Study on the Impact of Digital Economy Development on China's OFDI in Countries Along the "Belt and Road" Route

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Abstracts. This paper constructs a theoretical analysis of the impact of the digital economy of the countries along the route on OFDI and its mechanism, determines the indicators to measure the level of development of the digital economy of the "Belt and Road" countries, and collects panel data on the development level indicators of 76 countries along the "Belt and Road" route from 2009 to 2019. We collect panel data of the development level indicators of 76 countries along the Belt and Road from 2009 to 2019. The geographic distance is introduced to construct the basic gravity model, followed by the introduction of the core explanatory variables of the level of digital economy development, and other control variables are the level of industrialisation, trade openness, natural resource endowment and labor force size to construct an extended gravity model, and then empirically analyse the impact of the digital economy of the countries along the Belt and Road on the OFDI of China. The results show that a 1% increase in the level of digital economy development in the countries along the route will lead to an increase in China's OFDI by at least 0.085%, provided that other influencing factors remain unchanged. Natural resource endowment and labor force size also have a positive relationship with China's OFDI, while geographical distance and trade openness have a negative effect on China's OFDI. Based on the results of the empirical analyses, this paper puts forward policy recommendations for the countries along the Belt and Road, as well as for China.

Key words: Belt and Road; digital economy; extended investment gravity model

1. Introduction

In 2021, the State Council issued the "14th Five-Year Plan for the Development of the Digital Economy", which states that the digital economy is the main economic form following the agricultural and industrial economies, and that it takes data resources as the key element, modern information networks as the main carrier, and the integration of information and communication technologies and digital transformation of all elements as the important driving force to promote fairness and efficiency in a more unified new economic form. It is a new economic form that promotes greater unity between equity and efficiency. The digital economy, with its unprecedented speed of development, wide scope of radiation and depth of influence, is driving profound changes in the modes of production, living and governance, and has become a key force in restructuring global factor resources, reshaping the global economic structure and changing the pattern of global competition. During the "14th Five-Year Plan" period, China's digital economy has turned to a new stage of deepening application, standardised development and universal sharing. The digital economy utilises a new generation of information technology to realise the needs of life, operate the economy through data, and furthermore to realise production, operation and sales, affecting the lives of everyone in the economic system. Big data, as a fundamental and strategic resource, is a rich mine for improving the quality of people's lives and the country's ability to govern. China's current epidemic prevention and control is based on big data, so the country attaches great importance to the establishment of big data centres. The ability to communicate and forecast accurately, enhanced by information technology, gives intelligence to the economy itself.

Outward foreign direct investment (OFDI) is an important part of China's "going out" strategy, and is a proactive measure for China to actively participate in the international division of labor, to absorb advanced technology and management experience from abroad, and to grasp external information in a timely manner. With the frequent development of China's overseas cooperation,

China's outward investment has also developed rapidly, ranking first among developing countries. According to the relevant person in charge of the NDRC, China's outbound investment cooperation has achieved remarkable results, and during the 11th Five-Year Plan period, the average annual growth rate of outbound direct investment reached 34.3%. On 30 August 2012, the Ministry of Commerce, the National Bureau of Statistics, and the State Administration of Foreign Exchange (SAFE) jointly released the "2011 Annual Statistical Bulletin of China's Outbound Direct Investment", showing that in 2011, China's outbound direct investment in 2011 reached a record high. The Bulletin shows that in 2011, China's net outward FDI (flow) achieved a decade of consecutive growth since the release of the data, reaching US$74.65 billion, an increase of 8.5 per cent year-on-year, with non-financial investment reaching US$68.58 billion, an increase of 14 per cent year-on-year. China overtook the United States as the most attractive economy for FDI globally, a strong rebuttal to claims of "massive disinvestment by foreigninvested enterprises from China". In fact, the enthusiasm of foreign investment in China has not diminished, and the structure is more optimised and the content is higher. In the future, the large-scale "going out" of China's capital and the "bringing in" of high-level foreign investment will remain an important focus.

"The Belt and Road Initiative, as the focus of the new development pattern, has promoted internal and external exchanges and complementarity between China and the international economic double cycle. According to data from the Ministry of Commerce of China, by the end of 2020, China's direct investment in countries along the Belt and Road will have accumulated more than $130 billion, with an average annual growth rate of about 5 per cent. Even with the impact of the new pneumonia outbreak, China's investment in countries and regions along the Belt and Road reached $17.84 billion in 2020, an increase of 18.3 per cent year-on-year. The "Belt and Road" initiative provides a broader platform for international cooperation for Chinese enterprises. With the indepth promotion of the "Belt and Road" initiative, China's investment in countries along the "Belt and Road" has also achieved unprecedented prosperity. Based on the importance of the "Belt and Road" initiative, China's OFDI and the development of digital economy, this paper compiles and summarizes previous studies, and through comparative research, finds that there is a lack of research on the impact of the level of development of digital economy in "Belt and Road" countries on China's OFDI. The research on the impact of the development level of digital economy of "Belt and Road" countries on China's OFDI is relatively lacking. In order to promote the research in related fields, this paper complements the research on the impact of digital economy development and China's OFDI in the countries along the "Belt and Road". It deepens and improves the theoretical system of digital economy, "Belt and Road" digital construction, and China's outward investment.

2. Literature review

At present, domestic theoretical research on the "Belt and Road" initiative and China's outward foreign direct investment is relatively complete, and many scholars have conducted in-depth studies in this area, for example, Wu Xiaoxu and Ge Pengfei (2022) studied the impact of the "Belt and Road" initiative's For example, Wu Xiaoxu and Ge Pengfei (2022) studied the impact of the investment promotion effect (BR-IPE) of the "Belt and Road" Initiative on the OFDI of Chinese enterprises in non-coastal countries, and found that, on the whole, the BR-IPE significantly promotes the growth of the OFDI of Chinese enterprises in non-coastal countries, which has the effect of "incremental inducement"[1] . Yuan Zewei (2022) argues that China's investment in the countries along the Belt and Road is in a rapid development stage, and the analysis of its motivation is both a hot topic and of great value for the future development orientation. Taking the traditional international investment theory as the starting point, it conducts empirical analyses from the aspects of market-seeking, resource-seeking, efficiency-seeking, and technology-seeking, and then explores the strategies for expanding direct investment in the future, and draws the three major conclusions of meeting challenges and grasping opportunities, upgrading technology, cultivating talents, and overcoming barriers.[2] . Xu, S., He, Xiaoyi, and Zhong, K. (2019) found that after the Belt and Road Initiative

was put forward, the financing constraints of supporting enterprises have been significantly alleviated; the alleviating effect of the Belt and Road Initiative on the financing constraints of supporting enterprises is more pronounced in the emerging advantageous industries as well as in the export-oriented node cities; The "Belt and Road" Initiative alleviates the financing constraints of enterprises mainly through two channels: on the one hand, compared with enterprises not supported by the Initiative, enterprises supported by the Initiative obtain more financing, which is manifested in the increase of exogenous financing and bank loans; on the other hand, compared with enterprises not supported by the Initiative, enterprises supported by the Initiative obtain more bank loans; on the other hand, compared with enterprises not supported by the Initiative, enterprises supported by the Initiative obtain more bank loans. On the other hand, compared with non-initiative-supported enterprises, initiative-supported enterprises have lower costs of bank borrowing, lower costs of corporate bond financing, and more tax incentives[3] . Scholars such as Lu Yue and Lu Yi (2019) analysed the investment promotion effect of the Belt and Road Initiative in an all-round way through the double-difference method, and concluded that the investment promotion effect of the Belt and Road Initiative at the current stage mainly manifests itself in the expansion of the margin of agglomeration, that is to say, it mainly drives the existing investment base or investment projects to expand. It is concluded that at this stage, the investment promotion effect of the Belt and Road Initiative mainly manifests the expansion of the intensive margin, that is to say, it mainly drives the investment growth of the economies with existing investment bases or investment projects. In addition, based on the results of triple-difference estimation, in terms of industries, the outward investment promotion effect of the Initiative is mainly concentrated in infrastructure-related areas such as energy, transport and communications; in terms of investment sources, the Initiative has not yet generated significant investment promotion effects in the key provinces of the Belt and Road Initiative[4] .

Since the 1950s, Western scholars have focused on multinational corporations and their outward foreign direct investment (OFDI) and carried out in-depth research, forming many classic OFDI theories and models.

At the micro level, scholars such as Alfaro (2009) identified the location, ownership and activities of 650,000 transnational affiliates, and their findings suggest that the share of vertical FDI (affiliates supplying inputs to parent firms) is larger than commonly thought. The comparative advantage factor of TNCs locating activities abroad to take advantage of factor cost differentials hardly explains most subsidiaries. Instead, MNCs tend to have stages of production that are close to final production, giving rise to a class of high-skill, intra-industry vertical FDI.This paper measures the response of U.S. MNCs to the Clean Air Act Amendments (CAAA)[5] Hanna, Rema (2010) examines the impact of regulation on the overseas production decisions of multinational firms using firm-level data for the period 1966-1999.The CAAA induced a dramatic change in the level of regulation faced by firms, allowing for the estimation of econometric models that control for firm-specific characteristics and industry trends. The results of the study show that CAAA leads to a 5.3 per cent increase in overseas assets and a 9 per cent increase in overseas output for regulated multinationals. Heavily regulated firms did not disproportionately increase foreign investment in developing countries[6] Smarzynska Javorcik, Beata (2004) in the context of many countries' efforts to attract foreign direct investment (FDI) in the hope that knowledge brought by multinationals will spill over to domestic industries and increase their own productivity. Based on firm-level data from Lithuania, focusing on cross-industry effects, the evidence generated suggests positive productivity spillovers from FDI through linkages between foreign affiliates in the upstream sector and their local suppliers. The data suggest that spillovers are associated with domestic and foreign projects with shared ownership, but not with fully owned foreign investment[7] .

At the macro level, Ju, Jiandong, and Shang-Jin Wei (2010) propose a simple model to examine how domestic institutions affect the pattern of international capital flows. Inefficient financial systems and poor corporate governance may be bypassed by two-way capital flows in which domestic savings leave the country in the form of financial capital outflows, while domestic investment takes place

through inward foreign direct investment. While financial globalisation always improves welfare in developed countries with good financial systems, its impact on developing countries with inefficient financial sectors or poor corporate governance is ambiguous. Also, studies have found that financial institutions and property rights institutions may have opposite effects on capital flows[8] .

And the digital economy as a rising hotspot, in recent years there are many scholars on its research from multiple perspectives, the content involves the development of manufacturing enterprises, international trade and other areas. For example, Wei Zhuangyu (2022) in the research period, found that China's digital economy development trend is good, China's manufacturing enterprises resource allocation efficiency level shows a first lower and then higher change trend; urban digital economy development significantly improve the resource allocation efficiency of manufacturing enterprises; digital economy development can significantly improve the resource allocation efficiency of manufacturing enterprises in central and western regions, but the impact on the eastern region of the manufacturing enterprise The conclusions such as the impact of resource allocation efficiency is not significant, which provides a new perspective for the improvement of resource allocation efficiency of manufacturing enterprises under the new economic normal[9] . Zhan Xiaoning and Ouyang Yongfu (2018), on the basis of constructing the basic framework of the digital economy theoretical system, combined with the characteristics of the digital economy, in the face of the rise of the digital economy and the strategic transformation of global multinational corporations, China's focus on the strategy of utilising foreign investment should be transformed from investment promotion to "investment promotion to attract wisdom" and " The focus of China's foreign investment strategy should be changed from attracting investment to attracting intelligence and attracting energy, and new adjustments should be made to the focus, methods and performance evaluation system of investment promotion and facilitation. At the same time, it should play a leading role in the global digital economy and related investment regulation, and help developing countries meet the challenges of the digital economy and promote sustainable development[10]. Pei Changhong, Ni Jiangfei and other scholars (2018) concluded from their research that: the production of digital information products mainly relies on intangible capital inputs, exchange mainly relies on the virtual market, consumption mainly relies on the online, and the digital information product itself is an indispensable input; the digital economy has made the boundaries between urban and rural areas increasingly blurred, and formed a new type of urban-rural relationship with complementary advantages and interactive win-win situation; the platform enterprise has become the new production and exchange The main body of production and exchange, non-platform enterprises have a tendency of specialization and miniaturization, and the platform economy has become a new form of social production organization; to a certain extent, the production mode of the sharing economy has got rid of the "domination of dead labor over living labor", and the production process reflects more of the personalized willingness and participation of the main body of production, and the remuneration of intangible assets is higher than the income from physical capital. The digital information industry has the characteristics of high productivity and strong penetration ability, and is likely to be the fourth industry in the future. Finally, the emergence of digital economy makes the relevant principles of traditional economics face challenges, such as the principle of "invisible hand", the principle of diminishing marginal returns[11] .

With regard to the current state of the digital economy abroad, in a variety of fields, economists have examined how digital technologies are changing economic activity. While these papers tend to have different perspectives and cite different literature, a central theme is that digitisation reduces a number of specific economic costs. We have identified five such costs: search, copying, transport, tracking and verification. These themes inform our understanding of the nature of digital economic activity and the interaction between digital and non-digital environments. In defining the scope of this paper, we draw boundaries. For example, we do not discuss work on skill-biased technological change. Because skill bias is not primarily driven by the storage of information in bits, and because there are several other reviews of this literature, we instead refer to Katz and Autor (1999), Acemoglu (2002), Goldin and Katz (2008), and Acemoglu and Autor (2012). Similarly, we restrict the

discussion to the accounting literature on the growth of digital technologies, referring the reader to Jorgenson, Ho, and Stiroh (2008) and Bloom et al. (2010). We also restrict our discussion to three topics that have been reviewed in the Journal of Economic Literature: privacy (Acquisti, Taylor, and Wagman 2016), online auctions (Bajari and Hortacsu 2004), and telecommunications pricing and universal service (Vogelsang 2003). This overview highlights that changes in economic behaviour due to cost changes inherent in the digital context are not as obvious as the underlying economic models imply. For each of the cost changes highlighted, key open questions remain. In addition, other categories of costs may shift downwards as digital technologies evolve[12] . Susan O'Donnell (2016) Digital Economy Research for the EU mostly affirms the value of digital economic development, arguing that digital technologies enhance the ability of EU businesses and economies to profit from digital opportunities[13] . Mike Friedrichsen and Yahya Kamalipour (2017), among others, argue that digital transformation has opened up numerous opportunities for Europe, offering significant growth potential for business and society. However, new issues and challenges have also arisen, such as differences in the degree of digitisation across EU member states in terms of policy development, and the fact that digital transformation depends on the differences between development and innovation in different economies[14] Research by Milica Jovanović (2018) and others suggests that in the context of the increasing impact of digitalisation on the EU economy and society, the digital skills of the population become a key determinant of its success in the labor market. Some scholars have further investigated how the EU Digital Economy and Society Index (DESI) affects the level of sustainable development in economic, social and environmental terms[14] .

By analysing and summarizing the existing literature, this paper concludes that the development value of the digital economy has been affirmed both domestically and abroad, and that all countries have entered the stage of digital transformation, and that the digital economy provides great growth potential for business and social development, and will usher in unlimited development opportunities. With regard to the study of the current situation of foreign investment at home and abroad, this paper finds that many countries have an open attitude towards foreign investment, and most developed and developing countries have a positive attitude towards attracting foreign direct investment (FDI), in which the more developed the country, the stronger the ability to attract foreign investment and foreign capital. An efficient financial system, orderly government regulation, the level of financial development and institutional factors are all positively correlated with OFDI. Nowadays, the digital economy is gradually maturing and can be combined with outward investment to help national development in the future. Thus, OFDI and the development of the digital economy are both important contributors to the economic and social development of countries. As China's important co-development partners, the level of digital economy development and OFDI of the "Belt and Road" countries are of great significance to China's investment and development.

3. Theoretical Analysis and Research Hypotheses

This chapter will combine the "Belt and Road" along the countries of the digital economy of the digital economy development level of China's outward investment in the theoretical factors for elaboration, and from the level of scientific and technological innovation, trade openness, natural resource endowment and other aspects of the depth of discussion.

3.1 The digital economy of the coastal countries affects China's outward FDI by increasing ICT exports

A more comprehensive infrastructure development can help the output of national innovation performance, but also can provide a good guarantee for national science and technology innovation, the level of science and technology innovation is an important factor in attracting foreign investment, ICT (Information and Communications Technology) exports as a measure of a country's infrastructure development standard indicators, can be used as a representative factor of the level of science and technology innovation, therefore, can be regarded as an important factor in the

development of national innovation level. ICT (Information and Communications Technology) exports, as a standard indicator of a country's infrastructure development, can be used as a representative factor of the level of science, technology and innovation, and therefore infrastructure development can be regarded as an important factor in the development of the country's innovation level.

Most of the classical economic theoretical models of investment and STI point to a close relationship between the two. The Investment and Technological Progress Model suggests that investment is one of the key drivers of technological progress. Investment can provide financial and resource support to provide the necessary conditions for R&D and innovation. On the other hand, technological progress can improve the productivity and competitiveness of enterprises and promote economic growth. Therefore, the relationship between investment and technological progress is mutually reinforcing. The Innovation Diffusion Model (IDM) argues that the speed and breadth of diffusion of innovation is affected by the market and competitiveness. Investment can help firms improve their competitiveness, leading to faster diffusion and adoption of new technologies. At the same time, investment can also provide more funds and resources for innovation and facilitate the development and diffusion of new technologies[16] .

In summary, the relationship between investment and innovation is interdependent and mutually reinforcing. Investment can provide the necessary financial and resource support to facilitate the development of innovation, while innovation can increase the competitiveness and market share of firms and bring higher rates of return on investment.

In addition to classical economic theories, many empirical studies have found that the level of information and communication technology (ICT) can be a representative factor of the level of science, technology and innovation, and a number of scholars who have studied the "Belt and Road" and the digital economy (Xiao-Zhong Li and FangTing Mao (2023)(2021), Chao Liu and Ning-Yu Zheng (2021)[17-19]) cite ICT as an indicator of the relationship between the digital economy and the host country. economy and the host country, all cite ICT as a measurement indicator. Studies targeting the digital economy need to quantitatively measure the total size of the digital economy as well as its components. Scholars such as Liu Hang and Fu Lin (2019), Huang Yuanzhe and Zhong Changbiao (2019) theoretically determine the scope of the digital economy by combining the permeability, substitutability, and synergistic characteristics of information and communication technology (ICT)[20] , and theoretically conclude that the level of scientific and technological innovation can be used to measure the level of development of the digital economy[21] . By analysing the theories of various scholars, this paper can conclude that the breadth of outward investment has a positive promotion effect on innovation performance. The improvement of innovation performance is inseparable from the level of science and technology innovation, and there is a positive correlation between the breadth of outward investment and innovation performance. And ICT, as a representative factor to measure the level of science and technology innovation, can effectively promote the output of innovation performance. It is inferred that there is a positive relationship between the level of science and technology innovation and outward foreign direct investment in the countries along the route.

Based on the above analyses, this paper proposes hypothesis 1: The improvement of ICT exports of countries along the Belt and Road will help the output of their own innovation performance, enhance the development of the digital economy, and then attract China's outward foreign direct investment.

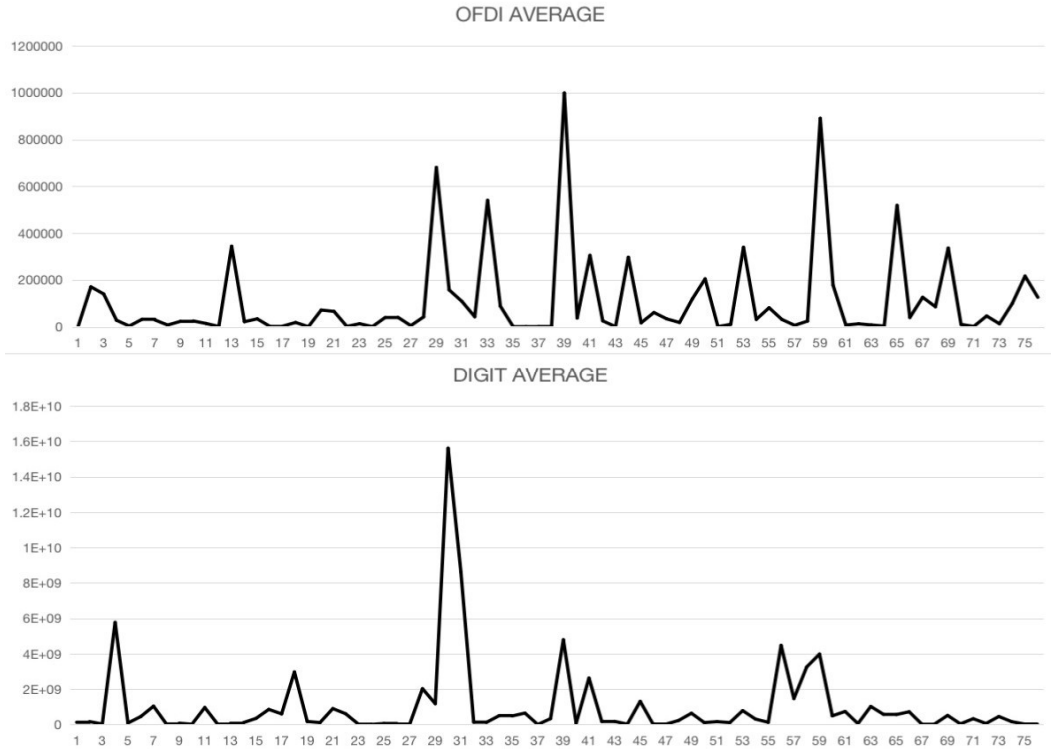

Figure 2-1 Average OFDI and Digital Economy Development Levels of 76 Countries along the Belt and Road Route

3.2 The development of the digital economy in countries along the route affects China's outward FDI by influencing the degree of trade openness

China's "Belt and Road" initiative aims to strengthen economic and trade cooperation with countries along the route and promote the liberalisation and facilitation of trade and investment. By comparing the differential impact of OFDI on trade complementarity before and after the Belt and Road Initiative, Mao, Hai-Ou and Liu, Hai-Yun (2019) found that the trade complementarity promotion effect of OFDI was greatly improved after the initiative was proposed[22] . (Cao, Shuwei, and Qiu, Jianyu (2023), Mao, Xinya, and Fang, Zhong (2022)[23-24]) also conclude that the degree of trade openness inhibits the development of China's OFDI through modelling analysis. By analysing the empirical part of several papers, this paper finds that there is a non-linear relationship between trade openness and economic growth in countries along the Belt and Road. Countries should conduct foreign trade prudently and improve the quality of trade openness, but if they blindly pursue a high level of trade openness and rely solely on labor-intensive and capital-intensive exports, the losses may outweigh the gains. None of the countries along the Belt and Road has reached the critical level of trade openness, so it has a dampening effect on economic growth. (Scholars believe that, for countries with lower levels of development and some developing countries, a higher level of trade openness will attract more foreign direct investment, which will correspondingly increase the pressure of competition in the market, thus affecting the integrity of the market structure and generating an uneven distribution of market size, which will be taken into account by Chinese enterprises when they make direct investment in the local market.

Based on the above analysis, this paper puts forward the hypothesis 2: the development level of the countries along the "Belt and Road" has not reached the critical value of promoting economic growth, and the blind pursuit of a high level of trade openness may increase the pressure of market competition, inhibit the development of the digital economy, and then inhibit China's outward investment.

3.3 The digital economy of the countries along the route affects China's outward FDI by increasing the size of the digital labor force

With the development and popularization of digital information technologies such as the Internet, big data and artificial intelligence, China's digital economy is developing at an exceptionally rapid pace, and the breadth and depth of its integration with all areas of the socio-economic sphere continues to expand. From the perspective of production methods, changes in digital technology inevitably affect the labor process. The digital mode of production and lifestyle that accompanies the digital economy makes people use digital technology in large numbers to engage in information dissemination, communication, learning and work. Liu Lu (2020) argues that the digital labor process compared with the traditional labor process, the place of labor, the way of combining labor and the means of production, labor relations digital labor process of the workers and the means of production changed, in the digital labor process, data information, digital infrastructure and so on, as a kind of social overall means of production shows a huge role, and has become a key means of production[25] . Chen Shili (2020) based on the analysis of host country's labor force level, China's outward FDI tends to flow into countries or regions with higher quality and scale of labor force. Host countries with high quality and scale labor force can provide more opportunities for Chinese enterprises to obtain advanced technology and management experience on the one hand, and on the other hand, a labor force with higher health level can ensure higher production efficiency, which can reduce the hiring cost and business risk of enterprises[26] . Promoting the digital transformation of the host country's labor force and increasing the size of its digital labor force can provide Chinese enterprises with more opportunities to acquire advanced technology and experience, and thus attract Chinese outward FDI.

Based on the above analysis, this paper puts forward hypothesis 3: Countries along the Belt and Road to promote their own digital transformation as the basis for increasing the size of their own labor force, so as to enhance the level of development of their own digital economy, which in turn attracts China's outward foreign direct investment.

4. Empirical Tests on the Impact of Digital Economy Development Level on China's OFDI in Countries Along the Belt and Road Route

4.1 Model construction and variable selection

4.1.1 Modelling

The gravity model, also known as the gravitational model, is known for its relationship to Newton's law of gravity similar to Newton's law of gravity. Based on the basic gravity model, this paper introduces the core explanatory variables of digital economy and other control variables to construct an extended investment gravity model. On the basis of reference studies, the variables are logarithmic to prevent the problem of heteroskedasticity. The extended investment gravity model is shown below:

$$lnOFDI = \alpha_0 + \alpha_1 lnDigit + \alpha_2 lnIdusi + \alpha_3 lnOpen$$

$$+\alpha_4 lnReso + \alpha_5 lnLabo + \alpha_6 lnDistcap + \mu \quad (5.1)$$

where i denotes the country along the route and t denotes the year (t=2009, 2010, …, 2019).$OFDI$,denotes the stock of China's outward FDI in country i in year t.$Digit$,denotes the level of digital economy development in country i in year t.Idusii,t denotes the level of industrialization in country i in year t.$Open$,denotes the level of trade openness in country i in year t.$Reso$,denotes the natural resource endowment of country i in year t.$Labo$,denotes the size of the labor force in country i in year t.$Distcap$, denotes the distance of Beijing, China, from the capital of country i. $\alpha 0$ is the constant term, and μ is the random error term.

4.1.2 Selection of variables

The variables used in this paper are described below:

Explained variable (OFDI): In this paper, the stock data of China's outward direct investment in countries along the Belt and Road is selected to measure the level of China's direct investment in the countries along the Belt and Road. Since the stock data of China's direct investment in countries along the Belt and Road is more comprehensive than the flow data, and the stock data is positive, which makes it easier to take logarithms, it is more reasonable to choose the stock data to reflect the level of China's direct investment in countries along the Belt and Road.

Core Explanatory Variables (Digit): This paper selects ICT service export data to measure the level of development of the digital economy of the countries along the line. ICT (Information, Communications and Technology) is the necessary PCBA (Printed Circuit Board Assembly) of modern electronic enterprises, which can effectively reflect the level of development of a country's digital economy.), which can effectively reflect a country's digital economy development level.

Control variables:

(1) The level of industrialization (Idusi): this paper selects the data of industrial added value as a percentage of GDP to measure the level of industrialization development in the countries along the route. Based on the majority of developing countries along the route, the level of industrialization is an important factor in promoting the level of local economic development, reflecting a country's level of development, the high level of industrialization indirectly reflects the market size of the countries along the route, and the larger the market size, the more attractive to China OFDI.

(2) Degree of trade openness (Open): this paper refers to Fang Hui and Zhao Sweet (2017)[27] The proportion of the import and export volume of the countries along the route to the GDP is selected to measure the degree of trade openness of the countries along the route. The higher the degree of trade openness of the countries along the route, the more beneficial for foreign direct investment to understand the local political environment, which in turn reduces the obstacles to direct investment in the countries along the route, and is conducive to foreign direct investment.

(3) Natural resource endowment (Reso): In this paper, we choose the data of total natural resource rent as a percentage of GDP to reflect the natural resource endowment of the countries along the route. Using the panel data of China's investment in 31 countries from 1991-2005, Cheung, Qian and Yao et al. (2010) discuss the impact of resources on China's outward FDI.[27] (2010) discuss the strong driving effect of resources on China's OFDI. The richer the natural resources of the countries along the routes, the more favourable it is to attract Chinese OFDI to the countries along the routes.

(4) Labor force size (Labo): In this paper, the labor force participation rate of the working population as a percentage of the total population over 15 years of age is chosen to indicate the labor force size of the countries along the route. Based on the theory of equilibrium between supply and demand in the labor market, it is concluded that the larger the size of the labor force, the greater the supply of labor in a country, the lower the price of labor, and the increase in attracting foreign direct investment.

(5) Geographic distance (Distcap): In this paper, the distance between China and the capitals of the countries along the Belt and Road is chosen to represent the geographic distance. International economics theory predicts that OFDI is more inclined to enter geographic neighbourhoods (Buckley and Casson, 1981).[27] The geographic proximity of the countries along the route to China The geographical distance between a country along the Belt and Road directly affects the cost of China's local OFDI, and the closer the geographical distance, the lower the investment cost and the more favourable the attraction of China's OFDI, all other influencing factors being equal.

Descriptive statistics for the above variables are shown in Table 3-1:

Table 3-1 Descriptive Statistics of Variables

variable name	average value	median	(statistics) standard deviation	minimum value	maxim um values	sample size
lnOFDI	9.655	9.941	2.469	0	14.286	836
lnDigit	19.096	19.163	2.044	11.341	24.019	836
lnIdusi	3.21	3.229	0.361	1.516	4.222	836
lnOpen	4.307	4.333	0.577	0.198	5.94	836
lnReso	0.835	4.333	0.577	-6.852	3.951	836
lnLabo	4.117	4.103	0.163	3.619	4.464	836
lnDistcap	9.012	9.02	0.481	7.067	9.861	836

Data source: Compiled from STATA 17.0 calculations.

4.2 Sample selection and data sources

4.2.1 Sample selection

This paper conducts empirical regression based on the panel data of 76 countries along the Belt and Road from 2009 to 2019, and adopts the extended investment gravity model and the double fixed effect model to study and analyse the impact of the level of development of the digital economy of countries along the Belt and Road on China's outward foreign direct investment (OFDI). The impact on China's outward FDI is analysed using the extended investment gravity model and double fixed effect model.

The specific countries are shown in Table 3-2.

Table 3-2 Names of the 76 sample countries along the Belt and Road

	Country		Country		Country		Country
1	Angola	20	Czech Republic	39	Luxembourg	58	Portugal
2	Albania	21	Fiji	40	Latvia	59	Romania
3	Austria	22	Georgia	41	Morocco	60	Russia
4	Azerbaijan	23	Guinea	42	Moldova	61	Saudi Arabia
5	Bangladesh	24	Gambia	43	Madagascar	62	Sudan
6	Bulgaria	25	Guinea-Bissau	44	North Macedonia	63	Sierra Leone
7	Belarus	26	Croatia	45	Mali	64	Serbia
8	Bolivia	27	Hungary	46	Mongolia	65	Slovakia
9	Botswana	28	Indonesia	47	Mozambique	66	Slovenia
10	Chile	29	Israel	46	Malaysia	67	Togo
11	Cameroon	30	Italy	49	Namibia	68	Thailand
12	Cape Verde	31	Jamaica	50	Nigeria	69	Tunisia
13	Costa Rica	32	Kazakhstan	51	Nepal	70	Tanzania
14	Benin	33	Kenya	52	New Zealand	71	Uganda
15	Dominica	34	Cambodia	53	Oman	72	Uruguay
16	Algeria	35	Lebanon	54	Pakistan	73	Uzbekistan
17	Ecuador	36	Sri Lanka	55	Panama	74	South Africa
18	Egypt	37	Lesotho	56	Peru	75	Zambia
19	Estonia	38	Lithuania	57	Poland	76	Zimbabwe

Data source: China Belt and Road Network http://www.yidaiyilu.gov.cn

4.2.2 Data sources

The data for each of the explanatory variables selected in this paper come from the following sources: the Statistical Bulletin of China's Outward Foreign Direct Investment in all years, the World Bank database and the CEPII database. The meanings, expected effects and data sources of all explanatory variables are shown in Table 3-3.

Table 3-3 Meanings, Expected Effects, and Data Sources for All Explanatory Variables

Variable type	variable name	Variable Meaning	Expected effects	Source of data
explanatory variable	$OFDI$	China's outward FDI to country i in year t Investment stock		Statistical Bulletin on China's Outward Foreign Direct Investment by Years
Core explanation variant	$Digit$	Level of digital economy development in country i in year t	+	World Bank comprehensive database
control variable	$Idusi$	Level of industrialization in country i in year t	+ -	World Bank comprehensive database
	$Open$	Trade openness of country i in year t	+	World Bank comprehensive database
	$Reso$	Natural resource endowment of country i in year t		World Bank comprehensive database
	$Labo$	Size of labor force in country i in year t	+	World Bank comprehensive database
	$Distcap$	Distance from Beijing, China to the capital of country i	-	CEPII database

Source of data: collated from the selection of variables in this paper.

4.3 Analysis of full sample regression results

4.3.1 Multicollinearity test

Multicollinearity refers to the high degree of correlation between explanatory variables in a regression model, i.e., there is a linear relationship between the independent variables, leading to model estimation distortion. Multicollinearity refers to multiple explanatory variables to construct linear regression model to predict the dependent variable, in this paper, namely by each explanatory variable to construct a regression model to predict the explanatory variable OFDI. this paper adopts the Variance Inflation Factor (Variance Inflation Factor) to determine whether there is a problem of multiple covariance between the variables, if the variables pass the test of multiple covariance, then the data for the empirical analysis of the results of this paper will be used. data for empirical analysis results have more credibility. Specific test results are shown in Table 3-4:

Table 3-4 Multicollinearity test results

variable name	VIF	1/VIF
lnDigit	1.56	0.642843
lnIdusi	1.35	0.743102
lnOpen	1.14	0.875181
lnReso	1.82	0.550620
lnDistcap	1.10	0.911350
Mean VIF	1.36	

Data source: Compiled from STATA 17.0 calculations.

As can be seen from Tables 3-4, the results of each explanatory variable in the model are between0 < VIF < 5 between and much less than 5, indicating that there is no multicollinearity problem for each explanatory variable.

4.3.2 Benchmark regression results

In this paper, we first test the individual effects , and the empirical results indicate that the fixed effects are better than the mixed Ols model, and the fixed effects are better. Next, time effects are tested and the results of random effects are also better than the mixed Ols model. Finally, using Hausman test, the results show that the fixed effect model is better than the random effect model. This paper finally chooses the fixed effect estimation method for empirical analysis.The results of Hausman test are shown in Table 3-5:

Table 3-5 Hausman test results

Test of H0: Difference in coefficients not systematic
chi2(3) = 108.61 Prob > chi2 =
0.0000

Data source: Compiled from STATA 17.0 calculations.

The model for benchmark regression analysis in this paper is Eq. 5-2. Firstly, the geographic distance between Beijing, China and the capitals of the countries along the route is used as an explanatory variable to regress the basic investment gravity model, and then the digital economy development level, industrialization level, trade openness, natural resource endowment and labor force size of the countries along the route are added to the model in order to gradually construct an extended investment gravity model. The details are as follows:

$$lnOFDI = \alpha_0 + \alpha_1 lnDistcap + \mu \quad (5\text{-}2)$$

$$lnOFDI = \alpha_0 + \alpha_1 lnDistcap + \alpha_2 lnDigit + \mu \quad (5\text{-}3)$$

$$lnOFDI = \alpha_0 + \alpha_1 lnDistcap + \alpha_2 lnDigit + \alpha_3 lnIdusi + \mu \quad (5\text{-}4)$$

$$lnOFDI = \alpha_0 + \alpha_1 lnDistcap + \alpha_2 lnDigit + \alpha_3 lnIdusi + \alpha_4 lnOpen + \mu \quad (5\text{-}5)$$

$$lnOFDI = \alpha_0 + \alpha_1 lnDistcap + \alpha_2 lnDigit + \alpha_3 lnIdusi + \alpha_4 lnOpen + \alpha_4 lnReso + \mu \quad (5\text{-}6)$$

$$lnOFDI = \alpha_0 + \alpha_1 lnDistcap + \alpha_2 lnDigit + \alpha_3 lnIdusi + \alpha_4 lnOpen + \alpha_4 lnReso + \alpha_6 lnLabo + \mu \quad (5\text{-}7)$$

Table 3-6 Regression results of the gravity model

variable name	basic model	Extended model					
		(1)	(2)	(3)	(4)	(5)	
lnDistcap	1.054***	-0.969***	-0.823***	-0.873***	-0.909***	-	0.936***
	(0.174)	(0.179)	(0.179)	(0.174)	(0.167)	(0.161)	
lnDigit		0.085**	0.071*	0.134***	0.335***	0.397***	
		(0.042)	(0.042)	(0.041)	(0.046)	(0.045)	
lnIdusi			1.059***	1.170***	0.195	0.277	
			(0.234)	(0.227)	(0.247)	(0.238)	
lnOpen				-1.056***	-0.759***	-0.867***	
				(0.143)	(0.142)	(0.137)	
lnReso					0.475***	0.380***	
					(0.056)	(0.055)	
lnLabo						3.895***	
						(0.493)	
_cons	19.151***	16.767***	12.320***	15.755***	13.694***	-2.991	
	(1.568)	(1.963)	(2.175)	(2.159)	(2.086)	(2.919)	
Obs.	836	836	836	836	836	836	
R-squared	0.042	0.047	0.070	0.127	0.197	0.253	

Note: Values in parentheses are robust standard errors. ***, **, * indicate significant at the 1 per cent, 5 per cent and 10 per cent confidence levels, respectively.

According to Table 3-6, as far as the regression results as a whole are concerned, from the base model to the extended investment gravity model (6), the model fit goodness of fit increases from 0.042 to 0.253 with the increase of control variables, and the fit becomes better. The regression coefficient of the level of digital economic development also increases with the introduction of other control variables, and the strength of the impact on China's OFDI increases through the 1% significance level test. Model (6) contains all the explanatory variables, except for the level of industrialisation, which passes the 1% significance level test.

The regression results for each variable are specifically analyzed below:

(1) Geographic distance between China's Beijing and the capitals of the countries along the route ($Distcap$): There is a significant negative correlation between the geographical distance between Beijing and the capitals of the countries along the route and China's OFDI, indicating that this explanatory variable has a hindering effect on China's OFDI, the further the geographical distance is,

the less attractive the countries along the route are to China's OFDI. However, with the gradual introduction of other explanatory variables into the model, the regression coefficient of geographical distance decreases from 1.054 to 0.936, indicating that other explanatory variables can reduce the hindering effect of geographical distance.

(2) Digital economy development level ($Digit$): The regression results show that the regression coefficient of the level of digital economic development is significantly positive, and it passes the 1% significance test. From the regression results, it can be seen that a 1% increase in the level of digital economic development of the countries along the route will at least prompt an increase in China's OFDI by 0.085%. The increase in the level of digital economy development in the countries along the route, on the one hand, prompts the improvement of the local digital infrastructure, and on the other hand, it also indicates that the government has formulated relevant policies to support the development of the digital economy, reflecting the good local political environment, which attracts the increase of China's OFDI.

(3) Industrialization level ($Idusi$): there is a significant positive correlation between the level of industrialization and OFDI, which means that an increase in the level of industrialization in the countries along the route can effectively attract China's OFDI in the countries along the Belt and Road. most of the countries along the route are developing countries, and industrialization is an important factor affecting the GDP, which can indirectly reflect the level of development and market size of the local economy. The higher the industrialization level, the larger the market size, which can attract the increase of China's local OFDI activities. In the extended model (1) to (3), the industrialization level is significantly positive, and in the extended model (4) to (5), although the variables do not pass the significance level test, they still have a positive impact on China's OFDI.

(4) The degree of trade openness ($Open$): There is a negative correlation between the degree of trade openness and China's OFDI, and it passes the significance test at the 1% level. The higher the degree of trade openness will attract more foreign direct investment, which will also increase the pressure of market competition, and Chinese enterprises will make comprehensive considerations when making direct investment in the local area.

(5) Natural resource endowment ($Reso$): the positive correlation of natural resource endowment on China's OFDI is tested at the 1% significance level, indicating that the richer the natural resources of the countries along the route, the more attractive China's increase in local OFDI, and for every 1% increase in natural resources, China's OFDI increases by 0.475%, and with the introduction of the explanatory variable of the size of the labor force, natural resource endowment is still significantly positive.

(6) Labor force size ($Labo$): The estimated coefficient of labor force size is significantly positive at the 1% level, and every 1% increase in China's OFDI will increase by 3.895%, indicating that the larger the labor force size of the countries along the Belt and Road, the more attracted to the increase of China's OFDI activities. The regression results also show that labor force size has the largest regression coefficient among all the explanatory variables, which means that Chinese enterprises prefer high efficiency labor force level when making OFDI in countries along the Belt and Road.

4.3.3 Robustness test

In order to further test the robustness of the empirical results, this paper conducts a panel regression by replacing the current explanatory variables with the lagged terms of China's OFDI to the countries along the Belt and Road, and then conducts a panel regression on the current explanatory variables of China's OFDI, thus obtaining two models. The treatment of model 1 can also reduce the estimation error caused by the endogeneity problem. The results show that the coefficients of the level of digital economic development are all significantly positive. Each test model is set as follows:

$$lnOFDI = \alpha_0 + \alpha_1 L.\ lnDigit + \alpha_2 lnIdusi + \alpha_3 lnOpen + \alpha_4 lnReso + \alpha_5 lnLabo + \alpha_6 lnDistcap + \mu \quad (5.8)$$

$$lnOFDI = \alpha_0 + \alpha_1 lnDigit + \alpha_2 lnIdusi + \alpha_3 lnOpen + \alpha_4 lnReso + \alpha_5 lnLabo + \alpha_6 lnDistcap + \mu \quad (5.9)$$

Firstly, the diagnosis of multicollinearity was carried out for each model, and the results showed that there was no serious multicollinearity problem in each model. Then the regression models were selected and the results of Hausman test informed that the models were analyzed using the fixed effect model.

Table 3-7 Robustness Type Tests

explanatory variable	Model 1 lnOFDI	Model II lnOFDI
L.lnDigit		0.404***
		(0.047)
lnDigit	0.397***	
	(0.045)	
lnIdusi	0.277	0.357
	(0.238)	(0.246)
lnOpen	-0.867***	-0.892***
	(0.137)	(0.139)
lnReso	0.380***	0.345***
	(0.055)	(0.057)
lnLabo	3.895***	4.115***
	(0.493)	(0.511)
lnDistcap	-0.936***	-0.939***
	(0.161)	(0.166)
_cons	-2.991	-3.988
	(2.919)	(3.031)
Obs.	836	760
R-squared	0.253	0.260

Note: Values in parentheses are robust standard errors. ***, **, * indicate significant at the 1 per cent, 5 per cent and 10 per cent confidence levels, respectively.

Data source: Compiled from STATA 17.0 calculations.

As can be seen from Table 3-7, the sign and significance level of each explanatory variable of the two models did not change after adding the lagged term and the current period data to the models respectively, thus it can be seen that the models passed the robust type test.

5. Conclusions and recommendations

5.1 Main findings

This paper firstly analyses the main concepts of digital economy and the development of OFDI by reading the literature, and finds that domestic and foreign scholars have already made more in-depth research on the influencing factors of China's OFDI, and the research on the related fields of digital economy has also been involved, but there are fewer relevant literatures to study China's outward investment from the starting point of the level of development of digital economy of the countries along the "Belt and Road". However, there is less literature on China's OFDI from the perspective of the development level of digital economy in the countries along the "Belt and Road", and the depth of research is insufficient. Then, by combing the domestic and international literature on digital

economy and OFDI and the relationship between the two, we construct the theoretical analysis and mechanism of the impact of digital economy on OFDI in the countries along the Belt and Road, and determine the indicators to measure the level of development of digital economy in the countries along the Belt and Road. Then, according to the availability of data, this paper selects 76 countries along the "Belt and Road" from 2009 to 2019 as the research object, and empirically analyses the relationship between the level of development of the digital economy of the countries along the route and China's OFDI by using the extended investment gravity model. Then, the lagged terms of the core explanatory variables and the current level of digital economy development are used to replace the explanatory variables in the regression, which on the one hand can weaken the problem of endogeneity, and on the other hand, according to the regression results, the model passes the robustness test. The specific findings of this paper are as follows:

(1) Every 1 per cent increase in the level of digital economy development in the countries along the route will lead to at least 0.085 per cent increase in China's OFDI. On the basis of the gravity model, it shows that the development of digital economy can reduce the hindering effect of geographical distance, which is conducive to increasing China's OFDI. At the same time, digital economy gradually becomes a new location factor affecting China's OFDI, and China's OFDI tends to invest in countries with a higher level of digital economy development.

(2) According to the extended model (2)(3), it can be seen that there is a significant positive correlation between the level of industrialization and China's OFDI, which is not significant in the extended gravity model (5), but still has a positive impact on China's OFDI activities, indicating that after the introduction of the degree of openness to trade, the natural resource endowment, and the size of the labor force, the influence of the level of industrialization on China's OFDI decreases, and the influence of natural resources as well as labor force size increase the influence of China's OFDI.

(3) The natural resources and labor force size of the countries along the route are significantly positively correlated with China's OFDI activities, of which the labor force size has the greatest influence on China's OFDI activities in the overall extended gravity model, indicating that Chinese enterprises are more inclined to make OFDI in countries with high labor efficiency or low labor costs. Trade openness, on the other hand, is negatively related to Chinese OFDI activity.

(4) Finally, the model is tested for robustness, and the test results show that the sign and significance level of each explanatory variable in the two models are consistent, indicating that the model of this paper and the positive impact of the digital economy of the countries along the Belt and Road on China's outward foreign direct investment activities are robust.

5.2 Policy recommendations

According to the empirical results of this paper, the level of development of digital economy in the countries along the "Belt and Road" has become one of the important factors affecting the choice of China's outward FDI activities, and the following suggestions are put forward for the purpose of realizing the common development and sharing between China and the countries along the route:

(1) Countries along the route should accelerate the construction of digital economy infrastructure and create a favourable development environment. The digital economy has gradually become one of the important location factors affecting OFDI, and this paper finds that the level of development of the digital economy in countries along the "Belt and Road" has played a significant role in promoting China's OFDI, and it is important to create a good environment for digital economy development and business operation by perfecting the construction of the local digital infrastructure, building rules of digital economy suitable for the "Belt and Road", and formulating relevant policies. One Road" digital economy rules, formulate relevant policies, and then create a good digital economy development and business environment, effectively promote China's economic and trade cooperation with countries along the "Belt and Road", and jointly promote the construction of the "Digital Silk Road". The construction of the "Digital Silk Road".

(2) Countries along the border should improve local labor efficiency by promoting the construction of digital economy infrastructure. Duggal et al. (2006) and Liu Shenglong and Hu Angang (2010)

found that the construction of information infrastructure can promote the dissemination of information and knowledge to improve the level of local economic development[30-31][31] . At the same time, according to the empirical analysis results of this paper, the countries along the route can improve the local labor efficiency by perfecting the digital economy infrastructure, and then attract China's outward foreign direct investment, effectively promote the trade interoperability between China and the countries along the route, and achieve the efficient development of the digital economy.
(3) Countries with a high level of digital economy development should be China's first choice for "Belt and Road" OFDI. The empirical analysis of this paper shows that the digital economy significantly promotes the increase of China's OFDI activities, and the higher the level of development of a country's digital economy, the more perfect the local digital construction, environment, system and policies, the more conducive to the development of the digital economy jointly achieved by both sides. In the context of digital economy, China's outward FDI to countries with higher level of digital economy development is conducive to improving the resilience of China's sustainable economic development on the one hand, and on the other hand, it is able to strengthen economic and trade cooperation with countries with higher level of digital economy development and learn from their experiences, so as to grasp the first opportunity for China's development in the wave of digital economy globalization.
(4) China should actively share its experience and promote the construction of the Digital Silk Road. In the context of the "double cycle" and the development of the digital economy, Chinese enterprises should take the digital economy as an important aspect of international cooperation, and take into account the development of the digital economy and infrastructure construction of the countries along the route while improving the level of development of their own digital economy, so as to make the concept of building a "community of human destiny" and a "Digital Silk Road" take root in people's hearts. The concept of building a "community of human destiny" and a "digital silk road" has been deeply rooted in people's hearts. In addition, by sharing the construction of digital economy infrastructure, China has reduced the trade costs of both sides, facilitated the formation of long-term stable and sustainable trade partnerships, and promoted the increase of China's outward foreign direct investment activities and the enhancement of trade efficiency.
(5) China should strengthen the general layout of digital economy construction and attach importance to cultivating digital talents. The digital economy has gradually become an important factor in the competition among countries, at this stage, although China has built 5G base stations, leading the world, but the development of the digital economy as a whole is not balanced, by attaching importance to the cultivation of digital talents, the formation of a group of digital talents, for the balanced development of China's digital technology to provide strong support, and to promote the completion of China's digital economy as a strong country.

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