Asian Journal of Economic Modelling
ISSN(e): 2312-3656
ISSN(p): 2313-2884
DOI: 10.18488/journal.8.2020.83.204.217
Vol. 8, No. 3, 204-217.

URL: www.aessweb.com

WHAT DO WE KNOW ABOUT KOREAN OUTWARD FOREIGN DIRECT INVESTMENT? APPLYING SPATIAL MODELS

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Article History
Received: 21 May 2020
Revised: 23 June 2020
Accepted: 27 July 2020
Published: 19 August 2020

Keywords
Outward foreign
Direct investment
Korean OFDI
Spatial dependence
Spatial heteroscedasticity
Spatial Durbin model
Determinants of Korean OFDI
Geospatial distribution of Korean OFDI.

ABSTRACT

This paper aims to prove that Korean outward foreign direct investment (OFDI) can be more comprehensively examined and major locational determinants are accurately identified when spatial dependence and heteroscedasticity effects are taken into consideration. This paper is the first one to adopt Spatial Durbin Model as the most appropriate approach in investigating Korean OFDI after a series of statistical tests. Our findings are different from the results of earlier studies without the spatial effects perspective. The empirical evidence signifies that the GDP per capita of Korean main trade-partner countries was the major Korean OFDI determinants. Korean OFDI favored economies with a higher degree of trade openness. Korean OFDI also took advantage of the economic integration. Meanwhile, it greatly underweighted its investment in most South Asian countries, South American, and African continent while Korean OFDI has outstandingly expanded into North America, the European Union, East Asian countries and mainland China markets. These provide important implications to the management of the corporate strategy and government policies on OFDI.

Contribution/ Originality: This study contributes to the existing literature on determinants of Korean outward foreign direct investment and its geospatial distribution around the world.

1. INTRODUCTION

Conventional econometric techniques are not applicable if spatial effects exist. Spatial dependence is caused by different levels of spatial aggregation, externalities, and spillover effects while spatial heteroscedasticity results from heterogeneity inherent from the presence of spatial units (Anselin, 1988). Thus, it is necessary to apply the spatial econometric model if spatial effects exist on the panel data.

Multinational enterprises (MNEs) strategically relocate their production overseas where they can benefit from country/location-specific advantages. A critical issue is which country/location-specific characteristics generate incentives and motives that shape the pattern of the outward foreign direct investment (OFDI) for MNEs (Chung, 2014). Previous studies typically focused only on factor endowments, such as low or skilled labor and physical capital (Yeaple, 2003). Also, most existing studies of outward foreign direct investment (OFDI) have been focused

on developed economies. By contrast, research on the OFDI of developing countries is almost nonexistent because developing countries have been mostly recipients rather than exporters of direct investment until the year 2000. South Korea was a net importer of direct investment through the 1980s, but since 1990, it has recorded more of OFDI than inward foreign direct investment (IFDI) on a flow basis (Kim, 2000). The OFDI from Korean MNEs has increased sharply over the last two decades. Despite this trend, comprehensive research on this development and the specific determinants of Korean OFDI are still underrepresented (Holtbrugge & Heidi, 2012). Korean OFDI has been making substantial investments overseas. Most studies concentrated mainly on the OFDI from developed countries to less developed countries and more importantly, excluded the spatial effects. This paper is motivated to conduct the research to fill in the gap of prior literature. The goal of this paper is to give a more comprehensive investigation of Korean OFDI (the OFDI of a newly industrialized economy) with the consideration of spatial dependence and heteroscedasticity effects.

The contribution of this paper identified that the focused-in elements of Korean OFDI were highly correlated with the income *per capita* of Korean main trade-partner countries. Korean OFDI also favored countries with a higher degree of trade openness and with the regional free trade agreement. It largely underweighted its investment in South Asian, most South American countries, and African continent, while Korean OFDI has concentrated greatly on the three regions: North America, the European Union, East Asian countries.

The remainder of this research is structured as follows. Section 2 reviews prior literature related to the OFDI. Section 3 is devoted to the explanation of the dataset and the configuration of the spatial econometric model. Section 4 analyses implications obtained from empirical results, and the final section concludes this paper.

2. LITERATURE REVIEW

Dunning (1958); Dunning (1973) explored subjects of OFDI and international production in the 1950s and proposed the Eclectic (Ownership, Location, Internationalization: OLI) Paradigm, which worked to explain the scope and geography of valued added activities by MNEs. Determinants of MNEs' OFDI location have been changing from low labor costs or plentiful natural resources in earlier years to have recently become more attracted to locations with superior technological infrastructure and pool of skilled labor (Dunning, 2009).

Many conventional foreign direct investment (FDI) theorists from Hymer (1976); Buckley and Cassson (1976) Rugman (1981) and Dunning (1988) viewed that the OFDI of MNEs from developed countries was to exploit ownership advantage. On the other hand, Moon and Roehl (1993) suggested that MNEs from less developed countries have strategic motivations such as market seeking exploration (market proximity), learning to compensate for disadvantages. Also, Mundell (1957) argued that OFDI in some cases caused a negative impact on exports. Interestingly, many other studies such as Lipsey and Weiss (1981) and Grossman and Helpman (1989) suggested that OFDI had a positive effect on home-country exports.

One of the motivations with which we conduct this study is to examine if Korean OFDI had a positive or negative impact on its exports.

Hill and Jongwanich (2009) suggested three common types of OFDI, market-seeking, efficiency-seeking, and resource-seeking motives. Efficiency-seeking investments refer to search for the production-center location with factors such as labor market costs and quality, infrastructure costs and quality, and the broader macroeconomic environments. MNEs spread production processes across international boundaries according to the economics of manufacturing and service provision at each stage of the production process. This form of OFDI grew rapidly, especially in the electronics, automotive, and machinery goods industries. The study of Makino, Lau, and Yeh (2002) also proposed similar viewpoints.

The OFDI from the newly industrialized economies (such as South Korea) has become one of the major sources of the world OFDI (Seo & Suh, 2006).

Korean OFDI was discovered to have a positive effect on exports. Kim (2000) identified that positive effects on exports through increased exports from parents (South Korea) to foreign subsidiaries.

Empirical results of Lim and Moon (2001) supported that Korean OFDI would have a more positive effect on home country exports if the subsidiaries are located in less developed countries than in developed countries if the industry is in a declining stage in the firm's home country.

The study of Seo and Suh (2006) found that Korean OFDI marginally contributes to Korean exports to the ASEAN (Association of South-East Asian Nations) region.

South Korea has been eager to sign bilateral or multilateral trade agreements with many countries since the 2000s. Korea had no regional trade agreements in the world until the late 1990s. It signed its first free trade agreement (FTA) with Chile in October 2002. Later, it signed a FTA with Singapore in August 2005 and with ASEAN in December 2005 (Lee, Koo, & Park, 2008). It further signed a FTA with the European Union (EU) in July 2011, the USA in March 2012, and China in December 2015. Korea intends to make use of the proliferation of regional trading blocs to increase its exports through OFDI (Lee et al., 2008). To this end, our paper takes the worldwide economic integration trend into account when Korea MNEs decide their OFDI.

Hill and Jongwanich (2009) pointed out that OFDI of the Korea increased quickly and exceeded inward OFDI over the past decades since the deregulation of the FDI regime in 1990s.

Chung (2014) found that Korean MNEs relying on old production technologies moved to countries with laxer environmental regulations (i.e. lower production costs) during the period: 2000 and 2007.

Both studies of Fung, Garcia-Herrero, and Siu (2009) and Hill and Jongwanich (2009) first took the geographical distance of Korean OFDI into account. However, no existing literature has taken the spatial dependence and heteroscedasticity into consideration so far. Thus, the goal of this paper is to investigate the geospatial distribution and locational determinants of Korean OFDI with the spatial econometric model.

3. SPATIAL ECONOMETRIC MODELS

3.1. Theoretical Framework

Krugman (1991) emphasized the importance of economic geography, the location of factors of production in space. This is different from the conventional international trade theory: treating nations as dimensionless points. (Krugman, 2011) suggested that most economists neglected about the location of production within countries in past decades. The new economic geography has now made the progress on econometric models with elements of location and spatial structure. Brulhart (1998) suggested that all international trade theories are based on restrictive and unrealistic assumptions strictly speaking. The correct should be which theory is best at approximating real-world events at a particular time, in a particular sector and/or at a particular location. Brulhart (1998) regarded that advances in trade theories were largely facilitated by changes of empirical findings. The new economic geography model (Krugman & Venable, 1995) uses full two-dimensional spatial structures rather than treating countries and/or regions as dimensionless points. It is the most compelling approach. The terms "economic geography", "spatial economics" and "economics of location" are used interchangeably by Brulhart (1998). The Gravity Model (proposed by Tinbergen (1962) has been employed widely by much research on topics of trade flows. This model identifies three fundamental determinants of bilateral trade volumes as follows: firstly, export supply, captured by income and GDP *per capita* of the exporting country, Secondly, import demand, captured by income and GDP *per capita* of the importing country, thirdly, transaction costs, captured by geographical distance and factors representing government policy and other trade barriers to trade. In terms of factors representing government policy and other trade barriers, a variety of proxies for 'closeness' between the trading partners: contiguity, common language (cultural affinity), foreign direct investment, free trade agreement (economic integration) dummy and so on. Though the gravity model is a useful empirical device, it has encountered strong criticism and cannot be applied as a tool to separate and test emerging new trade theories and location Brulhart (1998). Importing and exporting of

goods are normally conducted simultaneously in terms of their production requirements and are generally employed as proxy of the production due to the fact that the trade data are generally available, relatively reliable and highly disaggregated (Brulhart, 1998). The gravity model has provided the clear link between the explanatory variables chosen in this paper and the development of international trade theories. Both Brulhart (1998) providing the theoretical analysis on the evolvement of international trade theories and Porojan (2001) taking spatial effects into account in the econometric model related to trade flows among countries play the milestone role on this field.

Therefore, we build up spatial econometric models which consider the possible spatial autocorrelation and spatial heteroscedasticity, which originally proposed by (Anselin, 1988); Elhorst (2003) and Getis (2010) to obtain more accurate empirical results.

3.2. Data and Variables

The critical factors of the OFDI decisions appears to be closely related specific political and economic features in light of the theoretical review in the preceding section. Furthermore, we refer to prior empirical works below. We discern if these factors are statistically significant, i.e. which factors are the major locational determinants of Korean OFDI by estimating the spatial models developed in this research. These factors are as follows.

Several previous studies (Culem, 1998; Farrell, Gaston, & Sturm, 2004; Seo & Suh, 2006) in the case of Korean OFDI, Hill and Jongwanich (2009) in cases of both Japan and Korea) have emphasized that the lower labor and/or production costs in the host country is one of the important driving forces to the OFDI from a foreign country perspective. Thus, there would be a negative relationship between the OFDI and the GDP *per capita* (*GDPPC*) of the OFDI host country. However, some literature viewed that the higher the host country's GDP *per capita* is, the more foreign investors are attracted to invest in the country. In this case, motivations of the OFDI can be attributed to serve clients in the country Higher GDP *per capita*. Also, the OFDI may benefit from countries with higher GDP *per capit*a because these countries tend to have social and political stability or/and have better research and technology. Schneider and Frey (1985) suggested that *GDPPC* has a positive relationship with the OFDI. Therefore, we regard that there are various types of OFDI related to the *GDPPC* of host countries. The negative or positive relationship between the OFDI and *GDPPC* is a strategic decision of multinational enterprises.

Eaton and Tamura (1994) and Cheung and Qian (2009) regarded that Market Opportunity (*MO*) is a signifier of market seeking. It is estimated by the ratio of host country j's GDP *per capita* to the Korean GDP *per capita*.

Culem (1998); Nakamura and Oyama (1998) and Farrell et al. (2004) identified that there is a positive effect between the OFDI and the exports of its home country. The variable *EXPORT* is therefore selected in the model. We define variable: *Export* is home country's exports to host countries in year *t*

Seo and Suh (2006) investigated the relationship between Korean OFDI and the home country's imports from the host country. Earlier studies by Nakamura and Oyama (1998) and Farrell et al. (2004) identified that OFDI from the country where multinational enterprises situated in, positively correlated to imports from the host country. This paper also employs imports as an independent variable in our model. The definition of the variable: *IMPORT* denotes home country's imports from host countries in year *t*.

Nakamura and Oyama (1998) suggested that the host country's political stability is a substantive factor in terms of the foreign direct investment. The Swiss Federal Institute of Technology complies the *KOF* Index regularly. The *KOF* index represents the host country's political risk during time *t*. Agostino, Demaria, and Trivieri (2010) and Okpokpo, Ifelunini, and Osuyali (2014) utilized the *KOF* Index as a proxy variable for political risks. The more unstable the political environment is, the higher the risk is. The instable political situation would result in deterring OFDI from foreign countries. Thus, KOF index is also adopted in this model to examine the correlation of *KOF* index with Korean OFDI.

The finding of Fung et al. (2009) suggests that Korean OFDI favored economies with a higher degree of openness. The trade openness in host economy is selected as an explanatory variable in this paper to investigate if

the OFDI and the trade openness are correlated. The variable *OPEN* to represent the host country's openness to trade during time *t*. It is computed by the host country's volume of international trade (i.e. the sum of exports and imports) divided by its GDP (Wu, Chen, & Chen, 2007). Openness to trade signifies the relative intensity of economic interaction between the host country and other countries world-wide. We regard that *OPEN* normally has a positive effect on the home country's OFDI.

In the study of Balassa (1961) the term: "economic integration" (*EI*) is the first time to be used and discussed. This term has now been frequently adopted in the literature and in practice. Economic integration includes various forms such as free trade areas, customs unions, and common markets. Much literature (Bjorvatn, 2004; Culem, 1998; Hill & Jongwanich, 2009; Katsikeas, Piercy, & Ioannidis, 1996; Kreinin & Plummer, 1992; Lee et al., 2008; Winters, 1985) suggested that exports to the country joining the economic integration will increase while those elsewhere decrease. Thus, it is regarded that there is a positive relationship between economic integration (*EI*) and the OFDI.

To investigate economic and political factors on the flows of Korean OFDI, we choose seven explanatory variables: GDP *per capita* of Korean 30 largest OFDI countries (*GDPPC*), total amounts of Korean imports from its 30 largest OFDI countries (*Import*), exports from Korea to the 30 largest OFDI countries (*Export*), the ratio of host country j's GDP *per capita* to the Korean GDP *per capita (MO*), the host country's openness to international trade (*Open*), the level of the economic integration of the 30 largest OFDI partner countries (*EI*), political and country risks of Korea's 30 largest OFDI countries (*KOF*), and dependent variable: total amounts of Korean OFDI to its 30 largest OFDI partner countries (*OFDI*). A longitudinal dataset is collected and compiled for the estimation of the spatial econometric models by employing the variables discussed above. The data of *OFDI* by country is available from the Organization for Economic Cooperation and Development (OECD). Data for *Import*, *GDPPC*, and *Export* are downloaded from the DataStream (the online databank company). The *EI* data is evaluated by the World Trade Organization (WTO). The data of each country is categorized from level 1 to 4 according to the level of each country's free trade agreements signed with the identification information.

3.3. The Spatial Models

Firstly, we examine if the longitudinal data utilized in this research has spatial effects due to the potential bias may occur. Models are then configured by combining spatial conceptions and the geographical distance, applying the relative importance of geographic neighbors and the OFDI host countries in analysing the allocation of the OFDI as an example.

The Moran's I developed by Moran (1950) has been widely used to examine the spatial autocorrelation. The results of Table 1 exhibits that there exists the spatial autocorrelation on the longitudinal data utilized in this research. Thus, it is necessary to take spatial effects into account in analysing the longitudinal data.

In addition, Anselin (1995) proposed the Local Indicators of Spatial Association. Positive spatial associations signify spatial clustering of similar values (High-High, values above the mean or Low-Low, values below the mean). In the first quadrant (High-High), are countries with high OFDI from Korea, and whose neighbors also have high OFDI from Korea. In the third quadrant (Low-Low), are countries with low OFDI from Korea and whose neighboring countries also have low levels of OFDI from Korea. These also can be applied to the second quadrant (Low-High) and the fourth quadrant (High-Low). The results are displayed in Table 2 and Figure1.

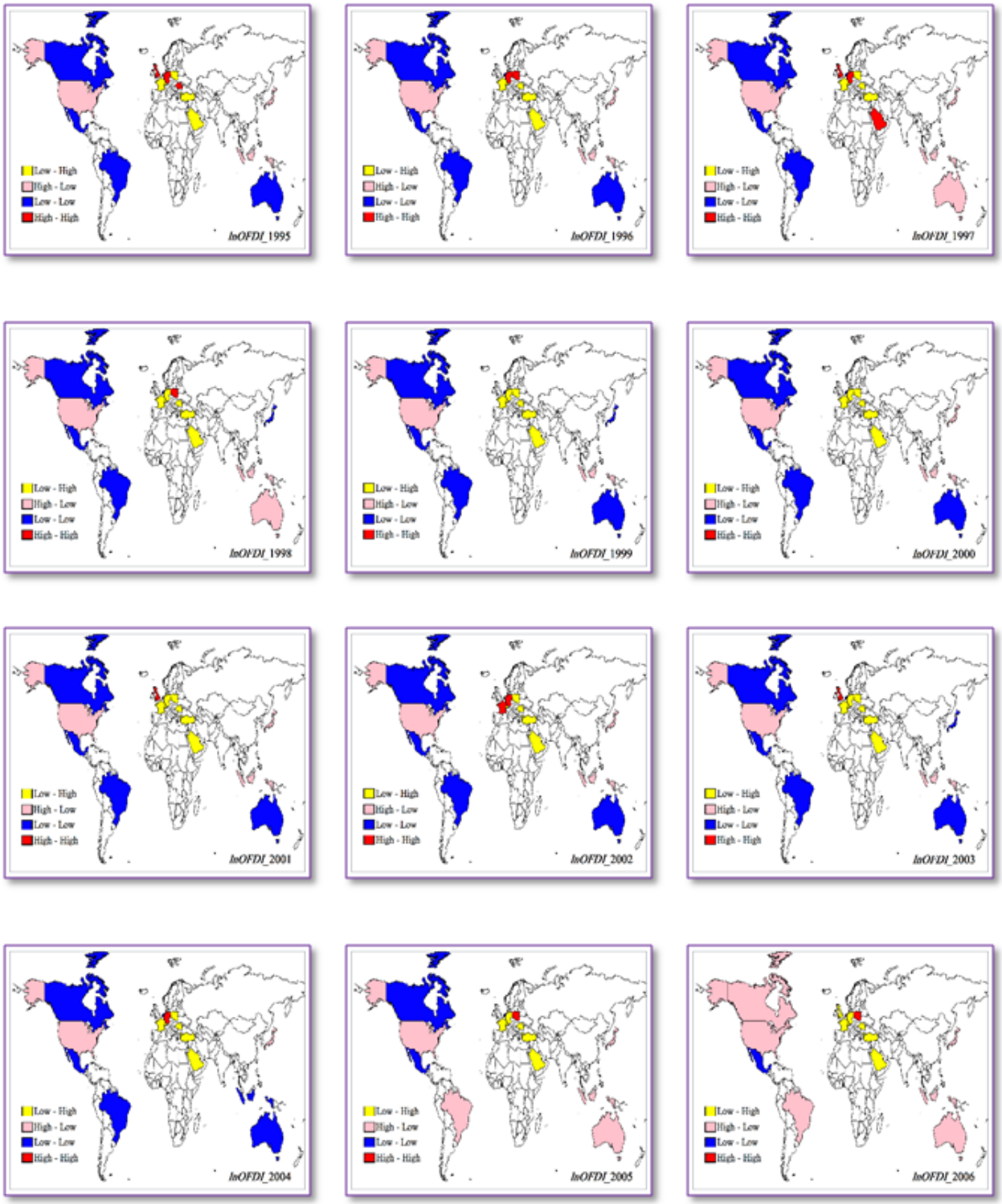

Figure-1. Changing Destination with significant Moran's I value of Korea's OFDI.

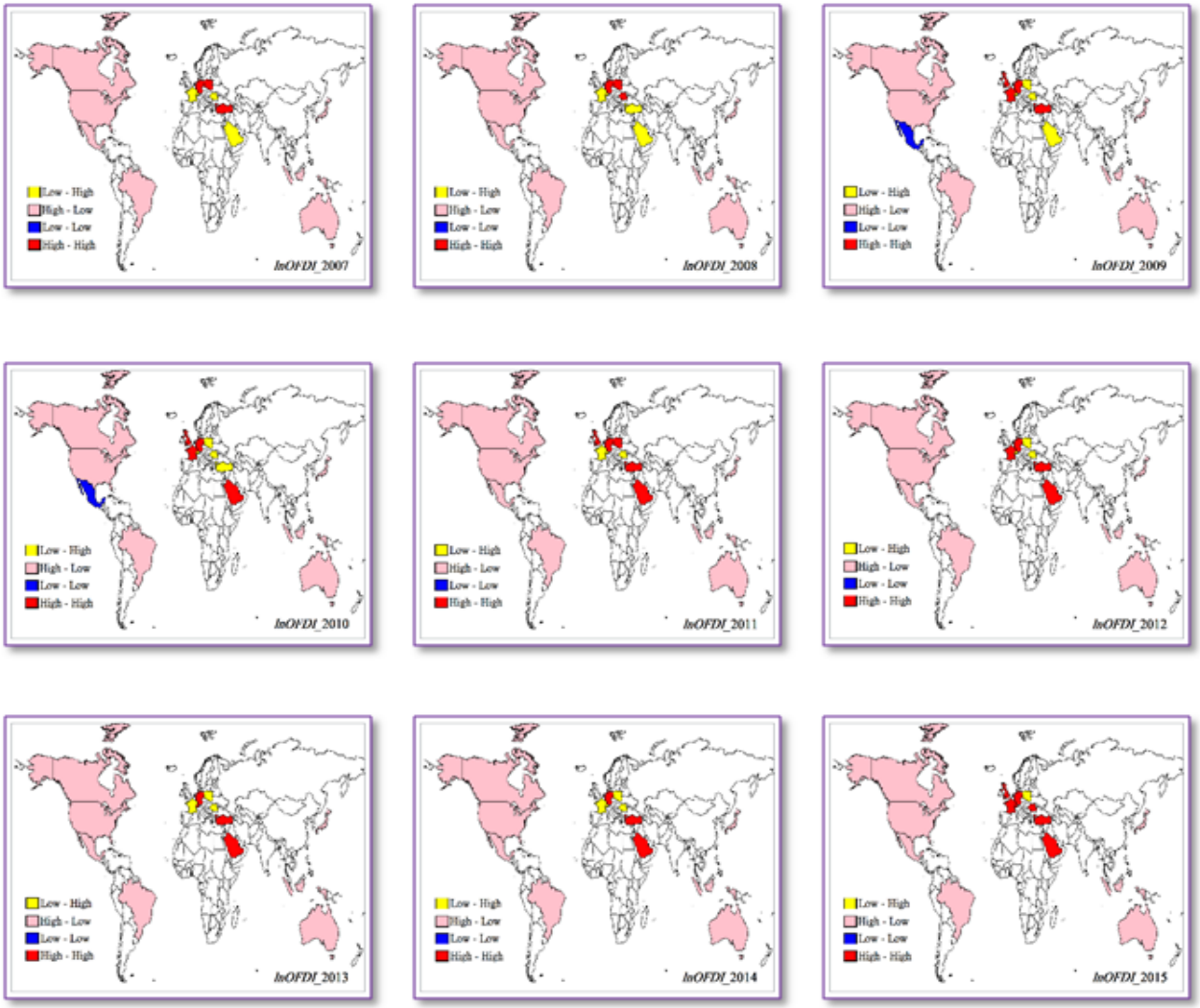

Figure-1. Changing destination with significant Moran's *I* value of Korea's *OFDI* (cont.).

In terms of the explanatory power of the spatial lag model (SLM) and the spatial error model (SEM), both the SLM or SEM are superior to the conventional Pooled Ordinary Least Squares (OLS) by comparing the R-squared of each. The SDM is identified to be the best fit model of all after the series of tests in the case of this research. These include the log-likelihood test, the LR test, the robust LR test, the Hausman test and Wald test as exhibited in Table 3 and Table 4.

Table-1. Moran's *I* Test for Spatial Correlation on Korea's *OFDI* .

Year	1995	1996	1997	1998	1999	2000	2001
Moran's *I*	-0.063 (0.374)	-0.048 (0.451)	-0.046 (0.491)	-0.009 (0.289)	-0.103* (0.059)	-0.024 (0.357)	-0.029 (0.382)
Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Moran's *I*	-0.156*** (0.008)	-0.063 (0.361)	-0.026 (0.350)	0.014 (0.167)	0.058* (0.095)	0.004 (0.223)	0.084* (0.057)
Year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Moran's *I*	0.030 (0.149)	0.038 (0.127)	0.084* (0.056)	0.174*** (0.010)	0.158** (0.016)	0.165*** (0.009)	0.105** (0.031)

Note: *Significance at level 0.1 **Significance at level 0.05 ***Significance at level 0.01

Table-2. Country clusters of spatial autocorrelation from 1995 to 2015.

Quadrant / Country	I (High-High)	II (Low-High)	III (Low-Low)	IV (High-Low)
Australia			1995***,1996***	1997***,1998***
Brazil			1995***-2004***	2005***-2015***
Cambodia			1995-2005 2014-2015	2006-2013
Canada			1995***-1998*** 1999**,2000** 2001***-2005***	2006***-2009*** 2010** 2011***-2015***
China	1995-2015			
France	2002*** 2009***,2010*** 2012***,2015***	1995***-2001*** 2003***-2008*** 2011***,2013***		
Germany	1995***-1997*** 2002***,2004***	1998***-2001*** 2003***,2005***		
Hong Kong	1995,1996 1998-2015		1997	
India	1996-1998 2005-2015	1995 1999-2004		
Indonesia			2004***	1995***-2003*** 2005***,2006** 2007***-2015***
Japan			1998***,1999*** 2003***	1995***-1997*** 2000***-2002*** 2004***-2015***
Laos		1995-2015		
Malaysia			1996-2006 2015	1995 2007-2014
Mexico			1995***-2006*** 2009***,2010***	2007***,2008*** 2011***-2015***
Mongolia		1995-2015		
Netherland			1996***-2000*** 2003***-2005***	1995***,2001*** 2002*** 2006***-2015***

Note: *Significance at level 0.1 **Significance at level 0.05 ***Significance at level 0.01.

The no-spatial longitudinal data model is constructed for the case of Korean OFDI with spatial (μ_i) and time (ν_t) as displayed below.

$$lnOFDI_{it} = \beta_1 \cdot \ln EXPORT_{it} + \beta_2 \cdot \ln IMPORT_{it} + \beta_3 \cdot lnGDPPC_{it} + \beta_4 \cdot MO_{it} + \beta_5 \cdot OPEN_{it} + \beta_6 \cdot KOF_{it} + \beta_7 \cdot EI_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (1)$$

Consequently, the SDM is superior to the SLM and the SEM in the case of this study see Table 3 and Table 4. Equation 1 can be modified as follows.

$$\begin{aligned} \ln OFDI_{it} &= \beta_1 \cdot \ln EXPORT_{it} + \beta_2 \cdot \ln IMPORT_{it} + \beta_3 \cdot \ln GDPPC_{it} + \beta_4 \cdot MO_{it} + \beta_5 \cdot OPEN_{it} \\ &+ \beta_6 \cdot KOF_{it} + \beta_7 \cdot EI_{it} + \rho \sum W_{ij} \times \ln OFDI_{jt} + \gamma_1 \sum W_{ij} \times \ln EXPORT_{jt} \\ &+ \gamma_2 \sum W_{ij} \times \ln IMPORT_{jt} + \gamma_3 \sum W_{ij} \times \ln GDPPC_{jt} + \gamma_4 \sum W_{ij} \times MO_{jt} \\ &+ \gamma_5 \sum W_{ij} \times OPEN_{jt} + \gamma_6 \sum W_{ij} \times KOF_{jt} + \gamma_7 \sum W_{ij} \times EI_{jt} + \mu_i + \nu_t + \varepsilon_{it} \end{aligned} \quad (2)$$

Table-2. Country clusters of spatial autocorrelation from 1995 to 2015 (cont.)

Quadrant / Country	I (High-High)	II (Low-High)	III (Low-Low)	IV (High-Low)
Philippines	1999***-2001*** 2007***-2015***	1995***-1998*** 2002***-2006***		
Poland	1996***,1998*** 2005***-2008*** 2011***	1995***,1997*** 1999***-2004*** 2009***,2010*** 2012***-2015***		
Romania	1995***,2008*** 2015***	1996***-2007*** 2009***-2014***		
Russia	2006-2015	1995-2005		
Saudi Arabia	1997** 2010**-2015**	1995**,1996** 1998**-2009**		
Singapore			1995,1997,2001 2002	1996,1998-2000 2003-2015
Switzerland	2013***,2015***	1995***-2012** 2014***		
Taiwan			1995-2013,2015	2014
Thailand	1997,1998 2006-2008 2010-2015	1995,1996 1999-2005,2009		
Turkey	2007***,2009*** 2011***-2015***	1995***-2006*** 2008***,2010***		
UAE	2006-2012 2014,2015	1995-2005,2013		
UK	1995*,1996,1997* 1998,1999,2001* 2003*,2004,2007 2008,2009*-2011* 2012-2014,2015*	2000,2002,2005 2006*		
US				1995***-2015***
Vietnam			1999-2001	1995-1998 2002-2015

Note: *Significance at level 0.1 **Significance at level 0.05 ***Significance at level 0.01.

Seo and Suh (2006) focused on Korean OFDI between from 1987 to 2002 on south-east Asian countries only. Hill and Jongwanich (2009) stressed that the major determinants for Korean OFDI include geographic proximity and ethnic familiarity. Our study also updated the changing patterns of Korean OFDI in comparison with the study of Kim (2000) which found that Korean OFDI to Asia jumped sharply from 1990 to 1996 and was the most important OFDI region while the USA is the 2nd. Our empirical findings signify that the USA was consistently the main destination of Korean OFDI during the period of this study.

Table-3. Model selection without spatial interaction effects on *OFDI*.

Determinants	No spatial & time-specific fixed effects	Spatial fixed effects	Time-period fixed effects	Spatial and Time-period fixed effects
Log likelihood	-1149.90	-1009.60	-1087.30	-951.7992
σ^2	2.2829	1.4600	1.8685	1.2152
R^2	0.5456	0.4320	0.5054	0.0875
LM test no spatial lag	142.1206*** (0.000)	58.4378*** (0.000)	0.3492 (0.555)	8.1908*** (0.004)
LM test no spatial error	68.7716*** (0.000)	12.0330** (0.001)	0.9510 (0.329)	10.0364*** (0.002)
robust LM test no spatial lag	73.4189*** (0.000)	59.1268*** (0.000)	11.1063*** (0.001)	1.9137 (0.167)
robust LM test no spatial error	0.0699 (0.791)	12.7220*** (0.000)	11.7081*** (0.001)	3.7594* (0.053)
LR-test joint significance spatial fixed effects	271.0527*** (0.0000)			
LR-test joint significance time-period fixed effects	115.6224*** (0.0000)			
Hausman test	-94.6079*** (0.0000)			

Note:
a. Figures in parentheses are the P-value.
b.*Significance at level 0.1 **Significance at level 0.05 ***Significance at level 0.01.

Table-4. Results estimated of SDM model with spatial and time-period fixed effects on OFDI.

Determinants	Spatial and Time-period fixed effects	Direct effect	Indirect effect	Total effect
$lnEXPORT_{i,t}$	0.6870*** (0.0000)	0.6768*** (0.0000)	0.1309 (0.7260)	0.8076** (0.0333)
$lnIMPORT_{i.t}$	0.3403*** (0.0083)	0.3024** (0.0220)	1.0527 (0.1080)	1.3551* (0.0516)
$lnGDPPC_{i,t}$	-0.8904*** (0.0000)	-0.8790*** (0.0002)	-0.5212 (0.5185)	-1.4002* (0.0872)
$MO_{i,t}$	0.0740 (0.2046)	0.0740 (0.1978)	-0.0120 (0.9400)	0.0620 (0.7202)
$OPEN_{i,t}$	0.1119 (0.6139)	0.0550 (0.8079)	1.4135* (0.0890)	1.4685* (0.0795)
$KOF_{i,t}$	-0.0153 (0.4906)	-0.0132 (0.5532)	-0.0264 (0.6808)	-0.0396 (0.5397)
$EI_{i,t}$	0.0527 (0.4710)	0.0297 (0.6952)	0.5798** (0.0310)	0.6095** (0.0312)
$W*lnEXPORT_{i,t}$	0.4209 (0.3771)			
$W*lnIMPORT_{i,t}$	0.4769* (0.0678)			
$W*lnGDPPC_{i,t}$	-1.0022 (0.3253)			
$W*MO_{i,t}$	0.0076 (0.9691)			
$W*OPEN_{i,t}$	1.8352* (0.0749)			
$W*KOF_{i,t}$	-0.0361 (0.6507)			
$W*EI_{i,t}$	0.7596** (0.0195)			
W*dep.var.	-0.3473*** (0.0011)			
Log likelihood	-935.92938			
σ^2	1.2243			

R^2	0.7716			
Wald test spatial lag	17.2047** (0.0106)			
LR test spatial lag	21.0709*** (0.0037)			
Wald test spatial error	15.2500** (0.0329)			
LR test spatial error	17.6631** (0.0136)			

Note:
a. Figures in parentheses are the P-value.
b.*Significance at level 0.1 **Significance at level 0.05 ***Significance at level 0.01

4. EMPIRICAL RESULTS

One of the most outstanding findings from Moran's I as exhibited in Table 2 and Figure 1 are that Korean OFDI has been broadening around the world. Interestingly, it is quite different from the findings of prior research. It is similar to the case of Japan but with a few years lapse. Germany was another important destination of Korean OFDI. The neighboring countries of Germany such as France, the Netherlands, Poland, and Romania were also important destinations of Korean OFDI. Indonesia has long been the main destination of Korean OFDI in the Asia-Pacific region. Australia and the Philippines appeared to be significant Korean OFDI-destination countries from the year 2000 onwards. Brazil also became an important Korean OFDI-destination country from 2005 consistently to 2015 see Table 1. In addition, the above results appear to be very different from the empirical finding of Fung et al. (2009) that distance deterred Korean investment. It is obvious that Korean OFDI has been expanding. Korean OFDI was not confined in the Asia-Pacific Region and had broadened into other continets according to the results of the Moran's *I*. Korean OFDI has now become a significant contributor to the global OFDI. Cleary, in observing the maps year by year from Figure1, the red-colored nations and, in particular, the pink-colored (High-Low) nations were increasing remarkably. Korean OFDI has expanded into many new markets and has significantly broadened into other regions. Meanwhile, mainland China was one of 30 largest host countries of Korean OFDI all the years studied and was categorized as High-High during the period of this study see Table 2 however, the estimation result signifies that it was relatively insignificant. This might be attributed to the geographic proximity to Korea, so it exported directly to mainland China. The facts with diverse patterns of OFDI indicate that spatial autocorrelation and spatial heteroscedasticity are apparent. The Moran's *I* test significantly discovers spatial autocorrelation, according to results of Table 1 and Figure 1. This highlights that spatial effects cannot be neglected.

As empirical results exhibited in Table 4, we estimated the direct and indirect effects to yield an interpretation of the spatial spillover effects with the reference of the model of LeSage and Pace (2009). The direct, indirect, and total effects of each explanatory variable are exhibited in Table 4 (column 3 to 5). Results denote that *EXPORT*, *Import*, and *GDPPC* all have a very significant direct effect and significant total effects to Korean OFDI. Also, *Open* and *EI* both have significant indirect and total effects while *MO* and *KOF* are insignificant.

The results of Table 4 show that Korean OFDI is highly and positively correlated to Korean international-trade (both imports and, in particular, exports) partner countries. It signifies that Korean OFDI complemented and strengthened its home country's exports through the export of parts and intermediate products. It could also have import-substituting effects. In addition, Korean OFDI has a significantly negative relationship with the *GDPPC* of the host country. This implies that Korean OFDI searched lower labor cost and built up a worldwide production network although some host countries of Korean OFDI with relatively higher *GDPPC*.

Both *OPEN* and *EI* had significant indirect effects and total effects. This provides a distinctive indication that Korean OFDI favored economies with a higher degree of trade openness. Furthermore, Korean OFDI chose its main trade-partner countries as export platforms, targeting their neighboring countries markets. Its OFDI has been taking advantage of free trade agreements with the recipient country of the region (economic integration).

In sum, we suggest that Korean OFDI decisions were a combination of determinants with statistical significance. Korean OFDI supported and strengthened its exports to these countries and their neighboring countries with significant indirect and total effects over the years. In light of the results of Moran's *I*, Korean OFDI reached and covered most countries in three regions: North American (Canada, USA and Mexico, so called NAFTA), the EU, and the Asia-Pacific region. Meanwhile, the empirical result also implied that it greatly underweighted its investment and opportunities in Africa continent, most South American, and South Asian countries.

Therefore, we concur the findings of the latest paper, La and Shin (2019) that Korean products have insignificant market shares in the above regions where it overlooked in comparison with those of mainland China. This is attributed to the more substantive OFDI from mainland China to Africa continent, most South American, and South Asian countries than that from Korea. Previous studies neglected the spatial and indirect effects. Our empirical findings stress that Korean OFDI expanded to more destinations in the three regions through the economic integration with indirect and total effects (spatial spillover effects). In sum, we conclude that it is more appropriate to utilize the spatial econometric techniques.

5. CONCLUDING REMARKS

This study sheds light on the importance of taking spatial effects into consideration in studying the geospatial distribution of OFDI and the key factors explaining the global pattern of a country's OFDI. While an understanding of changing spatial patterns of Korean OFDI has become increasingly important, to our knowledge, there have been no studies of the determinants of the geospatial distribution of Korean OFDI with the application of spatial econometric models. Thus, this paper is motivated to conduct the empirical testing by applying the spatial econometric method and panel data from Korea's 30 largest OFDI host countries from 1995 to 2015.

The contribution of this paper includes that it is more appropriate to apply the spatial econometric technique because the empirical evidences of this research are different from prior literature without taking spatial dependence and heteroscedasticity effects into account as discussed in the preceding section. Our empirical findings indicate that Korean OFDI decisions were a combination of determinants with statistical significance. While Korea's main trade-partner (exports and imports) countries and their GDP *per capita* are the major Korean outward foreign direct investment (OFDI) determinants, it is worthwhile to note that Korean OFDI favored economies with a higher degree of trade openness. Also, Korean OFDI used its main trade-partner countries as export platforms, targeting neighboring countries markets. Thus, its OFDI took advantage of the free trade agreements (economic integration) with the recipient countries in the region (spatial spillover effects). Though Korean OFDI has outstandingly expanded into North America, the European Union, South East Asian countries and mainland China markets, it has lagged behind that of mainland China in terms of the market competition on the developing countries including the South Asian, South America countries and Africa continent according to our empirical findings and the analyses of (La & Shin, 2019). Is it necessary and is it better to diversity its OFDI to other regions from the longer-term OFDI perspective? This provides important implications to the management of the corporate strategy and government policies.

Funding: This study received no specific financial support.
Competing Interests: The authors declare that they have no competing interests.
Acknowledgement: All authors contributed equally to the conception and design of the study.

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