Research on the Efficiency and Influencing Factors of Korea's Foreign Direct Investment in RCEP Partners[*]

Xin-Yue Wang

School of Economy, Shandong Women's University, China

Xi Chen[†]

Business School, Shandong Jianzhu University, China

Li Chen

School of Economy, Shandong Women's University, China

Qing Wang

School of of Statistic, Shandong University of Finance and Economics, China

Abstract

Purpose – In this paper, we, taking South Korea's foreign direct investment in RCEP partners as an example, will examine its investment efficiency in these countries and analyze the main influencing factors, making suggestions for further liberalizing and facilitating its investment in and even for promoting its trade and economic cooperation with them.

Design/methodology – In this study, we look at the panel data of South Korea and the other 13 RCEP countries (Brunei excluded) from 2000 to 2019 and apply the stochastic frontier analysis to measure its foreign direct investment efficiency and explore the influencing factors in RCEP countries. We examine the investment potential of South Korea in these places.

Findings – We find that South Korea's average investment efficiency in RCEP countries reached 0.62, indicating large investment potential. We also find that its investment efficiency in RCEP partners was heterogeneous. Our study reveals that South Korea's foreign direct investment is significantly positively correlated with the market size and population of the two countries, as well as with whether the host country has a coastline and rich natural resources, while negatively with geographic distance. It shows that free trade agreements, economic freedom, and regulatory quality play significant roles in improving investment efficiency.

Originality/value – Through theoretical and empirical analysis, we deal with the efficiency and influencing factors of South Korea's direct investment in RCEP partners, proposing new drivers for facilitating its trade and investment in these countries and comprehensively evaluating the efficiency and revealing the trend of its FDI in these countries. In this paper, we put forward a solid theoretical basis for empirical analysis of the future economic and trade development between South Korea and its RCEP partners and give objective insights for further improving its foreign direct investment efficiency and tapping its investment potential.

1. Introduction

Against the backdrop of the slowdown or even stagnation of multilateral free trade negotiations under the framework of the World Trade Organization (WTO), more and more

[†] **Corresponding author:** 409555097@qq.com

countries have sought to achieve economic development goals through regional trade liberalization agreements over the past two decades. The Regional Comprehensive Economic Partnership (RCEP) was officially signed by the Economic and Trade Ministers of its 15 member states on November 15, 2020. The signing of the agreement marks the free trade agreement with the largest population and the most diverse members in the world kicks off, playing an important role in promoting the development of the East Asian Free Trade Area. At present, RCEP countries are composed of 10 ASEAN countries, China, South Korea, Japan, Australia, and New Zealand. The establishment of RCEP will greatly increase the stability of regional economic and trade policies in Asia, eliminate tariff and non-tariff trade barriers, improve trade and investment facilitation and liberalization, and have a great potential for cooperation. The signing of RCEP will play the role of an "integrator" of economic and trade rules in the region and is a comprehensive improvement of several "10+1" investment agreements. It will create a more open, transparent, and convenient investment environment for investors inside and outside the region and will also help stimulate investment growth potential. The whole region of the 15 member countries of RCEP has attracted about a quarter of the world's foreign direct investment, but only 30% came from within the region. In the 1990s, the Korean government adopted a policy of liberalizing overseas investment as its overseas investment was also increasing. As shown in Fig. 1, South Korea's foreign direct investment in RCEP countries rose from US$1.5 billion in 2000 to over US$10 billion in 2011, and increased to US$ 17.9 billion in 2019, showing an overall upward trend. Thus, there is a broad space for growth in the upcoming days.

Fig. 1. Korea's Foreign Direct Investment in RCEP countries

(Unit: million dollar)
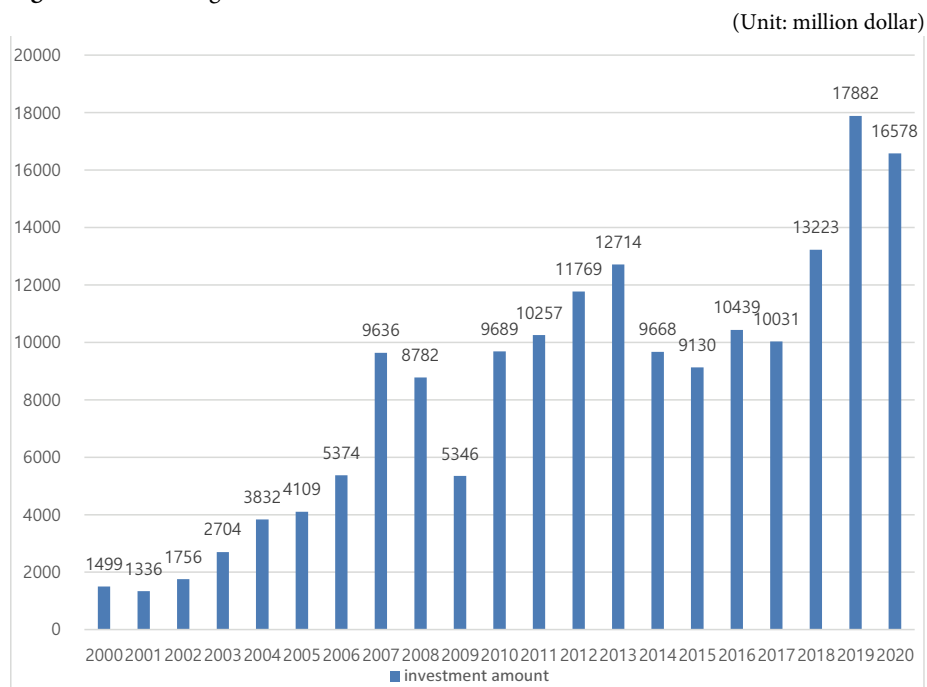
Source: Authors' calculation using Export- Import Bank of Korea data.

At present, most scholars' research on South Korea's foreign direct investment mainly focused on the motivation of investment in related countries, the factors affecting investment, investment strategy and economic effects, etc., while there are few studies on FDI in RCEP countries. The impact of the RCEP agreement on South Korea's foreign direct investment largely depends on South Korea's current foreign direct investment potential, efficiency, and influencing factors.

In this paper, we, taking South Korea's foreign direct investment in RCEP partners as an example, apply the stochastic frontier analysis to measure its foreign direct investment efficiency and explore the influencing factors, which is conducive to promoting South Korea's investment liberalization and facilitation in RCEP countries and strengthening investment cooperation between South Korea and RCEP countries. At the same time, it provides a solid theoretical basis for the future economic and trade development between South Korea and its RCEP partners and is conducive to further tapping the investment potential of South Korea in RCEP countries.

2. Literature Review

2.1. Research on Foreign Direct Investment

Many scholars have studied investment motivation, influencing factors, efficiency, and potential of investment. Regarding the motives of foreign direct investment, Hymer (1976) proposed the Monopolistic Advantage Theory, also known as the theory of market imperfections. He believed that enterprises in the home country have a favorable monopoly advantage over their likes in the host country, which leads to motives for enterprises to directly invest overseas. Dunning (1975) propounded the theory of the eclectic theory of international production. He believed that enterprises could make a foreign direct investment if they have ownership and advantages in internalization and location. Buckley and Casson (1981) theoretically discussed the relationship between FDI and the size of foreign markets, arguing that when the size of the foreign market is large enough, companies often choose to increase FDI. Park Young-Ryeol and Yang Young-Soo (2011) focused on the types and determinants of FDI that affect South Korea's FDI decision-making. They found that this country's FDI was closely related to institutional distance, such as market seeking, efficiency-seeking, strategic asset seeking, investment, and economic distance. Zhou Ying (2017) believed that the motivation of South Korea's foreign direct investment could be categorized as export-oriented, technology-intensive, resource acquired, and labor-management relations transferred. There are also many pieces of research on the influencing factors of FDI. Sun Jun (2002) thought that a region's industrial structure, trade openness, and marketization also have a significant impact on the investment environment. Kim Natalya and Yun Won-Cheol (2011) studied South Korea's foreign direct investment behavior in the CIS and CEE countries and regions. They believed that the agglomeration effect, market size, labor cost, the openness of economies, exchange rate, and government effectiveness were motivations of the main factors of South Korea's FDI. Won Ick-Choi (2015) argued that the determinants of FDI may vary depending on whether a company invested horizontally or vertically abroad, which were related to investment time, host country's political and economic situation, level of infrastructure, various systems, etc. Park Sun-Hwa, Nam Hyun-Jung, and Kim Dae-jung (2019) analyzed the impact of corruption and

global competitiveness on South Korea's FDI in 10 ASEAN countries, finding that their global competitiveness hurt FDI, while corruption had a positive one. Jung Heon-Joo and Kim Eun-Mi (2020) empirically examined that bilateral investment treaties signed or entered into force between South Korea and host countries have a positive impact on its direct investment in these countries. The research on investment efficiency and investment potential is still in its infancy. Some scholars have used stochastic frontier analysis to measure investment efficiency. He Huan and Chun-Feng Feng (2021) employed the stochastic frontier model to measure the efficiency of China's FDI in ASEAN countries.

2.2. Research on RCEP

RCEP has been widely concerned since it was proposed. The initial research on RCEP was on the background of RCEP. Zheng Xue-Dang & Rui Zhuang (2014) believed that ASEAN, out of internal motivation and external pressure, put forward the proposal of RCEP and it was a realistic need to integrate the economic cooperation mechanism in the Asia-Pacific region. With the start of the RCEP negotiation, some scholars focused on its progress and challenges of it. Zhang Bin and Fei Zhang (2016) noted that the RCEP negotiation involved many aspects of trade in goods, services, and intellectual property rights, and it was difficult to balance the complex interests of all parties involved. Some scholars mainly study the impact of the establishment of RCEP on the economy. Ko Jong-Hwan (2015) argued that RCEP would bring more benefits to South Korea's economic growth, welfare, and trade balance. Li Qiao-Min and Moon Hee-Cheol (2018) claimed that RCEP would increase China's trade by 1.5% and income by 2.5%. In South Korea, trade growth would reach $8 billion with its revenue increased by 0. 6%. In terms of welfare, China would achieve $214 billion and South Korea $233.5 billion which accounts for 2.3% of its GDP. Thus, RCEP had a significant impact on the trade and welfare of the two countries aforementioned. After the official signing of the RCEP agreement, Liu Ying, and Tian-You Xia (2021) began to turn to the rules of origin of RCEP, and Choi Hyun-Jung and Hoon, Lee-Hyun (2021) focused on the regional industrial chain.

In conclusion, studies from the scholars had provided basic support for advancing the establishment of RCEP. But at present, there are few issues concerning the efficiency of South Korea's FDI in RCEP Partners, and the main factors affecting bilateral investment have not been deeply explored. The main value of this paper is as follows: (1) This paper is the first to use the stochastic frontier model to study the efficiency and influencing factors of South Korea's FDI in RCEP partners which is of great practical significance for this country to inject new momentum to economic growth, improve economic and trade cooperation with RCEP countries. (2) The one-step method we use here, with all parameters in the model being estimated at one time by the maximum likelihood method, achieved more credible results than those by the two-step method.

3. Empirical Method and Data

3.1. Theoretical Model

The gravity model, which originated from the formula of universal gravitation by Newton, was first introduced into international economics by Tinbergen (1962), and Pullianen (1963),

especially in the research of international trade. This was started by Baldwin (1994) and had been employed many times in estimating the potential of bilateral trade between countries. The trade volume estimated by the gravity model is regarded as the trade potential between the two countries, and then the ratio of the actual trade volume to the potential trade volume is used to evaluate the efficiency of bilateral trade (Armstrong, 2007). The old gravity model, however, had limitations. Its assumption held no-trade friction, meaning that most of the trade friction factors could not be included in the unobservable disturbance term and thus it could not accurately reflect the bilateral trade efficiency. To overcome the shortcomings, more and more researchers began to introduce stochastic frontier analysis into the gravity model in recent years. Stochastic frontier analysis was first proposed by Aigner et al. (1977). Later, Wang Hung-Jen and Schmidt (2002) applied it to estimate the investment efficiency of China's foreign direct investment in countries along the Belt and Road, exploring the impact of the relevant institutional factors of the host country on investment efficiency and investment risk. Liang Shuang-Lu and Tao Shen (2019) used the stochastic frontier model to measure the efficiency and influencing factors of China's FDI in Indochina peninsula countries. All this provides a theoretical basis for using the stochastic frontier model to evaluate the efficiency and influencing factors of South Korea's foreign direct investment.

According to the stochastic frontier model, the FDI_{ijt} of country i to country j in period t is determined by formula (1). As shown in formula (1).

$$FDI_{ijt} = f(x_{ijt}, \alpha)exp(v_{ijt})exp(-u_{ijt}), u_{ijt} \geq 0 \qquad (1)$$

Where, FDI_{ijt} is the explained variable, x_{ijt} is the explanatory variable, α is the parameter vector to be estimated, v_{ijt} is a random error term and follows a normal distribution with a mean value of 0. Additionally, u_{ijt} is a non-negative random variable related to technical inefficiency which follows under the assumptions of a half-normal distribution. u_{ijt} reflects the investment resistance variable which is disturbed by subjective factors such as man-made and policy, and in other words, it causes the loss of investment efficiency. v_{ijt} is independent of the random error variable. i is the investment country, j is the host country, and t is the year of investment.

According to formula (1) of the stochastic frontier gravity model, the FDI of country i to country j in period t is determined by formula (2).

$$FDI_{ijt}^* = f(x_{ijt}, \alpha)exp(v_{ijt}) \qquad (2)$$

Drawing on the calculation method of trade efficiency, according to formula (1) and formula (2), the efficiency of FDI from country i to country j in period t is expressed by the ratio of the actual value to the frontier value. Therefore, the expression is formula (3).

$$TE_{ijt} = exp(-u_{ijt}) = FDI_{ijt} \Big/ FDI_{ijt}^* \qquad (3)$$

The value interval of TE_{ijt} is (0,1], $0 < TE_{ijt} < 1$ means that there is an efficiency loss in FDI. The larger the value of TE_{ijt}, the closer i to j which is the actual value to the potential value, and the investment efficiency is higher. The smaller the value TE_{ijt}, the larger gap between

the actual value and the potential value for i to j, and the lower the investment efficiency is. If $TE_{ijt}=1$ means the maximum efficiency, and the actual value is equal to the frontier value.

A linear model can be obtained after the logarithmic transformation of equation (1), and the transformed model is shown in formula (4).

$$\ln FDI_{ijt} = \ln f(x_{ijt}, \alpha) + v_{ijt} - u_{ijt}, u_{ijt} \geq 0 \tag{4}$$

To explore the influencing factors of investment inefficiencies, the technical inefficiencies effect equation from Battese and Coelli (1995) is often adopted, and the expression is:

$$u_{ijt} = y_{ijt}\beta + \varepsilon_{ijt} \tag{5}$$

In the technical inefficiencies effect equation, y_{ijt} represents the explanatory variable affecting the non-efficiency item of foreign direct investment, β is the parameter to be estimated for the explanatory variable, and ε_{ijt} is the random item. By bringing equation (5) into equation (4), a complete stochastic frontier gravity model (6) can be obtained.

$$\ln FDI_{ijt} = \ln f(x_{ijt}, \alpha) + v_{ijt} - (y_{ijt}\beta + \varepsilon_{ijt}), u_{ijt} \geq 0 \tag{6}$$

The early stochastic frontier model was based on unchanging with time, which was called the time-invariant model. However, the original assumption that the efficiency does not change with time is not in line with the actual situation, so there is a time-varying model. The expression of the time-varying model is shown in formula (7).

$$u_{ijt} = \{exp[-\eta(t - T)]\}u_{ij} \tag{7}$$

Where, η is a time-varying attenuation term, which represents the variation of efficiency loss with time. If $\eta = 0$ means a time-invariant model. When $\eta > 0$, it means that the technical inefficiency decreases gradually with time. When $\eta < 0$, it means that the technical inefficiency increases gradually with time.

3.2. An Empirical Model Construction of Korea's Foreign Direct Investment in RCEP Countries

3.2.1 Construction of the Stochastic Frontier Model

Based on the above theoretical analysis, this paper constructs an empirical model of South Korea's FDI in RECP countries. The expression of the stochastic frontier model is:

$$\ln FDI_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln POP_{it} + \beta_4 \ln POP_{jt} + \beta_5 \ln Dist_{ij} + \beta_6 NR_{jt} + \beta_7 Coastal_j + v_{ijt} - u_{ijt} \tag{8}$$

Where, FDI_{ijt} is the foreign direct investment of South Korea in RCEP partners in period t; GDP_{it} and GDP_{jt} represent the economic scale of South Korea and the host country in period t respectively, POP_{it} and POP_{jt} represents the population size of South Korea and

the host country, $Dist_{ij}$ means the distance between South Korea and RECP countries, NR_{jt} indicates the natural resource endowment of the RCEP countries, $Coastal_j$ is a dummy variable, indicating whether RCEP countries have coastlines. The value of coastal countries is 1 and that of landlocked countries is 0. The covariance of v_{ijt} and u_{ijt} is 0, which are independent of each other.

3.2.2 Construction of the Investment Efficiency and Inefficiency Model

The investment efficiency is the same as the efficiency expression on the theoretical basis. The inefficiency model is used to measure the influencing factors of the efficiency loss of the stochastic frontier model. If the coefficient is positive, it means the indicator has a positive correlation with the inefficiency item of FDI. Because the inefficiency has a reverse relationship with FDI, this indicator is an impeding factor for it. On the contrary, if the regression coefficient is negative, it means that it is a hindrance factor the inefficiency item and belongs to the promotion factor of foreign direct investment. Therefore, considering the economic environment, political environment, and regional cooperation organization of bilateral investment, the following model is constructed in formula (9).

$$u_{ijt} = \alpha_0 + \alpha_1 ECF_{jt} + \alpha_2 FTA_{ijt} + \alpha_3 CC_{jt} + \alpha_4 GE_{jt} + \alpha_5 PV_{jt} + \alpha_6 RQ_{jt} + \varepsilon_{ijt} \quad (9)$$

In this formula, the explained variable u_{ijt} represents foreign direct investment inefficiency, ε_{ijt} is a random disturbance term, and α is the estimated coefficient for the factors leading to efficiency loss. The others are variables selected by the model and are divided into three categories:(1) Indicators of the political-institutional environment, mainly including the control of corruption CC_{jt}, political stability PV_{jt}, government effectiveness GE_{jt}, and regulatory quality RQ_{jt}, range from -2.5 to 2.5. (2) Economic environment indicators, expressed by economic freedom index ECF_{jt}. The index of economic freedom includes ten dimensions of the environmental index, such as business freedom, financial freedom, trade freedom, and investment freedom, which measures a country's trade openness and investment environment. The higher the trade and investment freedom of a country, the more efficient the country's FDI will be, ranging from 0 to 100. (3) Relevant agreements and regional cooperation organizations. FTA_{ijt} is a dummy variable, mainly used to reflect whether South Korea has signed a bilateral free trade agreement with the host country. If so, it is 1, if not, it is 0.

3.3. Variables and Data Description

There are 15 RCEP countries. Due to the serious lack of data in Brunei, it is not included in this study. Considering the availability of collocation variable data, this paper takes the data from 2000 to 2019. The description of relevant variables and data sources are shown in Table 1. The data of a few countries in individual years are missing, which is supplemented by interpolation.

Table 1. Variables And Data Sources

Variable Type	Abbreviation	Variable	Data Sources
Explained variable	$\ln FDI_{ijt}$	FDI flows from Korea to RCEP countries	The Export-Import Bank of Korea
Indicators for Stochastic Frontier Model	$\ln GDP_{it}$	The economic size of South Korea，expressed in terms of per capita GDP	World Development Indicators
	$\ln GDP_{jt}$	The size of the host country's economy, expressed as GDP per capita	World Development Indicators
	$\ln POP_{it}$	South Korea's population, representing the size of South Korea's needs	World Development Indicators
	$\ln POP_{jt}$	host country's population	World Development Indicators
	$\ln Dist_{ij}$	Geographical distance between Korea and RCEP countries	CEPII
	NR_{jt}	The degree of dependence on natural resources of the host country, using the natural resource rent indicator	World Development Indicators
	$Coastal_j$	Dummy variables are set to 1 for coastal countries and 0 for landlocked countries.	Collected by the author
Indicators of Inefficiency Model	ECF_{jt}	The economic freedom index	American Heritage Foundation
	FTA_{ijt}	RCEP countries sign a free trade agreement with South Korea. The bilateral signed trade agreement is 1, otherwise it is 0.	Ministry of Trade, Industry and Energy
	CC_{jt}	Control of corruption in the host country	Worldwide Governance Indicators
	PV_{jt}	Political stability	Worldwide Governance Indicators
	GE_{jt}	Government effectiveness	Worldwide Governance Indicators
	RQ_{jt}	regulatory quality	Worldwide Governance Indicators

4. Empirical Analysis

4.1. Model Suitability Test

The premise of the stochastic frontier model is more stringent. To ensure the applicability of the model, we conduct a likelihood ratio test on the model before estimation. It is divided into the following two tests: First, check whether the investment inefficiency item exists. The null hypothesis is that $H_0 : \gamma = 0$ does not have an inefficiency term. Secondly, check whether the inefficiency term changes with time. The null hypothesis is that $H_0 : \eta = 0$ does not change with time. Among them, $\gamma = \sigma_u^2/(\sigma_v^2 + \sigma_u^2) = \sigma_u^2/\sigma^2$, namely γ represents the proportion of the inefficiency term in the compound disturbance term. From the model usability test in Table 2, the critical value corresponding to the significance level of the inefficiency item LR statistic is greater than 1%. Then the null hypothesis is that $H_0 : \gamma = 0$ is no inefficiency term is rejected, indicating that there is an inefficiency term. At the same time, the null hypothesis $H_0 : \eta = 0$ does not change with time is also rejected, indicating that the inefficiency term changes with time. By examining the stochastic frontier analysis, we find there is an efficiency loss in South Korea's direct investment in RCEP partners.

Table 2. Model applicability test results

Null Hypothesis H_0	Constraint Model lnL(H_0)	Unconstrained Model lnL(H_1)	LR Statistics	Degrees of Freedom	1% Threshold	Conclusion
$\gamma = 0$	-451.13	-390.26	121.74	3	10.50	reject
$\eta = 0$	-390.26	-401.68	23.51	2	8.27	reject

4.2. Analysis of Empirical Results of the Stochastic Frontier Gravity Model

After the above model setting test is completed and passed, we continue to use Frontier4.1 to analyze the panel data of RCEP country variables and obtain the regression coefficient and T value of each explanatory variable as shown in Table 3.

Table 3. Estimated Results of Stochastic Frontier Variables

Variable	Coefficient	Standard Error	T value
$cons$	-161.869***	1.002	-161.586
$\ln GDP_{it}$	0.644***	0.304	2.118
$\ln GDP_{jt}$	0.437***	0.066	6.634
$\ln POP_{it}$	9.782***	0.223	43.783
$\ln POP_{jt}$	0.318***	0.074	4.278
$\ln Dist_{it}$	-1.240***	0.192	-6.452
NR_{jt}	0.139***	0.024	5.681
$Coastal_j$	1.982***	0.348	5.699

Note: "* ""**"and"***" means significant at the levels of 10%, 5% and 1%, respectively.

Observing the variable coefficients of the model, we found that: (1) The regression coefficients of the economic scale of South Korea and the economic scale of its RCEP partners are significantly positive, and both are significant at a 1% level, which is in line with expectations. The larger the economic scale, the more foreign direct investment in South Korea, showing that South Korea's economic growth is conducive to its FDI. At the same time, for every 1% increase in the economic scale of the host country, South Korea's FDI in RCEP countries increases by 0.437%. Judging from the size of the coefficient of the bilateral economic scale, the increase in the economic scale of South Korea has more strongly promoted FDI. (2) Both the population size of South Korea and that of the host country passed the test at the 1% significance level, and their coefficients were both positive. As the population increases, the driving force for going abroad is stronger. For every 1% increase in the host country's population, South Korea's investment in RCEP countries increases by 0.318%. (3) The coefficient $Dist_{it}$ is negative and passed the test of 1% significance level, which is consistent with the expectation. It shows that the farther the distance between the two countries is, the higher the capital cost and time cost of transportation will be, which will restrict bilateral investment to a certain extent and reduce FDI. (4) NR_{jt} coefficient is positive and passes the 1% significance level test, indicating that the natural resource endowment of the host country has a positive impact on South Korea's FDI. (5) In this paper, the coastline is included in the model, and it is found that its impact on South Korea's FDI in RCEP member countries is significantly positive, and passed the 1% significance level test. This shows that South Korea's FDI in RCEP member countries is more inclined toward coastal countries or countries with coastlines.

4.3. Analysis of Empirical Results of the Investment Inefficiency Model

To further analyze the influencing factors of investment inefficiency, the coefficient estimation results of the investment inefficiency model are shown in Table 4. The test results are as follows:

(1) Signal-noise ratios γ =0.755 in the model is significant at the 1% level, indicating investment inefficiency is the main factor hindering South Korea's FDI.

(2) Economic environment of the host country is significantly negatively correlated with the inefficiency, which is in line with expectations and has passed the 5% significance test. This shows that economic freedom is an impediment to investment inefficiency and has a significant role in improving investment efficiency. Kim Natalya and Yun Won- Cheol(2011) empirically analyzed that economic openness is one of the important driving factors for South Korea's investment in the CIS and CEE countries and regions. The higher the degree of trade freedom of a country, the better the investment environment, and the more conducive it is to attract foreign investment.

(3) Free trade agreement FTA_{ijt} is negative and passes the 1% significance test, which indicates that it impedes investment inefficiency. Free trade agreements are a contributing factor to investment efficiency and can reduce the inefficiency of investment. Jung Heon-Joo and Kim Eun-Mi (2020) believe that bilateral investment treaties signed or entered into force between South Korea and host countries make South Korea's direct investment in these countries have a positive impact. At present, South Korea has signed free trade agreements with 10 ASEAN countries, Australia, New Zealand, China, and Japan. The establishment of the RCEP is the first time that South Korea has signed a free trade agreement with Japan, and

the advantages of the RCEP should be fully taken to improve investment efficiency.

(4) In terms of the political environment, the quality of supervision in the host country is negatively correlated with inefficiency, and the 1% significance test, it shows that government supervision has reduced investment inefficiency and promoted South Korea's investment efficiency in its RCEP partners. On the other hand, the coefficients of RCEP countries' control of corruption, government stability, and government efficiency are positive, and the control of corruption and government efficiency pass the 1% significance test, while government stability passes the 10% significance test. This shows that political factors such as controlling corruption, government efficiency, and government stability are the main factors for the loss of South Korea's investment efficiency in other RCEP countries.

Table 4. Technical Inefficiency Model Regression Results

Technical Inefficiency Variable	Coefficient	Standard Deviation	T statistic
ECF_{jt}	-0.131**	0.048	-2.704
FTA_{ijt}	-4.104***	0.970	-4.230
CC_{jt}	4.668***	0.991	4.712
PV_{jt}	1.428*	0.855	-1.670
GE_{jt}	6.197***	2.104	2.946
RQ_{jt}	-10.816***	2.572	-4.205
cons	3.583**	1.724	2.078
σ^2	4.598***	0.698	6.587
γ	0.755***	0.058	12.963

Note: "*", "**" and "***" indicate significance at the 10%, 5% and 1% levels, respectively.

4.4. Efficiency Analysis of Korea's FDI in RCEP Countries

Based on the one-step results of the stochastic frontier gravity model, the foreign direct investment efficiency of South Korea in RCEP countries is calculated to examine its future investment potential. The calculation results show that, overall, the average investment efficiency of South Korea in RCEP countries is 0.62, and there is potential for further improvement. From a country's perspective, it is heterogeneous. The maximum value of investment efficiency is 0.794, while the minimum value is 0.311. In Cambodia, Indonesia, Thailand, the Philippines, and Singapore, South Korea's investment efficiency is above 0.7, and the government and its companies could take some measures and there is still a certain space for investment in the future. In Laos, Vietnam, Malaysia, China, and Australia, however, South Korea's FDI is in its expansion stage, with the investment efficiency above 0.5 and enormous investment potential. The investment efficiency in Japan, New Zealand, and Myanmar is less than 0.5, among which Japan has the lowest investment efficiency, only 0.311, showing that more efforts should be made to dig the investment potential. From the perspective of investment regions, South Korea's high FDI efficiency is mainly concentrated in Southeast Asia. Its investment in Northeast Asia is mainly in China, and that in Oceania is mainly in Australia. And its investment efficiency in Japan and New Zealand is low. According to World Bank data, Australia, Japan, New Zealand, and Singapore are high-

income countries among the RCEP countries, and the others are middle- and low-income ones. According to Table 5, Korea's FDI efficiency in developing countries among RCEP members is relatively high, and that in developed countries is relatively low.

Table 5. Efficiency of Korea's Foreign Direct Investment in RCEP Countries from 2000 to 2019

	KHM	LAO	MMR	VNM	IDN	THA	MYS	PHL	SGP	CHN	JPN	AUS	NZL
2000	0.746	0.004	0.237	0.409	0.775	0.734	0.437	0.813	0.749	0.618	0.213	0.619	0.484
2001	0.747	0.020	0.104	0.417	0.775	0.705	0.373	0.771	0.753	0.570	0.185	0.404	0.516
2002	0.712	0.035	0.040	0.538	0.714	0.662	0.498	0.675	0.684	0.605	0.120	0.597	0.519
2003	0.730	0.074	0.018	0.584	0.680	0.694	0.386	0.666	0.743	0.678	0.220	0.581	0.607
2004	0.723	0.429	0.165	0.561	0.612	0.679	0.373	0.619	0.690	0.677	0.471	0.547	0.491
2005	0.780	0.772	0.009	0.526	0.651	0.718	0.392	0.634	0.666	0.723	0.384	0.607	0.564
2006	0.804	0.274	0.005	0.570	0.698	0.691	0.281	0.700	0.751	0.674	0.353	0.624	0.354
2007	0.866	0.689	0.021	0.730	0.762	0.774	0.577	0.760	0.756	0.676	0.443	0.585	0.577
2008	0.866	0.712	0.286	0.704	0.766	0.773	0.636	0.803	0.761	0.602	0.399	0.698	0.481
2009	0.847	0.742	0.631	0.695	0.789	0.725	0.617	0.790	0.732	0.618	0.355	0.711	0.468
2010	0.836	0.656	0.566	0.697	0.795	0.766	0.786	0.778	0.745	0.606	0.211	0.726	0.439
2011	0.811	0.605	0.641	0.682	0.801	0.820	0.672	0.742	0.790	0.558	0.204	0.753	0.461
2012	0.820	0.699	0.609	0.661	0.804	0.760	0.752	0.814	0.768	0.603	0.342	0.787	0.408
2013	0.820	0.717	0.725	0.680	0.780	0.775	0.722	0.776	0.787	0.605	0.275	0.801	0.552
2014	0.782	0.638	0.676	0.696	0.795	0.775	0.663	0.680	0.827	0.470	0.172	0.828	0.610
2015	0.754	0.672	0.700	0.720	0.798	0.762	0.648	0.734	0.834	0.597	0.300	0.813	0.538
2016	0.818	0.729	0.741	0.756	0.785	0.739	0.755	0.769	0.818	0.616	0.266	0.829	0.571
2017	0.800	0.730	0.740	0.754	0.777	0.724	0.784	0.813	0.800	0.634	0.392	0.814	0.307
2018	0.816	0.731	0.749	0.774	0.751	0.702	0.633	0.748	0.812	0.636	0.452	0.787	0.604
2019	0.801	0.794	0.777	0.804	0.793	0.699	0.716	0.768	0.834	0.635	0.458	0.804	0.430
mean	0.794	0.536	0.422	0.648	0.755	0.734	0.585	0.743	0.765	0.620	0.311	0.696	0.499

5. Conclusions and Prospects

5.1. Research Conclusions and Suggestions

Looking at the panel data from 2000 to 2019, this paper uses the stochastic frontier gravity model to measure the efficiency of South Korea's FDI in its RCEP partners and examines the main investment promotion and inefficiency factors. The conclusions are as follows:

First, the average direct investment efficiency of South Korea in other RCEP countries is 0.62, indicating it has great potential in the future. And its investment efficiency in different RCEP partners shows a significantly country-specific heterogeneity, that is, it is above 0.7 in Cambodia, Indonesia, Thailand, the Philippines, and Singapore, and there is a certain investment space. For Laos, Vietnam, Malaysia, China, and Australia, the investment efficiency is above 0.5, and the investment potential is great. while it is less than 0.5 in Japan, New Zealand, and Myanmar, among which Japan holds the lowest, only 0.311. From the perspective of investment regions, South Korea's FDI is mainly concentrated in

Southeast Asia, and the investment potential of Northeast Asia and Oceania is worthy of more attention. In addition, South Korea's investment efficiency in RCEP developing countries is significantly higher than that in developed ones.

Second, from the perspective of objective influencing factors, variables such as the size of the bilateral economy, the population of South Korea and the host country, the dependence on natural resources, and the coastline of the host country have obvious positive effects. And the long geographical distance between the two countries is a factor that hinders South Korea's direct investment in RCEP countries.

Third, from the perspective of human causes, there is investment inefficiency in South Korea's FDI in RCEP partners, that is, some policies and institution systems have caused the efficiency loss. In other words, free trade agreements, economic freedom, and regulatory quality play a significant role in increasing investment efficiency, while the host country's control of corruption, government efficiency, and government stability are positively related to investment inefficiency.

Based on the above conclusions, the following suggestions are made: (1) South Korea, as an economic powerhouse, against the increasing uncertainty in global economic cooperation, should give full play to its advantages, focusing on getting rid of the FDI inefficiency factors in RCEP countries. Given the heterogeneity, enterprises should make more effort in their scientific research and strengthen strategic high-tech cooperation with developed countries to enhance the reverse technology spillover effect. When investing in countries rich in resources, they must make reasonable use of labor resources and others.

(2) To optimize the selection of investment regions, South Korea should further assist other RCEP countries in infrastructure and investment facilitation systems and help host countries improve their logistics and transportation networks. This plays an important role for South Korea to reduce its investment cost and improve its investment efficiency.

(3) It is important to give full play to free trade agreements: From a macro strategy, South Korea should fully use the RCEP free trade agreement to strengthen its economic and trade exchanges with other countries. It is also conducive to further liberalizing and facilitating intra-regional trade and investment through the establishment of intra-regional economic alliances and intra-regional financial institutions for strategic complementarity and bilateral investment negotiations.

(4) South Korea's enterprises and companies should attach importance to the economic situation of the host country. Countries with high economic freedom are suggested to choose the ones with a good investment environment and high financial freedom. Besides, keeping an eye on inefficiency factors might help South Korea improve its FDI efficiency. South Korea and host country governments are supposed to establish a risk assessment system, focusing on indicators such as corruption control, regulatory quality, and government efficiency. Meanwhile, South Korea should speed up the signing of relevant investment guarantee agreements with host countries to provide a stable operating environment for its companies.

5.2 Research Limitations and Prospects

This paper studies South Korea's investment efficiency and the influencing factors in RCEP countries, finding that South Korea's investment potential in RCEP countries is relatively great, and puts forward some suggestions considering the influencing factors of investment efficiency. However, there are still some shortcomings:

In terms of data, we lack relevant ones from Brunei, a member of RCEP. In addition, it is

difficult to collect industry-level microdata. This paper mainly analyzes the efficiency of South Korea's FDI in RCEP countries from the macro level. As more data will be disclosed and the uneven investment efficiency of different industries considered, the investment efficiency of South Korea in different industries of its RCEP partners will be further refined based on obtaining the industry-level data.

And in terms of analysis of the influencing factors, the artificial influence of institutional factors is significantly considered. This paper, referring to the methods of the existing literature, emphasizes the influence of institutional variables. However, there may be other factors affecting efficiency. In future research, other variables will be incorporated into the model for investigation, and factors affecting investment efficiency will be considered more comprehensively to provide an objective basis for further increasing the efficiency of South Korea's foreign investment and tapping its investment potential. In the future, we will do more research on economic and trade cooperation between South Korea and RCEP countries to enrich relevant theories.

References

Aigner, D., C.A. Knox Lovell, and P. Schmidt, (1977), "Formulation and Estimation of Stochastic Frontier Production Function Models", *Journal of Econometrics*, 6(1), 21-37.

Armstrong, S. (2007), "Measuring Trade and Trade Potential: A Survey", *Asia Pacific Economic Paper,* 368,1-18.

Baldwin, R. (1994), "Towards an Integrated Europe", *Centre for Economic Policy Research,* 234, 12-95.

Battese, G.E. and T.J. Coelli, (1995), "A Model for Technical Inefficiency Effects in a Stochastic Frontier Production Function for Panel Data", *Empirical Economics,* 20, 325-332.

Buckley, P. J. and M. Casson (1981), "The Optimal Timing of Foreign Direct Investment", *The Economic Journal,* 91(361), 75-87.

Choi, Hyun-Jung and Hyun-Hoon Lee (2021), "An Analysis of Intra-Regional Trade and Backward Linkages on Global Value Chains among the RCEP Members", *Korea Trade Review,* 46(4) , 95-112.

Dunning, J.H. (1975), *Economic A analysis and the Multinational Enterprise*, New York, Praeger.

He, Huan and Chun-Feng Feng (2021), "A study on the efficiency of China's direct investment in ASEAN", *Statistics & Decision,* 37(4),146-149.

Hymer (1976), *The International Operation of National Firms: A Study of Direct Foreign Investment*, Cambridge, MA: MIT Press.

Jung, Heon-Joo and Eun-Mi Kim (2020), "International treaties and foreign direct investment: an empirical analysis of effects of bilateral investment treaties on South Korea's FDI", *Journal of The Asia Pacific Economy,* 25(3), 402-417.

Kim, Natalya and Won-Cheol Yun(2011), "An Empirical Study of South Korea's Direct Investment in CIS and CEE countries", *Economic Research Journal,* 32(2), 93-106.

Ko, Jong-Hwan(2015), "RCEP vs. TPP: Which One Would Be More Beneficial to Korea Economically?", *The Journal of International Trade & Commerce,*11(4), 51-70.

Liang, Shuang-Lu and Tao Shen (2019), "Analysis on the Efficiency of China's Direct Investment in Indo-China Peninsula Countries and Its Influencing Factors", *Indian Ocean Economic and Political Review,* 2,115-132.

Li, Qiao-Min and Hee-Cheol Moon (2018), "The trade and income effects of RCEP: implications for China and Korea", *Journal of Korea Trade,* 22(3), 306-318.

Liu, Ying and Tian-You Xia (2021). "Research on RCEP Rules of Origin: Comparison, Challenges and Coping Strategies", *International Economics and Trade Research,* 37(6), 86-101.

Park, Sun-Hwa, Hyun-Jung Nam and Dae-Jung Kim(2019), "The Influence of Social and Economic Factors in ASEAN on Foreign Direct Investment of Korean", *Korean Review of Corporation Management,* 10(3), 147-158.

Pullianen, K. A. (1963), "An Econometric Model of the Pattern of Commodity Flows in International Trade in 1948~1960", *Ekonomiska Samfundet Tidskrift,* 2, 78-91.

Sun, Jun (2002), "Study on the factors of FDI location choice in China", *China Economic Quarterly*, 1(3), 687-698.

Tinbergen, J. (1962), *Shaping the World Economy: Suggestions for an International Economic Policy*, New York, The Twentieth Century Fund.

Wang, H.J. and P. Schmidt (2002), "One-Step and Two-Step Estimation of the Effects of Exogenous Variables on Technical Efficiency Levels, *Journal of Productivity Analysis,* 18(2), 129-144.

Won, Ick-Choi(2015), "The Determinants of FDI and The Relationship between FDI and Economic Growth", *The International Association of Area Studies,* 19(4), 201-233.

Young, Ryeol-Park and Young-Soo Yang(2011), "Determinants of Foreign Direct Investment of Korean Firms: Types of FDI and Institutional Distance",*The International Association of Area Studies(IAAS)),* 15(3), 429-449.

Zhang, Bin and Fei Zhang (2016), "Research on the progress, obstacles and Strategies of RCEP in China", *Nankai Journal(Philosophy, Literature and Social Science Edition),*6,122-130.

Zheng, Xue-Dang and Rui Zhuang (2014), "Research on the motivation, content, challenge and Countermeasures of RCEP", *Southeast Asian Studies,* 1,33-38.

Zhou, Ying (2017). "A Study on the Motivation of South Korea's Foreign Direct Investment and Its Impact on Export", *Market Modernization,* 13, 33-34.