

# The impact of OFDI in G7 countries on domestic industrial structure upgrading: Evidence from China

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**Abstract.** OFDI promotes industrial structure upgrading by reallocating resources. Based on the time series data of China's industrial structure and OFDI in G7 countries from 2003 to 2021, this paper discusses the relationship between OFDI in G7 countries and China's industrial structure rationalization and advancement. The results show that China's OFDI in G7 countries can promote its industrial structure's advancement in the short term, but not in the long term. Further research shows that China's OFDI in G7 countries does not have a significant impact on the industrial structure's advancement of China's central and western provinces, and its impact on the industrial structure's advancement of China's provinces without free-trade zones and ethnic minority autonomous regions is weaker than that of the rest areas of China. This paper suggests that support for China's central and western regions should be strengthened to optimize the allocation of innovative factors and industrial structure, and to promote better development in remote areas.

**Keywords:** OFDI, developed countries, industrial structural upgrading, time series.

## 1. Introduction

International trade is an important "engine" of economic growth, and the rapid development of China's foreign trade has boosted the world's economic growth (Qu, 2021). Researching on the relationship between China's OFDI in developed countries and its domestic industrial upgrading can promote China's self-reliance in science and technology and improve the effectiveness of the innovation chain. The economic development potential of a modern country depends largely on the strategy of industrial restructuring, and if a country has the mechanism and motivation to achieve industrial technology upgrading in a sustainable way, there is a benign interaction between domestic industrial restructuring and industrial technology upgrading (Wang et al., 2005).

China's outward foreign direct investment (OFDI) embarked on 1979, and its pace accelerated rapidly after China's accession to the World Trade Organization (WTO) in 2001. According to the *Statistical Bulletin of China's Outward Foreign Direct Investment*, China's OFDI has realized rapid growth for many consecutive years since the establishment of the OFDI statistical system in 2003. China gradually increased its direct investment in the United States and Europe after 2008 (Rong et al., 2013), and the scale of OFDI in developed countries has gradually increased in recent years. However, until 2018, about 80% of China's OFDI was still in developing countries and regions (Guo et al., 2018). As can be seen from Figure 1, China's OFDI in countries or regions such as Europe, the United States and Australia has been on an overall upward trend since 2008. Although the data declined from 2017 due to some reasons (e.g. the trade friction between China and the United States), it raised again since then.

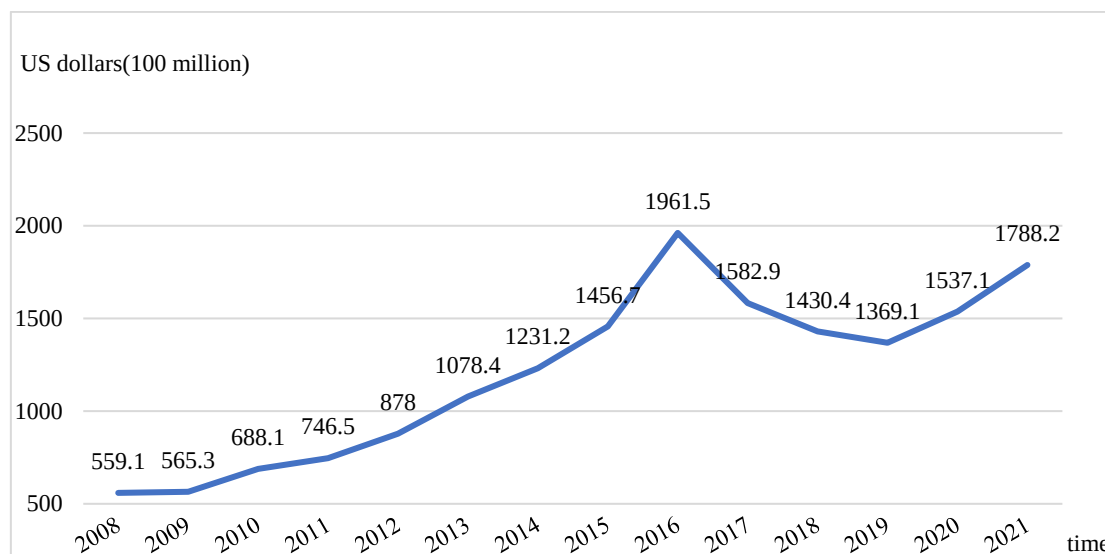


**Fig. 1** China's OFDI in Europe, the United States and Australia

In recent years, more Chinese enterprises have actively participated in international competition and cooperation, promoting China's industrial upgrading. Technology spillover from developed countries plays an important role in the technological progress of developing countries. This paper selects seven major developed countries(G7) as typical representatives of developed countries to research on the relationship between China's OFDI in them and China's domestic industrial structure upgrading.

## 2. Literature review

Research on the relationship between OFDI and industrial upgrading began in the 1960s and has focused mainly on the impact of OFDI from developed countries on the upgrading of their domestic industries, which can be broadly categorized into the "promotion theory" and the "inhibition theory". Among them, the "promotion theory" believes that OFDI can help promote the upgrading of the industrial structure of the home country, such as Vernon's (1966) product life cycle theory and Kojima's (1978) marginal industrial expansion theory. The former points out that transnational corporations will locate their production bases and markets in countries with different levels of development at different stages of the product's life cycle, which allows developing countries to take advantage of international industrial transfers to develop high-tech industries. The latter points out that developing countries can bring in investment or technology from developed countries to cultivate marginal industries, thus improving labor productivity and technology level and realizing industrial structure upgrading. Although the above theories can argue the motivation of developed country's OFDI in developing countries, it can hardly explain the rationale of developing country's OFDI in developed countries. However, since the 1990s, with the expansion of the scale of OFDI from developing countries, it has begun to arouse the interest of many scholars and stimulated the relevant research, such as Technology Innovation Industry Upgrading Theory put forward by Cantwell and Tolentino (1990). This argues that developing countries will take the initiative to invest in the developed countries, whose technological spillover can promote their technological innovation and increase the added value of their industries. According to this theory, developing countries can gradually narrow the gap with developed countries in industrial upgrading and economic development by absorbing, adopting and improving external technologies, and move towards higher value-added industries. According to the "inhibition theory", OFDI will reduce domestic investment and consumption, which will lead to the exodus and decline of domestic industries, i.e. the "hollowing out of industries". The transfer of manufacturing industries brought by OFDI will lead to the decline of the number of employed people and their wages, and the decline of the class (Davis and Huston, 1992).

After Technology Innovation Industry Upgrading Theory was put forward, scholars from many countries have analyzed and concluded the research on the impact of OFDI on industrial structure upgrading. Kogut et al. (1991) showed that South Korea(which was a developing country then)'s OFDI in developed countries, such as Japan, promoted its domestic investment, technological acquisitions, and research and development (R&D) in industries such as infrastructure, precision instruments, and chemicals, and facilitated the upgrading of industrial structure. OFDI can promote domestic industrial upgrading by transferring the production factors of backward industries to emerging high-tech industries and by generating reverse technology spillovers to the host country (Blomstrom et al, 2000).

Most of the existing studies on the relationship between China's OFDI and industrial upgrading in home countries focus on different perspectives. Some studies focus on the length of the impact period. For example, the long-term impact of OFDI on the promotion of industrial structure upgrading is greater than the short-term impact (Pan et al., 2010) and there is a long-term stable proportional relationship between the two effects (Yang et al., 2013). Some studies focus on the differences in the types of investment countries. For example, compared with investing in developing countries, investing in developed countries can achieve adequate promotion of industrial structure upgrading (Jia et al., 2016). Some studies look at "industrial upgrading" in different dimensions. For example, both rationalization and advancement of industrial structure can significantly promote the expansion of Chinese firms' OFDI (Dong et al., 2021).

There is also literature that examines the impact of other mechanism variables on whether China's OFDI can promote industrial structure upgrading. Much of the literature focuses on the factor of financial development. A low level of financial development will hinder enterprises from carrying out OFDI, and only a better-developed domestic financial market can meet the financing needs of enterprises for OFDI, which in turn will be conducive to the absorption of new technologies from OFDI (Yu et al., 2014). There is a threshold effect of OFDI on the rationalization of industrial structure, and OFDI has an obvious promotion effect on the rationalization of industrial structure only when the level of financial development is greater than the threshold (Zhang et al., 2021). Some literature also mentions the factor of green technological innovation, and the reverse technological spillovers obtained by OFDI have the influence mechanism of green technological innovation, which can promote the improvement of industrial labor productivity and the upgrading of China's industrial structure (Xie et al., 2022). However, there is little literature about the impact of China's OFDI in developed countries on the upgrading of its domestic industrial structure and the heterogeneity of industrial structure upgrading in different regions of China. Accordingly, this paper takes seven major developed countries(G7) as a whole as the research target. Overall, this paper puts forward the following hypotheses:

**Hypothesis 1:** China's OFDI in G7 countries can promote China's domestic industrial structure upgrading.

**Hypothesis 2:** There are regional heterogeneities in the role of OFDI in G7 countries in promoting industrial structure upgrading in China.

### 3. Research design

#### 3.1. Modeling

In this part, we first refer to the "standard structure" model proposed by Chenery in 1975 and widely borrowed by scholars such as Zhang et al. (2019) , i.e. model (1).

$$X_t = \alpha + \beta_1 \times \ln(Y) + \beta_2 \times \ln(Y) + \gamma_1 \times \ln(N) + \gamma_2 \times \ln(N)^2 + \sum \delta_i \times T_i + \varepsilon_t \times F \quad (1)$$

In model (1), t denotes time.  $X_t$  denotes the change of industrial structure of a country/region, Y denotes the GDP per capita of a country/region, N denotes the number of population, T denotes time, and F denotes the flow of factors of production and resources of a country/region, such as the inflow and outflow of capital, the change of imports and exports, etc. Considering the actual situation of

China, this paper removes Y and N, which have little influence, and adds the variable OFDI, i.e. the percentage of foreign direct investment in GDP of a country/region. In order to reduce the influence of variable heteroskedasticity, this paper takes the logarithm of the variable OFDI to get the following model (2).

$$X_t = \alpha_0 + \alpha_1 \times \ln(\text{OFDI}_t) + \varepsilon_t \quad (2)$$

The core explanatory variable is  $\ln(\text{OFDI})$ , which is the logarithmic ratio of the sum of China's OFDI to G7 countries in year t to China's GDP of that year.

### 3.2. Data sources

G7 countries refer to France, Germany, Italy, Japan, the United Kingdom, the United States and Canada, seven major developed countries with high levels of social and economic development. The technological spillover from developed countries plays an important role in the technological progress of developing countries. G7 countries are typical representatives of developed countries, with their combined GDP remaining stable at about three quarters of the combined GDP of all developed countries between 2012 and 2022.

Due to the late development of China's OFDI, it was not until 2003 that *Statistical Bulletin of China's Outward Foreign Direct Investment* was released for the first time, and in light of the availability of data, the sample data in this paper is selected for the interval of 2003 to 2021, and the data are all obtained from *China Statistical Yearbook*, *Statistical Bulletin of China's Outward Foreign Direct Investment*, and the relevant official websites.

### 3.3. Explained variables

The explanatory variable  $X_t$  denotes the level of industrial structure in China in year t. Referring to the method of Wang et al. (2019), this paper takes the rationalization of industrial structure (TL) and the advancement of industrial structure (IS) as two indicators to measure industrial structure upgrading. Rationalization of industrial structure refers to the dynamic process of improving the coordination capacity and strengthening the level of association between industries. It is an indicator of the coordination strength and aggregation quality of each industry. This paper draws on the method of Gan et al. (2011) and uses the Theil Index to measure industrial structure rationalization, as shown in model(3).

$$TL_t = \sum_{i=1}^n \left( \frac{Y_i}{Y} \right) \ln \left( \frac{\frac{Y_i}{L_i}}{\frac{Y}{L}} \right) \quad (3)$$

In model (3), Y denotes GDP and L denotes labor force.  $Y_i$  and  $L_i$  represent the value added and the number of labor force of industry i respectively. The Theil Index is negatively correlated with the degree of industrial structure rationalization. Therefore, only when its regression coefficient is negative does it indicate that China's OFDI in G7 countries significantly promotes the industrial structure rationalization.

According to modern economic theory, the advancement of industrial structure refers to the process of evolution of industrial structure and production efficiency from lower to higher stages, such as the evolution from primary industry to secondary industry and tertiary industry, or the evolution from labor-intensive industry to capital-intensive and technology-intensive industry, or the evolution from the manufacture of primary products to the manufacture of intermediate and final products, or the combination of the above. Most of the existing literature chooses to measure it with the ratio of tertiary industry output to secondary industry output. However, in some cases, the ratio will be out of balance and cannot objectively and accurately measure the degree of industrial upgrading, this paper draws on the practice proposed by Xu in 2008 and later adopted by scholars

such as Wang et al. (2020) and Fang et al. (2021), and adopts the following model to measure the degree of the advancement of industrial structure, as shown in model 4:

$$IS_t = 1 \times \frac{One_t}{GDP_t} + 2 \times \frac{Two_t}{GDP_t} + 3 \times \frac{Three_t}{GDP_t} \quad (4)$$

In model 4,  $One_t$ ,  $Two_t$  and  $Three_t$  represent the added value of China's primary, secondary and tertiary industries in year  $t$  respectively. The reason for assigning coefficients 1, 2 and 3 to the shares of added value of primary, secondary and tertiary industries in the GDP respectively, is to emphasize the importance of each industry in industrial upgrading by weighting the coefficients separately. This indicator can objectively reflect the fact that with the economic and social development, the proportion of the three major industries in China has gradually evolved from being dominated by the primary industry to the fact that the secondary industry and the tertiary industry have taken up a major share.

## 4. Empirical analysis

### 4.1. Stationarity test

In order to avoid the pseudo-regression problem, the ADF test should be performed on all time series before the empirical analysis to confirm whether there is a unit root in the series and thus whether they are stationary or not, the results of which are shown in Table 1. The original series of the three variables are not smooth at the 5% significance level, while their series after first-order differencing pass the ADF test at the 5% significance level, which means all the above three time series are integrated of order one series  $I(1)$ . Cointegration relationship test can be performed afterwards.

**Table 1** ADF unit root test

| variant     | Test form (C,T,k) | ADF value | P-value | variant            | Test form (C,T,k) | ADF value | P-value | verdict |
|-------------|-------------------|-----------|---------|--------------------|-------------------|-----------|---------|---------|
| TL          | C,T,0             | -2.9190   | 0.0627  | $\Delta TL$        | C,T,0             | -3.9191   | 0.0094  | I (1)   |
| IS          | C,T,0             | -0.0356   | 0.9430  | $\Delta IS$        | C,T,0             | -3.5904   | 0.0179  | I (1)   |
| $\ln(OFDI)$ | C,T,0             | -2.9705   | 0.0581  | $\Delta \ln(OFDI)$ | C,T,0             | -6.0672   | 0.0001  | I (1)   |

### 4.2. Johansen cointegration test

Some linear combinations of the above non-stationary time series may still be stationary time series, which provides a breakthrough for further research. In this paper, Johansen's maximum likelihood method is used to test the cointegration of the above three variables. A VAR model is constructed for them, and the row with the most asterisks, i.e., 2, is chosen to represent the optimal lag order of the VAR according to the Akaike Minimum Information Criterion (AIC) and the Schwartz Criterion (SC) (the results are shown in Table 2). The AR root plot also corroborates that the construction of the VAR(2) model is reasonable (as shown in Figure 2, the AR roots of all eigenvalues are located within the unit circle, indicating that the model is stable).

**Table 2** Determination of the optimal lag order of the VAR

| Lag | LogL     | LR       | FPE       | AIC        | SC         | HQ         |
|-----|----------|----------|-----------|------------|------------|------------|
| 1   | 95.27657 | NA       | 4.21e-09  | -10.78457  | -10.34999* | -10.76232  |
| 2   | 107.6980 | 15.52682 | 3.04e-09* | -11.21225* | -10.34309  | -11.16774* |
| 3   | 116.5474 | 7.743176 | 4.31e-09  | -11.19342  | -9.889678  | -11.12666  |

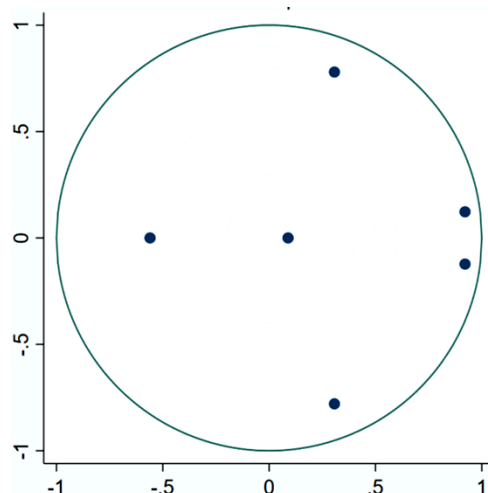


Fig. 2 AR root test results

As shown in Table 3, when the trace statistics of the variables show that there is no cointegration relationship, the t-statistic is greater than its critical value at the 5% level of significance and the hypothesis should be rejected, and when the trace statistics show that there is no more than 1 cointegration relationship, the t-statistic is less than its critical value at the 5% level of significance and the hypothesis should be accepted. This indicates that the above three variables have and only have 1 cointegrating relationship at 5% significance level. This indicates that there is a long-term stable proportional cointegration relationship between the logarithm of China's investment in G7 countries, the rationalization of industrial structure and the advancement of industrial structure.

Table 3 Results of Johansen's cointegration test

| null hypothesis | eigenvalue | trace statistic | 5% threshold |
|-----------------|------------|-----------------|--------------|
| $r=0$           | 0.673788   | 31.01925        | 29.79707     |
| $r \leq 1$      | 0.398283   | 11.97570        | 15.49471     |
| $r \leq 2$      | 0.178386   | 3.340241        | 3.841466     |

#### 4.3. Estimating the coefficients of model (2)

The regression of  $\ln(\text{OFDI})$  on the explanatory variables TL and IS was done using least squares to obtain the follows respectively:

$$\text{TL} = 0.685937 - 0.040008 \ln(\text{OFDI}) \quad (5)$$

$$\text{Se } (0.040182) \quad (0.003128)$$

$$t \quad (17.07055) \quad (-12.78832)$$

$$R^2 = 0.905839$$

$$F = 163.5412$$

$$\text{IS} = 1.928247 + 0.034450 \ln(\text{OFDI}) \quad (6)$$

$$\text{Se } (0.074590) \quad (0.005807)$$

$$t \quad (25.85119) \quad (5.932142)$$

$$R^2 = 0.674269$$

$$F = 35.19031$$

The TL value is the reverse indicator of the degree of industrial structure rationalization and the IS value is the positive indicator of industrial structure advancement. It is known from the regression results that both China's industrial structure rationalization and advancement are positively correlated with its OFDI in G7 countries. The higher R-Square value of equation (5) indicates that the rationalization of industrial structure has a more significant correlation with OFDI in G7 countries.

#### 4.4. Granger causality test

It has been shown that the three time series in the model are all integrated of order one series and have cointegration, so the causal relationship between the variables can be determined by constructing a vector error correction model. A Granger causality test can be conducted on the I(1) series of each variable (Table 4). The findings show that  $\ln(\text{OFDI})$  is a Granger cause of IS in the short run but not in the long run; TL is not a Granger cause of  $\ln(\text{OFDI})$  in the short run but is in the long run, and there is no Granger causality between the other variables in the short run or long run. This implies that China's OFDI in G7 countries can promote China's industrial structure advancement in period 2, but there is no such effect by period 4. The rationalization of China's industrial structure cannot promote its OFDI in G7 countries in period 2, but there is such effect by period 4. To sum up, China's OFDI in G7 countries can promote its domestic industrial structure advancement in the short term, but not in the long term, while it cannot promote China's domestic industrial structure rationalization in either the short term or the long term.

**Table 4** Granger causality test results

| null hypothesis                                   | lag | F-statistic | P-value | verdict         | lag | F-statistic | P-value | verdict         |
|---------------------------------------------------|-----|-------------|---------|-----------------|-----|-------------|---------|-----------------|
| IS is not the Granger cause of TL                 | 2   | 1.815       | 0.208   | Accepted<br>*** | 4   | 2.434       | 0.178   | Accepted<br>*** |
| TL is not the Granger cause of IS                 | 2   | 1.232       | 0.329   | Accepted<br>*** | 4   | 2.085       | 0.220   | Accepted<br>*** |
| IS is not the Granger cause of $\ln(\text{OFDI})$ | 2   | 0.037       | 0.964   | Accepted<br>*** | 4   | 0.637       | 0.658   | Accepted<br>*** |
| $\ln(\text{OFDI})$ is not the Granger cause of IS | 2   | 4.073       | 0.047   | Rejected<br>**  | 4   | 2.542       | 0.167   | Accepted<br>*** |
| TL is not the Granger cause of $\ln(\text{OFDI})$ | 2   | 0.821       | 0.465   | Accepted<br>*** | 4   | 7.170       | 0.027   | Rejected<br>**  |
| $\ln(\text{OFDI})$ is not the Granger cause of TL | 2   | 0.593       | 0.570   | Accepted<br>*** | 4   | 1.289       | 0.386   | Accepted<br>*** |

#### 5. Robustness test

The previous parts concluded that there is short-term relationship between China's OFDI in G7 countries and its domestic industrial structure advancement. In order to further verify the accuracy of the above conclusion, this part conducts a robustness test.

The following control variables are added to Model (2):

- (i) FTR, the ratio of China's broad money supply (M2) to its GDP,
- (ii) GRP, the number of China's green patents granted (in 10,000),
- (iii) RD, the ratio of China's R&D expenditures to its GDP.

Model (7) is obtained by modifying the model based on the results of the research in Part 4. Table 5 demonstrates the base regression results of this model and compares them with Model (2). It can be seen that after adding the control variables, the core explanatory variable  $\ln(\text{OFDI})$  is always three-star significant and the R-Square value increases significantly, which indicates that the above control variables can better explain the process of China's advanced industrial structure.

$$IS_t = \beta_0 + \beta_1 \times \ln(\text{OFDI}_t) + \beta_2 \times \text{FTR}_t + \beta_3 \times \text{GRP}_t + \beta_4 \times \text{RD}_t + \varepsilon_t \quad (7)$$

**Table 5** Base regression results

| explanatory variable | explained variable: IS |                     |
|----------------------|------------------------|---------------------|
|                      | model (2)              | model (7)           |
| ln(OFDI)             | 0.034***<br>(0.006)    | 0.017***<br>(0.004) |
| FTR                  |                        | 0.065<br>(0.041)    |
| GRP                  |                        | 0.004***<br>(0.001) |
| RD                   |                        | -0.050*<br>(0.027)  |
| constant term        | 1.928***<br>(0.075)    | 2.069***<br>(0.052) |
| sample size          | 19                     | 19                  |
| <b>R<sup>2</sup></b> | 0.674                  | 0.968               |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Referring to Guo et al. (2022), this part constructs two other measures of industrial upgrading as replacement variables for the explanatory variable IS as a robustness test. They are respectively:

(i) STR, the ratio of the output value of China's tertiary industry to the output value of the secondary industry,

(ii) EDU, the ratio of the number of university graduates in China in the calendar year to the total national population.

Table 6 demonstrates the results of the robustness test. We can find that the core explanatory variable ln(OFDI) is consistently three-star significant regardless of the substitution of the explanatory variable IS, and the control variables are also mostly significant. This further validates the relationship between IS and ln(OFDI) derived in the previous section. China's OFDI in G7 countries promotes its domestic industrial structure advancement robustly. Thus, **hypothesis 1** is confirmed.

**Table 6** Results of IS robustness tests

| explanatory variable | (1)                 | (2)                  | (3)                  | (4)                  |
|----------------------|---------------------|----------------------|----------------------|----------------------|
|                      | IS                  | TL                   | STR                  | EDU                  |
| ln(OFDI)             | 0.017***<br>(0.004) | -0.014***<br>(0.002) | 0.038***<br>(0.011)  | 0.000***<br>(0.000)  |
| FTR                  | 0.065<br>(0.041)    | 0.029<br>(0.040)     | 0.476***<br>(0.137)  | -0.003***<br>(0.001) |
| GRP                  | 0.004***<br>(0.001) | -0.000<br>(0.000)    | 0.015***<br>(0.002)  | 0.000<br>(0.000)     |
| RD                   | -0.050*<br>(0.027)  | -0.122***<br>(0.024) | -0.335***<br>(0.088) | 0.003***<br>(0.001)  |
| constant term        | 2.069***<br>(0.052) | 0.532***<br>(0.049)  | 0.118<br>(0.181)     | -0.000<br>(0.001)    |
| sample size          | 19                  | 19                   | 19                   | 19                   |
| <b>R<sup>2</sup></b> | 0.968               | 0.987                | 0.972                | 0.981                |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 6. heterogeneity analysis

Due to the unbalanced development of China's different regions, their industrial structure, technological level, and level of economic development vary, and thus the level of industrial structure

upgrading may also differ. In order to analyze the regional heterogeneity of the above promotion, this part selects data on industrial structure upgrading of 31 provinces, autonomous regions, and municipalities directly under the central government in mainland China from 2003 to 2021, and conducts regressions according to the eastern, central or western provinces, ethnic minority autonomous regions or non-ethnic minority autonomous regions, and whether the province has free trade zones or not, six categories in total (Table 7).

The classification results of different caliber show that the regression coefficients of the explanatory variable IS are mostly positive and significant. However, the IS indicator of provinces without free trade zones is two-star significant, the IS indicator of minority autonomous regions is only one-star significant, and the IS indicator of central and western provinces is not significant. One possible reason for this phenomenon is that the eastern region has always been the first to receive the economic dividends of OFDI. As a result, the promotion effect of China's OFDI in G7 countries on its industrial structure upgrading will be more significant in the eastern region first. Compared with the developed regions in the east, China's inland areas have a weaker industrial foundation and policy effects, so the trend of industrial structure advancement is not yet obvious. Since most of the ethnic minority autonomous regions are geographically remote, with inconvenient transportation and infrastructure that needs for improvement, the impact of the dividend of industrial structure advancement from China's OFDI in developed countries is weaker than in non-ethnic minority autonomous regions. Compared with provinces with free trade experimental zones (FTZs), provinces without FTZs lack efficient channels for external exchanges and can hardly receive its dividends, so the trend of their industrial structure advancement is weaker. Overall, China's OFDI in G7 countries promotes its domestic industrial structure advancement with regionally heterogeneous effects. Thus, **hypothesis 2** is confirmed.

**Table 7** Results of Heterogeneity Analysis of IS Regions

| explanatory variable | (1)<br>eastern provinces       | (2)<br>central and western provinces | (3)<br>non-ethnic minority autonomous regions | (4)<br>ethnic minority autonomous regions | (5)<br>provinces with FTZs     | (6)<br>provinces without FTZ |
|----------------------|--------------------------------|--------------------------------------|-----------------------------------------------|-------------------------------------------|--------------------------------|------------------------------|
| ln(OFDI)             | 0.028*<br>**<br>(0.007)        | 0.006<br>(0.019)                     | 0.024***<br>(0.008)                           | 0.022*<br>(0.010)                         | 0.024**<br>*<br>(0.008)        | 0.024**<br>(0.009)           |
| FTR                  | -0.021<br>(0.054)              | 0.008<br>(0.141)                     | 0.007<br>(0.059)                              | 0.017<br>(0.078)                          | 0.014<br>(0.060)               | 0.053<br>(0.070)             |
| GRP                  | 0.006*<br>**<br>(0.001)        | 0.002<br>(0.002)                     | 0.006***<br>(0.001)                           | 0.005***<br>(0.001)                       | 0.006**<br>*<br>(0.001)        | 0.005***<br>(0.001)          |
| RD                   | -0.099*<br>(0.051)             | 0.003<br>(0.134)                     | <b>-0.102*</b><br>(0.056)                     | -0.071<br>(0.074)                         | <b>-0.105*</b><br>(0.057)      | -0.082<br>(0.067)            |
| constant term        | <b>2.181*</b><br>**<br>(0.066) | <b>1.499***</b><br>(0.172)           | <b>2.138***</b><br>(0.072)                    | <b>2.000***</b><br>(0.095)                | <b>2.128**</b><br>*<br>(0.074) | <b>1.957***</b><br>(0.086)   |
| sample size          | 19                             | 19                                   | 19                                            | 19                                        | 19                             | 19                           |
| R <sup>2</sup>       | 0.967                          | 0.419                                | 0.961                                         | 0.932                                     | 0.949                          | 0.946                        |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 7. Conclusions and recommendations

This paper leads to the following conclusions:

(i) Johansen's cointegration test and regression analysis show that there is a long-term stable proportional cointegration relationship between the logarithm of China's investment in G7 countries, the rationalization of industrial structure and the advancement of industrial structure. This indicates that OFDI in developed countries and the promotion of a more rationalized and advanced industrial structure of China is deeply correlated.

(ii) The Granger causality test shows that China's OFDI in G7 countries promotes its domestic industrial structure advancement in the short run, but not in the long run. This may be because the advanced technology of developed countries can provide an excellent sample for China's industrial reform, thus promoting a more balanced development of each industry in a short period. However, the reverse technology spillover from developed countries cannot change China's macro-industrial layout, so it is difficult to sustainably promote the proportion of China's high-end manufacturing industry and tertiary industry to continue to rise and realize long-term industrial structure upgrading.

(iii) Heterogeneity analysis shows that although China's OFDI in G7 countries has contributed to the domestic industrial structure advancement of ethnic minority autonomous regions and provinces without FTZs in China, the effect is weaker than in other regions of China. Furthermore, the promotion effect hardly radiates to the central and western provinces.

This paper puts forward the following suggestions:

(i) While continuing the eastern regions' modernization, China should give priority to the investment and development of industries, capital, technology, talents and infrastructure construction in the central and western regions. Therefore the allocation of innovation factors can be optimized, and the upgrading of the industrial structure can be promoted effectively, in particular, in remote regions.

(ii) China should give full play to the advantage of the talent dividend and the huge market potential brought about by its accession to the RCEP, especially by drawing on the experience of developed countries of the RCEP. Hence the shortage of domestic market factors can be made up for with the help of booming RCEP market.

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