	0.625*** (40.52)	0.629*** (51.72)	0.620*** (23.72)	0.607*** (25.07)	0.634*** (34.61)
Below thre	0.159*** (3.50)	0.118*** (5.04)	0.053 (1.63)	0.058*** (3.40)	0.065** (2.11)	0.046** (1.96)
Above thre	0.107*** (2.57)	0.048 (1.27)	0.076*** (2.94)	0.056*** (2.80)	0.044 (1.38)	0.073** (2.49)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Regional effect	Yes	Yes	Yes	Yes	Yes	Yes
Constant term	-0.556 (-0.72)	-2.019* (-1.85)	0.693 (0.86)	0.024 (0.03)	-1.870** (-2.00)	1.155*** (4.31)
Threshold value	-4.932	-1.163	-1.360	-4.442	-0.807	12.200
Obs	510	510	510	510	510	510

Underdeveloped areas do not have the advantages of competing with developed areas in technology, capital, environment and other aspects, and the industrial structure has not been realized in these areas, so the impact of FDI on the REAL has declined. When the HC exceeds the threshold of 12.2, the positive impact of FDI on the REAL is enhanced, which is due to the fact that local governments have formulated many preferential policies to attract talents. In the field of science and technology,

the innovation ability and technical level of high-end talents are greatly improved. In particular, high-quality talents in FDI can promote scientific and technological progress and industrial upgrading, thus promoting the high-quality development of the REAL.

### 5.5. Robustness Analysis

1. Considering that FDI and control variables may have a certain lag effect on the development of the REAL, the robustness test is conducted by replacing the original variable with a lag period of the explanatory variable and the control variables. According to the estimated results in column (1) of Table 6, it can be seen that the positive impact of FDI on the REAL is significant at the level of 5%, and the estimated results in this paper have good robustness.

2. To eliminate the estimation bias caused by different levels of regional economic development, enhance the universality of the results of FDI's impact on the REAL, and considering that the economies of Beijing, Tianjin, Shanghai and Chongqing are relatively developed, the sample data of the four cities are excluded in this paper, and the further estimation results are shown in column (2) of Table 6. According to the results, the positive impact of FDI on the development of the REAL is significant at the level of 1%, with good robustness, and the impact of FDI on the REAL is still prominent.

**Table 6.** Robustness analysis results

	One-phase lag	Change sample	Change variable	Instrumental variable method
FDI	0.039** (2.10)	0.064*** (3.47)	1.027*** (149.46)	0.050** (2.10)
ER	-0.016 (-0.83)	-0.022 (-1.10)	0.009 (1.11)	-0.017 (-0.95)
GI	0.708*** (5.98)	0.332*** (2.85)	-0.422*** (-10.60)	0.556*** (5.28)
TF	-0.004 (-0.10)	0.057 (1.41)	-0.006 (-0.42)	0.008 (0.22)
TEF	-0.101 (-1.64)	-0.102* (-1.70)	-0.130*** (-5.75)	-0.104 (-1.64)
IS	0.774*** (6.29)	0.368*** (2.73)	0.681*** (14.97)	0.648*** (5.22)
HC	0.454*** (4.84)	0.285*** (3.02)	0.301*** (9.11)	0.580*** (6.39)
Time effect	Yes	Yes	Yes	Yes
Regional effect	Yes	Yes	Yes	Yes
Constant term	-5.198*** (-3.91)	-3.973*** (-3.08)	-4.560*** (-9.78)	-7.860*** (-6.09)
Cragg-Donald Wald F statistic				695.432
R2	0.576	0.642	0.989	0.845
Obs	510	468	540	510

3. Considering that the explained variables may have measurement biases, this paper takes per capital utilization of foreign capital as an alternative variable of the REAL. As shown in Table 6, column (3), after replacing, the influence coefficient of the FDI variable on the per capital utilization of foreign capital remains markedly positive, which is in line with the estimated results obtained by the previously adopted measurement indicators.

4. To study the possible endogenous issues between FDI and the development of the REAL, this paper adopts the IV-2SLS method for robust estimation. This paper draws on the practice of Nie and Qi [33], and selects the instrumental variable as the lag period of FDI. The results are given in Table 6, column (4).and it is found that the baseline regression results are still significant.

## 6. Conclusion and Suggestions

The REAL is the source of material wealth, and FDI is a major driver of REAL development. China is vigorously deepening reform and opening up, and FDI is closely related to China's REAL. This paper uses the panel data of 30 provinces in China from 2003 to 2020 to build a dynamic panel model and mediating effect model to empirically test the mechanism of FDI's impact on the growth of the REAL. The main conclusions are as follows: (1) FDI has a significant promoting effect on the REAL, and it is found that the influence of FDI on the REAL has regional heterogeneity, and the influence is more significant in the eastern, middle and developed regions of China; (2) The test results of mediating effect indicate that FDI affects the high-quality development of China's economy through such ways and mechanisms as MS effect, IC effect and ECG effect, and ECG plays a full mediating role; (3) Further analysis of threshold effect shows that the impact of FDI on the REAL is different in different regions such as ER,GI and IS. In regions with good HC and TF, the positive effect of FDI on the REAL is more obvious.

On the basis of these findings, the following policy recommendations are proposed: (1) Further expand the scale of utilizing foreign capital, improve the policy of utilizing foreign capital, and enhance the degree of opening up in China. The inflow of FDI has had a very positive impact on the development of the national REAL. Due to China's history, geographical and other factors, there are great differences in the development of different regions. There are great differences in regional environment, infrastructure and economic development level among different regions. Therefore, when formulating economic development policies, each region must take into account the differences in the utilization degree of FDI in the region, and formulate different economic development policies accordingly. We should concentrate more FDI in the middle and western regions, pay attention to the quality of FDI in the eastern coastal areas, and should be linked to the specific conditions of each region, accelerate the innovation of the introduction of FDI, optimize the regional opening structure, so as to achieve balanced development. (2) In terms of policy, it is necessary to guide FDI, concentrate funds on high-tech or technology-intensive industries, modern service industries, strengthen technology absorption of companies, and enhance technological innovation of companies through FDI. In addition to introducing some advanced scientific and technological equipment, we should also pay attention to the introduction of the company's management, knowledge, research and development At the same time, the government can also use certain preferential policies to encourage transnational corporations with basic scientific and technological innovation capabilities, and in this process, it can also promote the cooperation between domestic scientific research and innovation enterprises and transnational corporations. At a higher level, FDI can play a positive role in the development of real enterprises. Thus, the development and application of new products and new technologies can be realized, and the technical level of our country's industries and enterprises can be enhanced. (3) Improve services for FDI and make them more convenient and secure. We should accelerate the establishment of a legal and equal market, enhance China's attractiveness to FDI, and promote China's technological and managerial progress in relevant fields. While strengthening intellectual property protection and technology exchanges, we should pay more attention to protecting the legitimate rights of foreign investors, such as intellectual property rights. (4) Improve the quality of talents. It is necessary to focus on broadening the channels for human capital investment and

actively attracting social capital for investment, while strengthening the development of vocational education and training to nurture the talents needed for sustainable economic development. Through the optimization of human capital and institutional environment, FDI can improve the absorption and competitiveness of technology spillover, thus promoting the development of the REAL.

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