# Impact of the Belt and Road Policy on R&D Investment and Innovation Level of Enterprises Along the Line

Chenyang Guo[1,*], Feng Liu[2]

[1.]The School of Economics and Trade, Hunan University, Changsha, China
[2.]The School of Economics, Xiamen University, Xiamen, China
*Contact information: cyang0127@163.com

**ABSTRACT**

In recent years, "innovation-driven development strategy" is an important measure to adjust the supply-side structural reform. At the same time, the Belt and Road policy has become an important strategic layout for China. This paper selects the data of listed A-share companies from 2011 to 2018 and uses the DID model to explore whether the policy impact of "The Belt and Road" can significantly improve the company's R&D investment. In addition, this paper will divide enterprises according to their ownership and explore the different responses of state-owned enterprises and private enterprises to policy impact. At the micro-level of firms, it is concluded that firms' responses to policies have expected effects, and the mechanism of policy impact on R&D investment is analyzed. Finally, the paper concludes that the sustainability of the increase in R&D investment is difficult to predict and greatly affected by the impact of the policy environment.

*Keywords: The Belt and Road, R&D investment, Innovation output*

## 1.INTRODUCTION

With the exhaustion of globalization dividend, the decline of industrialization dividend and reversal of demographic dividend, Chinese economic growth has entered the medium-high growth period from high-speed growth period. Therefore, General Secretary Xi Jinping proposed the Belt and Road Initiative in 2013 to reap new dividends of economic globalization and break the bottleneck of economic development. In February 2015, the work conference on promoting the construction of the Belt and Road was held in Beijing, and the Belt and Road initiative entered the stage of implementation. At the 19th CPC National Congress, General Secretary Xi Jinping made it clear that "innovation is the primary driving force for development and the strategic underpinning for building a modernized economy." Romer[1] pointed out that knowledge or technology is different from other common commodities in that knowledge has a spillover effect, that is, knowledge or technology accumulated by a manufacturer not only improves its productivity but also that of other manufacturers in the society. Thus, the economy can sustain long-term growth. Technological progress is the result of R&D innovation input by private manufacturers seeking profit maximization[2]. The Chinese industrial policy to stimulate enterprises'

innovation is more of a strategy rather than substantive innovation[3]. Many enterprises have not taken complete measures in the long-term industrial upgrading plan, and the purpose of recovering cash flow and obtaining short-term discounts outweighs the purpose of gaining a long-term technological advantage. In addition, by mastering key production factors, state-owned enterprises have problems such as inefficient allocation of production factors and administrative monopoly in recent years[4], which have hindered the upgrading of the industrial structure.

Therefore, at the micro-level of enterprises, this paper will explore whether the Belt and Road policy will have a significant impact on the R&D investment of enterprises in provinces along the line from the perspective of R&D investment. Further, this paper discusses whether the Belt and Road Initiative will significantly promote the innovation level of state-owned enterprises and large enterprises and form knowledge spillover effect, and realize the industrial upgrading and resource allocation optimization.

## 2.LITERATURE REVIEW

The Belt and Road Initiative is a top-level design proposed by China to deepen international economic and

trade cooperation and promote mutual benefit and win-win results in the new era of economic globalization. At the macro-level, trans-regional economic connectivity, and multinational economic cooperation promote industrial structure adjustment, and large-scale infrastructure construction promotes OFDI[5]. In the new economic environment, enterprises' technological innovation is not only affected by market structure, but also by the national political environment. The government plays a particularly important role in influencing enterprises' technological innovation[6]. The Belt and Road Initiative makes multinational companies more active in countries along the Belt and Road. The relaxed tax environment and the reduction of uncertainties in the foreign policy environment have significantly increased OFDI[7]. As an important carrier of economic globalization, the knowledge spillover effect of transnational corporations can promote the optimization and updating of production lines of local enterprises. Meanwhile, the open market enables enterprises of various countries to take advantage of their comparative advantages to compete in a broader market and force them to actively seek technological innovation and obtain cost advantages.

At present, domestic research mainly focused on whether the Belt and Road initiative can significantly promote the industrial structure upgrading of enterprises along the route. Under the background of the Belt and Road, the scale of OFDI between China and countries along the Belt and Road has increased, thereby promoting enterprise innovation and industrial upgrading. Through the intermediary effect test, Wang Guijun and Lu Xiaoxiao[8][9] believe that OFDI is an important path for the Belt and Road Initiative to promote enterprise innovation. At the same time, the industrial upgrading brought by technological innovation has a counter-effect on OFDI[10]. The adjustment of industrial structure centering on changing "factor-driven" to "innovation-driven" is being initiated in China. It has promoted the transfer and expansion of highly labor-intensive industries, industries with obvious overcapacity, and industries constrained by domestic resources based on the "demographic dividend" to countries along the Belt and Road with great strides. However, some scholars believe that the Belt and Road initiative has been proposed for a short period, and domestic enterprises are currently focusing on expanding overseas markets while ignoring innovative research and development[11].

To sum up, current works of literature all believe that policy orientation is an important factor affecting the level of innovation of enterprises, and OFDI is a direct product of the Belt and Road Initiative, which affects industrial upgrading as an intermediate mechanism. The Belt and Road Initiative may not significantly increase enterprises' innovation in the short term, but enterprises will follow the policy guidance to increase R&D

investment to obtain subsidies or political protection from local governments. This paper finds the provinces affected by the Belt and Road Initiative based on the geographical location of different provinces and then uses the difference in differences model (DID)[12] to explore whether the Belt and Road Initiative will promote the provinces to increase their R&D expenditure in the short term and further drive the level of innovation. This paper will also further discuss the policy expectations and lag of the Belt and Road Initiative. Besides, this paper will analyze the mode through which provinces change the innovation level and the sustainability of the improvement of the innovation level in the future.

## 3. STUDY DESIGN

### 3.1. Model design

This paper regards the Belt and Road construction work conference held in February 2015 as a quasi-natural experiment, generally considered Xinjiang, Shaanxi, Qinghai, Chongqing, Inner Mongolia, Heilongjiang, Jilin, Gansu, Ningxia, Liaoning, Guangxi, Yunnan, Tibet, Fujian, Guangdong, Shanghai, Zhejiang, Hainan 18 provinces (autonomous regions, municipalities directly under the Central Government) are the key affected provinces of the Belt and Road initiative. Therefore, enterprises in these provinces were set as the treatment group and enterprises in other provinces as the control group. In addition, the provinces (Shanghai, Beijing, Anhui, Fujian, Jiangsu, Guangdong, Tianjin, Zhejiang，and Hubei) that took the lead in replacing business tax with value-added tax are excluded in this paper. And the turnover tax reform in the remaining provinces is carried out at the same time. Even if it has an impact on innovation behavior, it has the same impact on the treatment group and the control group. DID model design is as follows:

$$RDspend_{it} = \beta_0 + \beta_1 Place_{it} + \beta_2 Policy_{it} + \beta_3 \ Place_{it} \times Policy_{it} + X_{it} + \varepsilon_{it} \qquad (1)$$

Among them, the $RDspend_{it}$ represents the logarithm of the R&D investment of enterprise i in t years. Dummy variable $place_{it}$ indicates the grouping of enterprises. If the enterprise is located in a province heavily affected by the Belt and Road Initiative, place=1; otherwise, place=0. Dummy variable $Policy_{it}$ in this paper, the time is 4 years before and after the working meeting. Before the working meeting (2011-2014), the policy is set to 0, and after the working meeting (2015-2018), the policy is set to 1. In the DID model, we focus on judging policy effectiveness by observing the significance of β3. $X_{it}$ is the control variable, including monetary capital, quick ratio, return on equity, etc. Specific variable definitions are shown in Table 1.

**Table 1.** Variable names, symbols, and definitions

| Variable name | Symbol | Definition |
|---|---|---|
| R&D spending | RDspend | Log of R&D investment of listed companies in the current year |
| place | Place | Place =1 if the company focuses on provinces under the Belt and Road Initiative; Otherwise, the place = 0 |
| policy | Policy | Distinguish whether policies are implemented or not, 2011-2014, policy=1; From 2015 to 2018, the policy = 0 |
| Monetary fund | Lnmoney | Log of monetary fund of listed companies in the current year |
| Return on equity | ROE | The ratio of after-tax profit to net asset size |
| Quick ratio | Quickratio | The ratio of quick assets to current liabilities |
| Numberof R&D personnel | RDperson | Log of number of R&D personnel of listed companies in the current year |
| Year fixed effect | i.year | Control year |
| Industry fixed effect | i.indus | Control industry |

### 3.2. Data sources and descriptive statistics

The time of this paper is from 2011 to 2018, which is 4 years before and after the policy officially enters the implementation stage and the research objects are A-share listed companies in various provinces. In this paper, the provinces that carried out the pilot program of "replacement of business tax with value-added tax" were excluded, and the samples with missing financial, ST，and R&D investment data were excluded. Finally, 4208 observations of 526 listed companies were obtained. Data were obtained from the CSMAR database and Giant Tide Information network. According to descriptive statistics, the average value of RDspend is 7.69, the minimum value is 5.63, and the maximum value is 9.93, indicating that there is a large gap between R&D investments of various enterprises. Besides, according to the statistics of dummy variable Place, 73% of the sample enterprises are significantly affected by the Belt and Road Initiative.

## 4. THE EMPIRICAL ANALYSIS

### 4.1. The empirical results

The data in this paper have passed the parallel trend test. The regression of benchmark model (1) is carried out below, and the results are shown in Table 2. The interaction coefficient $\beta_3$ in the mixed OLS results was significant at the 5% confidence level and was highly significant at the 1% confidence level when the fixed-effects model was used. The $\beta_3$ obtained by using the FE model is smaller than that obtained by mixed OLS, indicating that incomplete control of individual fixed

effect at the enterprise level will lead to overestimation of interaction term coefficient $\beta_3$. In other words, the promotion effect of the Belt and Road policy on enterprise R&D investment will be overestimated. According to the property of ownership, the results of sub-sample regression show that the scale increment of R&D investment of state-owned enterprises in provinces along the Belt and Road Initiative does not significantly exceed that of enterprises in non-provinces along the Belt and Road. On the contrary, the R&D investment of private enterprises increased under the influence of the policy. State-owned enterprises did not take the lead in increasing R&D investment after the proposal was put forward, and the investment structure did not change in the short term.

### 4.2. Robustness analysis

#### 4.2.1. Placebo test

Referring to the previous practice of Lu Yue et al. [13], this paper randomly selects the treatment group and the control group for a placebo test. 264 enterprises were randomly selected from the original 526 samples as the "pseudo-treatment group" and the remaining enterprises as the control group. The regression of model (1) was continued. Column (3) and (4) of Table 2 showed that the coefficient of Place× Policy in the placebo test was not significantly different from 0, indicating that when the treatment groups were randomly selected, the Belt and Road Initiative had no significant promoting effect on the R&D investment of the "pseudo-treatment group", and the placebo test passed.

**Table 2.** Baseline regression and placebo test results

| Rdspend | (1)Mixed OLS | (2)FE model | (3)The original regression | (4)Pseudo-processing group |
|---|---|---|---|---|
| Place | 0.08667 * * * (4.66) | omitted | omitted | omitted |
| Policy | 0.41892 * * * (14.44) | 0.42694 * * * (26.10) | 0.42694 * * * (26.10) | 0.44967 * * * (31.66) |
| Place× Policy | 0.05089 * * (2.02) | 0.03931 * * * (2.08) | 0.03931 * * * (2.08) | 0.01179 (0.95) |
| lnmoney | 0.25743 * * * (44.71) | 0.10838 * * * (19.02) | 0.10838 * * * (19.02) | 0.24989 * * * (19.02) |
| Control variables | YES | YES | YES | YES |
| i.year | YES | YES | YES | YES |
| i.indus | omitted | omitted | omitted | omitted |
| FE | NO | YES | YES | YES |
| Observations | 4196 | 4196 | 4196 | 4196 |
| Adj-$R^2$ | 0.4886 | 0.4562 | 0.4562 | 0.4552 |

### 4.2.2.The expected effect

This paper defines the policy timing as the Belt and Road construction work conference, which is the beginning of 2015. But between the end of 2013 and the beginning of 2015, China has made macro plans for the implementation of specific measures, including the establishment of the Asian Infrastructure Investment Bank, ASEAN Expo Initiative. Therefore, this paper carries out the expected effect test and advances the time point of the policy to 2014. To ensure the integrity of the study, this article also carries out the lagged effect test, assuming that policy shock occurred in 2016. Empirical results show that the interaction coefficient of the expected effect test is similar to the original interaction coefficient and significant at 1% level. This proves that even assuming that the policy impact is one year earlier, the promotion effect of the initiative on R&D investment is still significant, indicating that the expected effect exists. However, the interaction term of the lag effect test is much smaller than the original and not highly significant, which cannot indicate the validity of the lagged effect.

**Table 3.** Tests for expected and lagged effects

| Policy time | 2014 | 2015 | 2016 |
|---|---|---|---|
| Dependent variable | | RDspend | |
| Place | omitted | omitted | omitted |
| Policy | 0.42398*** (25.54) | 0.42694*** (26.10) | 0.43161*** (26.04) |
| Place×Policy | 0.04324*** (2.99) | 0.03931*** (2.08) | 0.03286** (2.27) |
| lnmoney | 0.25048*** (19.09) | 0.10838*** (19.02) | 0.24923*** (18.99) |
| Control variables | YES | YES | YES |

| | | | |
|---|---|---|---|
| i.year | YES | YES | YES |
| i.indus | omitted | omitted | omitted |
| FE | YES | YES | YES |
| Observations | 4196 | 4196 | 4196 |
| Adj-$R^2$ | 0.4564 | 0.4562 | 0.4558 |

## 5.MECHANISM AND TREND ANALYSIS

OFDI is considered to be the most significant micro-level performance brought by the Belt and Road Initiative. The accelerated infrastructure construction and the formulation of policies have continuously optimized the business environment, providing a convenient opportunity for countries along the Belt and Road to conduct OFDI[14]. MAO Qilin and Xu Jiayun[15] also believed that OFDI could significantly promote the improvement of innovation levels. From 2013 to 2018, the scale of China's OFDI sharply increased, leading to a boom of transnational investment in China. The mediating effect of OFDI is reflected in the following aspects: Enterprises expand their production scale through OFDI, and the formation of economies of scale effect increases corporate profits and provides sufficient funds to support R&D, which is the most direct mechanism at the micro-level. At the same time, OFDI has narrowed the relationship between government and business. Government departments provide enterprises with policy support such as customs services, tax incentives, and financing permits. Enterprises take advantage of such policies to facilitate technological innovation. Besides, multinational corporations face dual competition in the local market and foreign market, which has a significant role in promoting enterprise innovation.

Enterprises along the Belt and Road have increased their R&D investments year by year in recent years, and the growth rate is significantly higher than that of non-enterprises along the Belt and Road. When we consider future trends, most scholars' assumptions are based on a stable policy environment. However, with the outbreak of the US-China Trade War and the turbulent global economy, the R&D investment of enterprises has become highly risky and unstable, and the scale of OFDI has declined in 2019, hindering the R&D innovation of enterprises. The research findings of Li Qiumei et al. [11] found that the Belt and Road Initiative did not significantly improve enterprises' innovation output. Due to the long R&D cycle and low level of original technology, the enterprise has not obtained the dividend of innovation output in the short term. This situation may hurt the confidence of enterprises in R&D and reduce R&D investment by focusing on expanding overseas markets and capturing market share.

## 6.CONCLUSIONS

This paper establishes DID model to explore the impact of the Belt and Road initiative on enterprise R&D investment and finds that the initiative significantly improves the R&D investment of enterprises in key provinces. And state-owned enterprises have not significantly increased R&D investment and formed knowledge spillover effect. Compared with previous literature, this paper selected a longer policy window period to demonstrate the validity of the common trend test and prove the validity of the estimated results. As for the test of expected effect, this paper believes that enterprises have already responded to the Belt and Road Initiative in 2014.

The research results of this paper are of practical significance. It explores enterprises' responses to the Belt and Road Initiative from the micro-level, and provides the following enlightenment to the government and enterprises: Policy shocks at the macro-level do cause corporate responses. But state-owned enterprises tend to occupy favorable resources and are in the core position, the response to the policy tends to be not a positive attitude. So the country should continue to deepen the reform of state-owned enterprises. In addition, although the Belt and Road Initiative can promote enterprises to increase R&D investment, it may not translate into innovation output. In the implementation of macro policies, the government should carefully examine the response of enterprises at the micro-level and accurately implement policy preferences to truly encourage enterprises to carry out technological innovation.

## REFERENCES

[1] Romer, P. M. Increasing Returns and Long-run Growth. J. Polit. Econ. 94, 1002 -- 1037 (1986).

[2] Pan Shiyuan, Shi Jinchuan. Endogenous Economic growth theory: A Literature review [J]. Economic Quarterly,2002(03):753-786.

[3] Li Wenjing, Zheng Manni. Substantive or strategic innovation? Economic research journal,2016,51(04):60-73.

[4]  Chu M, Jin T. Why China's industrial structure upgrading is slow: Based on the dual impact of local government behavior and state-owned enterprise monopoly [J]. Finance and Trade Economics,2013(03):112-122.

[5]  Zhao S.On the relationship between "The Belt and Road" strategy and China's economic development and regional economic cooperation from a macro perspective [J]. International Finance,2015(09):38-44.

[6]  Liu Mingxia, Yuan Jingbo. Research on the dynamic mechanism of technological innovation of enterprises under the New Economic environment [J]. Science and Technology Progress and Countermeasures,2007(07):94-97.

[7]  Li, Huang, Dong. The Influential Factors on Outward Foreign Direct Investment: Emerging Markets Finance and Trade,2019,55(14).

[8]  Wang Guijun, Lu Xiaoxiao. Can the Belt and Road Initiative promote Chinese enterprise innovation?[J]. Journal of finance and economics,2019,45(01):19-34.

[9]  Wang Guijun, Lu Xiaoxiao. The Belt and Road Initiative and the upgrading of Chinese enterprises [J]. China Industrial Economics,2019(03):43-61.

[10] Yang Y, Liu C X.The relationship between OFDI and China's industrial upgrading under the Background of "The Belt and Road" [J]. Journal of South China Normal University (Social Science Edition),2015(05):93-101+191.

[11] Li Qiumei, Lin Ling, Zeng Haijian. Whether the Belt and Road Initiative can promote enterprises' innovation capability [J]. Science and technology progress and countermeasures,2019,36(17):47-56.

[12] Marianne Bertrand, Esther Duflo, Sendhil Mullainathan. How Much Should We Trust Differences-in-Differences Estimates?2004, 119 (1) : 249-275.

[13] Lu Yue, Lu Yi, Wu Songbo, Wang Yong. The promotion effect of the Belt and Road Initiative on outbound investment: Based on the differential difference test of Chinese enterprises' greenfield investment from 2005 to 2016.] Economic research journal,2019,54(09):187-202.

[14] Liao H W, Yang L P.OFDI, industrial structure upgrading and economic growth in the Belt and Road countries: interaction mechanism and China's performance [J]. Social Science Research,2018(05):29-37.

[15] MAO Qilin, Xu Jiayun. Does China's ofdi promote enterprise innovation? [J]. World economy,2014,37(08):98-125.