The Dynamics of Foreign Portfolio Investment and Exchange Rates: An Interconnection Approach in ASEAN

Abstract

This paper examines the spatial dependence of foreign portfolio investment (FPI) inflows among ASEAN countries (Association of Southeast Asian Nations) in 2002Q1-2018Q4 utilizing the spatial econometric approach. This paper adds clarity to the identification of the true nature of portfolio investment performances.

I show a competitive relationship among ASEAN countries, indicating crowding out of FPI in the host country is most likely to occur when the neighboring country is experiencing a crowding out. I also show that exchange rate volatility and changes, both in the host country and neighboring country, do not significantly affect FPI in the host country.

Furthermore, I find that, aside from macroeconomic factors of the host country, foreign investors also consider the macroeconomic conditions in the neighboring country, suggesting the existence of spatial dependency. Robustness checks are conducted to confirm the main findings of this study.

Keywords: Foreign Portfolio Investment, Exchange Rates, Macroeconomics, Spatial Panel Econometrics, Spillover Effects

Yabancı Portföy Yatırımları ve Döviz Kurları Arasındaki Dinamikler: ASEAN Ülkeleri Arasında Bağlantılı Bir Yaklaşım

Özet

Bu makale, ASEAN ülkeleri (Güneydoğu Asya Ülkeleri Birliği) arasındaki yabancı portföy yatırımı (FPI) akımlarının mekansal bağımlılığını 2002Q1-2018Q4 dönemi için mekansal ekonometri yaklaşımı kullanarak incelemektedir. Bu makale, portföy yatırımı performanslarının gerçek yüzünün daha açık tanımlanmasına katkı sağlamaktadır.

ASEAN ülkeleri arasında bir rekabet ilişkisi bulunduğunu gösteriyorum, ki bu rekabet şu anlama gelir, komşu ülkede bir kalabalıklaştırarak kovulma etkisi sözkonusu olmuşsa büyük ihtimalle evsahibi ülkedeki yabancı portföy yatırımları da kalabalıklaştırarak kovulma etkisine tabii olacaktır. İlaveten, gerek evsahibi ülkedeki gerekse komşu ülkedeki döviz kuru oynaklığının ve değişimlerinin, evsahibi ülkedeki yabancı portföy yatırımlarını önemli bir ölçüde etkilemediğini gösteriyorum.

Ayrıca, yabancı yatırımcıların, evsahibi ülkedeki makroekonomik etkenlerin yanısıra, komşu ülkedeki makroekonomik şartları da gözönüne almakta olduklarını saptadım, bu da bir mekansal bağımlılık ilişkisinin mevcut olduğuna işaret eder. Bu çalışmanın temel bulgularının doğruluğunu belirlemek üzere ekonometrik sağlamlık kontrolleri yapılmışır.

Anahtar Kelimeler: Yabancı Portföy Yatırımları, Döviz Kurları, Makroekonomi, Mekansal Panel Veri Ekonometri, Yayılma Etkileri

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1 Background

Most of the countries in the Association of Southeast Asian Nations (ASEAN) are developing economies that require immense resources, such as foreign portfolio investment, to boost their economy. The expansion of foreign portfolios in ASEAN began after the 1990s when the stock and securities markets grew in importance to enhance economic growth. The trade agreement between ASEAN countries and the implementation of the ASEAN Comprehensive Investment Agreement (ACIA) in 2012 has led to increased investment flows to ASEAN, creating a liberal, transparent, and competitive investment environment in the region. Therefore, it is not surprising that foreign portfolio in terms of liabilities (FPI inflows) that going into ASEAN incrased nearly sixteenfold from US$ 3.2 billion in 2001 to US$ 51 billion in 2017

There have been debates on the impact of changes in exchange rates on foreign portfolio investment flows. Studies by Garg & Dua (2014), Srinivasan & Kalaivani (2015), Haider et al. (2016), Wong (2017), and Anggitawati & Ekaputra (2020) show that an appreciation in the exchange rate promotes portfolio investments. The reason is that foreign investors have access to additional returns, thus encouraging them to invest when the exchange rate appreciates. The opposite result was found by Bleaney & Greenaway (2001), which argue that the foreigners will be motivated to invest in the host country when there is a devaluation in the host country's currency due to higher returns. Studies by Baek (2006), Cenedese et al. (2014), and Singhania & Saini (2018) have different perspectives where they find no relationship between the exchange rates and portfolio investments by foreign investors. Moreover, Persson & Svensson (1989), Bleaney & Greenaway (2001), and Garg & Dua (2014) find that volatility in the exchange rate has a negative and significant impact on inducing portfolio investments.

Economic integration creates interdependence between countries with either abundance or lack of capital. It is also driving cross-border assets growth beyond the expansion of goods and services. With higher technological advancement and faster information exchange, geographical distances have become increasingly artificial. Coval & Moskowitz (2016) reported that asymmetric information makes geographic proximity beneficial for investors to be located near potential investments. They benefit from stock selection, meaning that geographic location, informed trade, and asset prices are closely related.

This paper will delve into areas that the literature has yet to scrutinize. To the best of our knowledge, existing literature has not adequately addressed the spatial inter-relation of FPI between regions and between one country and another. First, existing literature uses conventional methodologies, which hold geographical interdependence factors as exogenous when the FPI behavior is investigated empirically (Ahmed and Zlate, 2014; Garg and Dua, 2014; Haider et al., 2016; Rafi and Ramachandran, 2018; Singhania and Saini, 2018; and Srinivasan and Kalaivani, 2015). As those methods cannot capture the effects of third countries in examining the portfolio flow determinants (particularly in exchange rate dynamics), a spatial panel data model can overcome this problem. Studies that discuss FPI behavior influenced by third countries are still relatively rare, and the two that investigate the spatial relationship of FPI are by Chuang & Karamatov (2018) and Jory et al. (2018). Second, many studies have examined the FPI inflow determinants in an economic union, e.g., Baek (2006), for Asian and Latin American FPI inflow, Singhania & Saini (2018), Fratzscher (2012) for developed and developing countries' FPI inflow, Ghosh et al. (2014) and Ahmed & Zlate (2014) for developing countries' FPI inflow, and Waqas et al. (2015) for South Asian countries' FPI inflow). However, to this day, there is no research that related to the determinants of FPI for ASEAN countries.

This paper contributes to the literature in two crucial ways. First, this study adds significantly to the current literature on the broader aspects of spatial econometrics of FPI inflows from the perspective of the geographic investment phenomenon, especially for the ASEAN region. Jory et al. (2018) argue that due to the intertwined nature of demographic, location-specific, attachment-attributable factors with financial and economic variables, it makes these factors endogenously determine portfolio investment performance. Therefore, the discussions about the existence of spatial distribution of third country can no longer be ignored. Second, using the spatial spillover effect, this paper clarifies the true nature of portfolio investment performances in ASEAN. Our analysis provides evidence of the existence of the geographical interdependence of international investments in the ASEAN region, thus offering new insights for policy practices and financial investments.

Our empirical investigations, which are based on a panel dataset of ASEAN countries in 2002Q1-2018Q4, have unveiled several crucial findings: (i) I uncover that there is a competition effect between countries in ASEAN in attracting FPI - where the inflows of foreign portfolio investment in a particular country are significantly affected by the influx of FPI in neighboring countries; (ii) Second, our results suggest that the exchange rate dynamics in the host and the third country do not significantly affect FPI in the host country; and (iii) We find that aside from macroeconomic factors of the host country, foreign portfolio investors also contemplate the interlinkages among the ASEAN countries in their quest to invest in the most optimal location. Last, I find that the results are susceptible to the structure of the weighting matrix W.

This paper is organized as follows: Section II discusses the methodological aspects, which comprise data, variables, theoretical insight, and econometric specification. Section III discusses the estimation results. The last section provides the concluding remarks and policy implications.

2 Empirical Strategy

2.1 Data

I examine the FPI determinant factors in five ASEAN countries (Indonesia, Malaysia, Philippines, Singapore, and Thailand), focusing on the spatial dependence of ASEAN foreign portfolio investment (FPI) inflows. The data used is quarterly from 2002Q1-2018Q4. The dependent variable is FPI inflows for ASEAN represented by the data on net foreign portfolio purchases in terms of liabilities divided by the nominal gross domestic product (refer to Baek (2006), Rafi & Ramachandran (2018), Rai & Bhanumurthy (2004), Singhania & Saini (2018)). I use FPI in terms of liabilities to determine the ownership of foreign assets that enter into or exist in a country.

Ouedraogo (2017) uses a one-year change from the Spot exchange rate (percent) to capture exchange rate change. Also, I use exchange rate volatility to capture the risk of the exchange rate (as used in Rafi & Ramachandran (2018), Baek (2006), Ndou et al. (2017), Diebold (1988), Yu et al. (2007)). Following Ndou et al. (2017), this study examines the exchange rate risk implications from two main assumptions, specifically looking at the impact of expected and unexpected exchange rate risk on foreign portfolio investment in the ASEAN Region. With the definition based on the US Dollar, the expected exchange rate is captured through a 12-month moving variance of squared deviations of exchange rate changes. The unexpected exchange rate risk uses the GARCH model to capture the conditional variance of changes in exchange rates. The neoclassical theory advocates that capital flows respond to differences in interest rates between countries. Following Rafi & Ramachandran (2018), Singhania & Saini (2018), Bhasin & Khandelwal (2019), Garg & Dua (2014), for instance, I use the difference between the interest rate on the 10-year country-i government bond and the interest rate on the 10-year US government bond to represent the interest rate differential.

I use total export and import (as a percent of GDP) to denote trade openness (used by Singhania & Saini (2018), Alam et al. (2013), Fratzscher (2012), Qureshi et al. (2012)). I use the Real gross domestic product growth (%) to measure the country's economic conditions (Rafi & Ramachandran (2018), Singhania & Saini (2018), Vardhan & Sinha (2016)). The consumer price index represents inflation (Al-Smadi, 2018; Baek, 2006; Fratzscher, 2012). I also employ the indicator of Government Debt Rating Index by Standard & Poor's (S&P), where the scale is from 1 (lowest / D) to 22 (highest / AAA) from the global economy, following Luitel & Vanpée (2018), Fratzscher (2012), to represent the risk of default on debt issuers. FPI and trade openness data are taken from IMF. Data for exchange rate growth and volatility are derived from Bloomberg. Interest rate differential, GDP growth, and inflation are derived from the CEIC. Summary statistics of variables are reported in Table 1.

Variable	Explanation	Mean	Median	Std. Dev.
FPI	Foreign portfolio investment inflow is illustrated on net foreign portfolio purchase in terms of liabilities divided by nominal GDP	1.33	1.32	4.6
EXPSXR	Exchange rate volatility using moving variants for expected exchange rate risk and GARCH models for unexpected exchange rate risk	18.23	9.23	28.12
UNEXPSXR	GARCH models are used for unexpected exchange rate risk	0.26	0.17	0.31
SXRGROWTH	One-year change from the Spot exchange rate	-0.22	-0.18	6.98
IRD	Interest rate differential used the difference between the interest rate on 10-years government bond of the respective countries and the interest rate on 10-years US government bond	1.83	1.09	2.85
GDPGROWTH	The percentage of real GDP growt	5.14	5.2	2.95
OPENNESS	Trade openess is calculated from division between total trade (export and import) percentage of nominal GPD	156.26	127.73	118.67
INF	Inflation is illustrated by Consumer price index grown in percent	3.34	2.98	2.95
SP	Government Debt Rating Index by Standard & Poor's (S&P), where the scale is from 1 (lowest / D) to 22 (highest / AAA)	14.96	15	4.21

Table 1. *Data Statistics*

2.2 Spatial Econometric Model

This study extends the framework developed by Elhorst (2015) framework and Rafi & Ramachandran (2018) by examining the effects of third countries on FPI flows into ASEAN countries. This study uses three spatial models to check for the consistency of findings: (1) Spatial autoregressive model (SAR), which contains only the spatial lag term of the dependent variable (θ=0 and λ=0); (2) Spatial error model (SEM), which contains only the spatial lag of the error term (ρ=0 and θ=0); and (3) Spatial Durbin model (SDM), which contains both the dependent variable and independent variable spatial lag term (λ=0). The following equation shows the spatial panel empirical model used in the study:

$$FPI_{it} = \alpha + \rho \sum_{j=1}^{n} w_{ij} FPI_{jt} + \sum_{k=1}^{K} \beta_k x_{itk} + \sum_{k=1}^{K} \sum_{j=1}^{n} \theta_k w_{ij} x_{jtk} + \mu_i + \gamma_t + \epsilon_{it} \quad (1)$$

$$v_{it} = \lambda \sum_{j=1}^{n} w_{ij} v_{jt} + \epsilon_{it}$$

where FPI_{it} is the vector Nx1 FPI inflows into the host country ith $(i = 1, \dots, N)$ at time t $(t = 1, \dots, T)$, μ_i *and* γ_t are the spatial units of fixed effect and time-period fixed effect). x_{itk} is the characteristics of the ith host country at time tth in the independent variable k$(k = 1, \dots, K)$, w_{ij} is the spatial weight matrix NxN, where j≠i (j=1,…, N) standardized using row-normalized, where each row equals one total. $\rho . w_{ij} FPI_{jt}$ is the spatial autoregression and ρ acts as a spatial autoregressive coefficient to calculate how much impact incoming FPI in the neighboring country j has on the FPI entering the host country i. v_{it} is the Nx1 error-term vector of the host country to -ith at time t. $\lambda . w_{ij} v_{jt}$ is the spatial autocorrelation term. λ acts as the spatial autocorrelation coefficient to calculate how much impact the error-term shock of neighboring country j has on the host country i. The range of values for ρ and λ is from -1 to 1.

LeSage & Pace (2009) and Jing et al. (2017) suggest that using the point estimates from the spatial regression model to test for a spillover effect can give rise to a biased result. There may also be a feedback effect due to the impact of passing through neighboring countries and returning to the state itself. Therefore, LeSage &Pace (2009) propose the partial derivative interpretation to separate the estimated coefficients into direct and indirect effects.

2.3 Spatial Weight Matrix

To verify the robustness of the estimation results, I conduct alternative specifications. I propose three weighting methods, for which two are the spatial weight matrices based on the geographic correlation while the last is based on the economic correlation. The spatial weights based on geographic correlation are the inverse distance matrix (W1) and the 1-order binary contiguity (W2) matrix. The spatial weight based on economic correlation is the economic distance matrix (W3). Specifically, these three spatial weight matrices are structured as follows:

$$W_1 \begin{cases} \frac{1}{d_{ij}}, if\ i \neq j \\ 0\ , if\ i = j \end{cases} \tag{2}$$

$$W_2 \begin{cases} 1, if\ i\ and\ j\ are\ adjacent \\ 0\ , \quad otherwise \end{cases} \tag{3}$$

$$W_3 \begin{cases} \frac{1}{\left|\overline{GDP_i} - \overline{GDP_j}\right|}, if\ i \neq j \\ 0 \qquad , if\ i = j \end{cases} \tag{4}$$

where d_{ij} denotes the great circle distance between country i and country j. $\overline{GDP_i}$ refers to the average GDP of country i during the study period. I adopt the normalization procedure of row-normalized spatial weight matrix following Elhorst (2010) and Kelejian & Prucha (2010), which means that the rows sum up to 1 and their diagonal elements are set to 0, with $1/r_{min} < \rho < 1/r_{max}$ before normalizing and $1/r_{min} < \rho < 1$ after.

3 Results and Discussion

3.1 An Empirical Analysis for Model with Inverse Distance Weighting

I estimate the spatial panel model with inverse distance (W1) as the spatial weight matrix. The Wald and likelihood ratio (LR) test for the model with inverse distance (W1) as the spatial weight matrix shows that the fitting degree of the SDM under the space-and-time fixed effect is superior to the SAR and SEM models. I next consider the spatial Durbin model specification with W1 as the spatial weight matrix as reported in Table 2. Based on the Hausman test, the random effects are selected for the SDM model (SDM-RE) when using both the exchange rate risks (EXPSXR and UNEXPSXR) with W1 as the spatial weight matrix. The coefficient ρ generated in the SDM-RE estimation is the same as the SAR-FE model, which is significant and negative at the 1% level. Using the Hausman test, the random effect (RE) on the fixed effect (FE) was tested with spatial fixed effects and time periods for the SAR and SEM models. The test results show that the null hypothesis is rejected, which means that the fixed effects model is more appropriate than the random-effects model for the SAR and SEM models.

The result using the inverse distance weighting shows that there is a transfer of capital, where an increase in the inflow of FPI to neighboring countries reduces the inflow into the host country. Furthermore, a significant negative sign may also indicate due to the continuous selection of the study area without a white spot, the effects of third countries are more visible, although the study focuses on specific regions (Regelink & Paul Elhorst, 2015).

The results show that both exchange rate volatility variables have no significant effect on FPI inflows into ASEAN when using W1 as the spatial weight matrix. This is in line with Baek (2006), which states that real exchange rate volatility does not significantly affect foreign portfolio investment inflows into countries in Asia and Latin America. The SDM estimation result of the exchange rate change (SXRGROWTH) is also not significant. This is in line with Singhania & Saini (2018), which state an insignificant relationship between exchange rates and foreign portfolios in developing countries. According to Wong (2017), there is no real explanation for the relationship between exchange rates and stock price returns in Asia and Europe. Insignificant changes can also be caused by taking points from the daily average to the exchange rate variation every quarter since the exchange rate is a very volatile variable, which can differ from minute to minute (Cenedese et al., 2014).

Variable	Inverse distance weighting (W1) with UNEXPSXR as independent variable							Inverse distance weighting (W1) with EXPSXR as independent variable						
	OLS	SAR_FE	SAR_RE	SEM_FE	SEM_RE	SDM_FE	SDM_RE	OLS	SAR_FE	SAR_RE	SEM_FE	SEM_RE	SDM_FE	SDM_RE
IRD	0.547***	0.463***	0.284*	0.430***	0.332**	1.076***	0.898***	0.637***	0.518***	0.342**	0.476***	0.395***	1.072***	0.910***
	1.431	2.654	1.946	2.621	2.079	3.567	3.424	3.294	3.093	2.452	2.962	2.564	3.495	3.433
UNEXPSXR	1.341	0.802	0.086	0.971	0.324	-1.544	-1.693							
	-0.181	1.027	0.097	1.059	0.359	-1.126	-1.333							
EXPSXR								0.003	0.001	-0.009	0.002	-0.009	-0.013	-0.020
								0.294	0.148	-0.966	0.209	-0.945	-0.695	-1.289
SXRGROWTH	0.076	0.057	-0.030	0.086	-0.026	0.075	0.079	0.055	0.044	-0.033	0.071	-0.033	0.067	0.070
	-1.155	1.223	-0.808	1.579	-0.601	1.025	1.156	1.048	0.971	-0.906	1.339	-0.764	0.939	1.050
INF	-0.440***	-0.215*	-0.318***	-0.220	-0.379***	0.302	0.234	-0.414***	-0.196*	-0.312***	-0.193	-0.369***	0.292	0.254
	-3.280	-1.805	-3.041	-1.503	-3.097	1.496	1.343	-3.007	-1.649	-2.991	-1.322	-3.011	1.454	1.458
GDPGROWTH	0.050	0.072	0.243***	0.104	0.217***	0.093	0.138	0.060	0.078	0.231***	0.109	0.213**	0.089	0.137
	3.842	0.944	3.083	1.176	2.576	0.856	1.440	0.682	1.025	2.907	1.227	2.532	0.818	1.410
SP	0.477*	0.484**	-0.015	0.538**	-0.008	1.255***	1.017***	0.462*	0.473**	-0.010	0.533**	-0.023	1.265***	0.935***
	-0.877	2.133	-0.266	2.091	-0.040	2.607	2.942	1.739	2.062	-0.169	2.065	-0.108	2.567	2.702
OPENNESS	-0.006	-0.004	0.003	-0.011	0.002	-0.001	-0.018*	-0.007	-0.004	0.003	-0.010	0.002	-0.001	-0.015
	1.027	-0.347	0.755	-1.382	0.252	-0.042	-1.648	-0.525	-0.357	0.825	-1.285	0.362	-0.031	-1.364
W*IRD						3.884**	2.913**						3.662**	2.899**
						2.436	2.450						2.246	2.380
W*UNEXPSXR						-12.308**	-12.476**							
						-2.199	-2.390							
W*EXPSXR													-0.092	-0.116*
													-1.207	-1.727
W*SXRGROWTH						0.135	0.139						0.105	0.122
						0.460	0.521						0.355	0.453
W*INF						2.078***	1.907***						2.092***	2.017***
						3.482	3.550						3.441	3.641
W*GDPGROWTH						0.067	0.215						0.063	0.210
						0.200	0.712						0.187	0.687
W*SP						3.628*	2.601**						3.916	2.436**
						1.845	2.383						1.923	2.225
W*OPENNESS						-0.006	-0.043						0.003	-0.036
						-0.135	-1.294						0.070	-1.069
W*dep.var.		-0.712***	0.262***			-0.673***	-0.696***		-0.717***	0.260***			-0.666***	-0.687***
		-9.995	4.754			-9.358	-9.755		-10.084	4.711			-9.216	-9.582
spat.aut.				-0.749***	0.278***						-0.759***	0.271***		
				-10.661	5.041						-10.863	4.872		
teta			0.997***		0.000		0.997			0.997***		0.000		0.997***
			3.134		0.000		3.133			3.134		0.000		3.133
R2	0.450	0.643	0.162	0.442	0.162	0.664	0.407	0.447	0.645	0.164	0.438	0.163	0.659	0.398
LM spatial lag	52.865***							53.268***						
LM spatial error	50.983***							51.666***						
Robust LM spatial lag	3.182*							2.525						
Robust LM spatial error	1.300							0.924						
Wald test spatial lag						23.085***	24.162***						19.888***	22.566***
LR test spatial lag						24.137***	24.018***						22.344***	21.978***
Wald test spatial error						22.020***	22.623***						18.912***	20.727***
LR test spatial error						12.777*	21.25***						10.470	18.398***
Hausman Test		2896.595***		-591.725***		7.779			2192.9558***		-632.4818***		8.674	

Notes: The t-values are given in the parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance levels, respectively. LM means Lagrange multiplier. LR means likelihood ratio. All testing results of Lagrange multiplier and robust Lagrange multiplier are under the spatial fixed effect.

Table 2. *Estimation results of spatial panel model with inverse distance weighting*

The result shows a positive and significant interest rate differential coefficient (IRD) at the 1% level. This is in line with Garg & Dua (2014), Ghosh et al. (2014), Verma & Prakash (2011), and Ahmed & Zlate (2014), which establish a positive relationship between IRD and FPI inflows. The greater the difference in interest rates between the host country and the United States, the greater the draw for the entry of FPI into the host country. According to Qureshi et al. (2012), there is a positive relationship between interest rate differential and FPI. The neoclassical theory advocates that capital flows respond to differences in interest rates between countries. Specifically, capital will flow from countries with low returns (developed with abundant capital) to countries with high returns (developing with limited capital).

The estimation result using the SDM-RE model shows that the coefficient on the state debt rating (SP) is significant with a positive sign at the 1% level, indicating that government debt ratings help investors weigh risks when assessing sovereign debt investment, a higher (better) rating attracts foreign investors to the host country. This is in line with Luitel & Vanpée (2018) and Fratzscher (2012), which find that countries with poor government debt ratings experienced higher net capital outflows during a crisis. The estimation results of the SDM-RE model show that inflation (INF), trade openness (OPENNESS), and economic growth (GDPGROWTH) do not significantly affect FPI inflows in ASEAN countries. This is in line with Fratzscher (2012), Waqas et al. (2015), Kinda (2010), and Baek (2006).

The inclusion of the spatial relationship between the macroeconomic variables of the neighboring countries and the host country's FPI inflows using the SDM estimation results may produce bias conclusions. Therefore, I cannot interpret the estimates of Table 2 directly. A more concise interpretation needs to calculate and analyze the direct and indirect effects presented in Table 3. The analysis (of direct and indirect effects) is carried out to detect the feedback effect and spillover effect between neighboring countries and the host country. I estimate the direct effect from the model using W1. The result shows that exchange rate volatility and exchange rate change are not significant, which is similar to the estimation of the SDM. The direct effect of interest rate differential and government debt ratings is significant and positive at 5% and 10%, respectively.

Using inverse distance (W1), the feedback effect of unexpected exchange rate risk and expected exchange rate -0.457 and -0.382 respectively. Those numbers are obtained from the substraction of respective direct effect and estimated coefficient. From this result, I can observe that the feedback effect is relatively large. The negative value of the feedback effect indicates that an increase in the interest rate differential in the host country reduces the impact of increased FPI inflows into the host country, as a result of the impact of passing through neighboring countries before returning to the state itself. These differences are due to the feedback effect that arises as a result of the impact of passing the dependent variable to a neighboring country based on the nonzero elements in the matrix W and returning to that country (Jing et al., 2017).

The empirical evidence from the SDM estimation shows that the spatial lag coefficient of the independent variables is more supportive to the inference relationship interference relationship between the independent variables of the host country and the influx of FPI in neighboring countries than the indirect effect. This can be seen from the significance of each independent variables. The reason behind those results are probably due to the calculation of the indirect effect (spillover) depends on three parameters $(\rho, \beta_k, \theta_k)$, so that if one of the three parameters is not significant, there is a possibility that the indirect effect would likewise be insignificant (Jing et al., 2017). In the estimation of indirect effect with inverse distance (W1), inflation is the only variable that has a positive significant at the 5 percent level. This indicates that the increment of inflation in the host country, to some extent, can increase the inflow of FPI in neighboring countries with an elasticity of 1.383 and 1.434 when using unexpected and expected exchange rate risk, respectively.

	Inverse distance weighting (W1) with UNEXPSXR as independent variable			**Inverse distance weighting (W1) with EXPSXR as independent variable**		
	Direct Effects	Indirect Effects	Total Effects	Direct Effects	Indirect Effects	Total Effects
IRD	0.441**	1.815*	2.257**	0.528**	1.800*	2.328**
	2.795	2.232	2.680	3.262	2.322	2.827
UNEXPSXR	0.527	-8.989*	-8.462*			
	0.636	-2.434	-2.207			
EXPSXR				-0.003	-0.078	-0.081
				-0.282	-1.742	-1.677
SXRGROWTH	0.063	0.063	0.126	0.055	0.044	0.099
	1.317	0.344	0.669	1.105	0.246	0.511
INF	-0.110	1.383**	1.273**	-0.061	1.434***	1.373**
	-0.791	3.816	3.067	-0.454	4.131	3.436
GDPGROWTH	0.113	0.099	0.212	0.118	0.092	0.210
	1.489	0.492	0.970	1.466	0.446	0.917
SP	0.632*	1.530*	2.161**	0.631*	1.371	2.002*
	2.557	2.117	2.573	2.544	1.931	2.356
OPENNESS	-0.011	-0.025	-0.037	-0.010	-0.019	-0.029
	-1.503	-1.166	-1.449	-1.312	-0.861	-1.097

Notes: The t-values are given in the parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance levels, respectively.

Table 3. *The direct and indirect effects of spatial panel model with inverse distance weighting*

Lastly, I compare the estimation results of SDM with SAR and SEM using inverse distance weights. The results are the same as that for SDM. The estimation results of the SAR and SEM models with spatial fixed effects and periods (SAR-FE and SEM-FE) for the model with W1 as the spatial weight matrix are presented in Table 2. Like SDM, the SAR-FE model's estimation results show that the coefficient ρ is significant at a 1% level with a negative sign. The estimation results of the SAR and SEM models also show that FPI inflows are affected substantially by the interest rate differential and government debt ratings at significance levels of 1% and 5%, respectively. Meanwhile, the coefficient λ for the SEM-FE model is negative, indicating that the error-term in neighboring countries has a negative effect on FPI flows into the host country.

3.2 Robustness Checks

We also estimate the model using W2 and W3 as the spatial weight matrices for the robustness test. First, I estimate the spatial panel model with 1-order binary contiguity (W2). The Wald and likelihood ratio (LR) test from the model with W2 shows that the spatial Durbin model specification with the random effect when using the unexpected exchange rate risk and fixed effect when using the expected exchange rate risk, as reported in Table 4.

Variable	1-order contiguity weighting (W2) with UNEXPSXR as independent variable							1-order contiguity weighting (W2) with EXPSXR as independent variable						
	OLS	SAR_FE	SAR_RE	SEM_FE	SEM_RE	SDM_FE	SDM_RE	OLS	SAR_FE	SAR_RE	SEM_FE	SEM_RE	SDM_FE	SDM_RE
IRD	0.547***	0.521***	0.271*	0.431***	0.248	0.629***	0.587***	0.637***	0.560***	0.343**	0.469***	0.323**	0.644***	0.637***
	2.717	2.609	1.803	2.706	1.510	2.759	3.346	3.294	2.933	2.394	3.042	2.050	2.913	3.751
UNEXPSXR	1.341	1.086	0.016	1.270	0.021	1.040	1.285							
	1.487	1.214	0.017	1.394	0.022	1.156	1.546							
EXPSXR								0.003	0.013	-0.013	0.011	-0.014	0.013	0.015
								0.294	1.202	-1.312	1.013	-1.423	1.224	1.485
SXRGROWTH	0.076	0.059	-0.044	0.082	-0.035	0.056	0.077	0.055	0.051	-0.046	0.071	-0.038	0.059	0.074
	1.401	1.105	-1.168	1.511	-0.840	1.073	1.606	1.048	0.975	-1.250	1.331	-0.921	1.161	1.568
INF	-0.440***	-0.330**	-0.313***	-0.331**	-0.364***	-0.403***	-0.428***	-0.414***	-0.325**	-0.302***	-0.319**	-0.354***	-0.384***	-0.427***
	-3.210	-2.428	-2.903	-2.379	-3.043	-2.962	-3.424	-3.007	-2.394	-2.814	-2.291	-2.961	-2.835	-3.444
GDPGROWTH	0.050	0.124	0.282***	0.122	0.264***	0.154*	0.141*	0.060	0.125	0.262***	0.126	0.247***	0.154*	0.134*
	0.573	1.429	3.487	1.399	3.132	1.796	1.791	0.682	1.438	3.205	1.444	2.921	1.798	1.701
SP	0.477*	0.643**	-0.006	0.450**	-0.181	0.860***	0.614***	0.462**	0.678***	0.002	0.461**	-0.190	0.841***	0.639***
	1.819	2.474	-0.101	1.957	-0.874	3.133	2.693	1.739	2.585	0.026	1.996	-0.918	3.118	2.779
OPENNESS	-0.006	-0.011	0.002	-0.009	0.007	-0.011	-0.013**	-0.007	-0.010	0.003	-0.009	0.008	-0.010	-0.013**
	-0.510	-0.874	0.576	-1.345	1.117	-0.870	-2.033	-0.525	-0.845	0.665	-1.331	1.248	-0.835	-2.031
W*IRD						-0.917	0.279						-1.143**	0.137
						-1.561	0.992						-1.989	0.500
W*UNEXPSXR						-0.464	-0.944							
						-0.242	-0.583							
W*EXPSXR													0.025	0.016
													1.166	0.819
W*SXRGROWTH						0.114*	0.074						0.090	0.058
						1.740	1.291						1.368	0.986
W*INF						-0.554**	-0.311						-0.548**	-0.330
						-2.131	-1.340						-2.027	-1.353
W*GDPGROWTH						0.860***	0.743***						0.873***	0.737***
						5.199	4.821						5.262	4.762
W*SP						-0.825	-0.257						-0.572	-0.403**
						-1.105	-1.458						-0.785	-2.326
W*OPENNESS						-0.030	0.004						-0.021	0.015
						-1.343	0.282						-0.960	1.009
W*dep.var.		-0.193***	0.107**			-0.244***	-0.270***		-0.204***	0.114**			-0.252***	-0.274***
		-3.884	2.102			-5.251	-5.799		-4.122	2.246			-5.483	-5.888
spat.aut.				-0.270***	0.110**						-0.278***	0.111**		
				-5.636	2.123						-5.836	2.153		
teta			0.997***		0.000		0.997***			0.997***		0.000		0.997***
			3.134		0.000		3.134			3.134		0.000		3.134
R^2	0.450	0.532	0.107	0.446	0.107	0.589	0.286	0.447	0.534	0.112	0.440	0.113	0.592	0.284
LM spatial lag	99.397***							100.593***						
LM spatial error	95.589***							96.968***						
Robust LM spatial lag	4.111**							4.181**						
Robust LM spatial error	0.303							0.556						
Wald test spatial lag						36.165***	23.881***						37.298***	24.583***
LR test spatial lag						22.146***	23.251***						22.971***	23.918***
Wald test spatial error						34.523***	26.638***						35.484***	26.934***
LR test spatial error						19.452***	23.291***						18.849***	23.268***
Hausman Test		360.1277***		326.2535***		22.075			427.9590***		290.7662***		25.3352***	

Notes: The t-values are given in the parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance levels, respectively. LM means Lagrange multiplier. LR means likelihood ratio. All testing results of Lagrange multiplier and robust Lagrange multiplier are under the spatial fixed effect.

Table 4. *Estimation results of spatial panel model with 1-order contiguity weighting*

	1-order contiguity weighting (W2) with UNEXPSXR as independent variable			1-order contiguity weighting (W2) with EXPSXR as independent variable		
	Direct Effects	Indirect Effects	Total Effects	Direct Effects	Indirect Effects	Total Effects
IRD	0.570**	0.125	0.695*	0.797**	-1.199*	-0.402
	3.393	0.520	2.239	3.647	-2.379	-0.756
UNEXPSXR	1.421	-1.121	0.300			
	1.855	-0.779	0.189			
EXPSXR				0.010	0.020	0.030
				0.942	1.025	1.496
SXRGROWTH	0.069	0.051	0.120	0.047	0.070	0.118
	1.373	0.967	2.013	0.899	1.105	1.796
INF	-0.405**	-0.189	-0.594**	-0.332*	-0.417	-0.749**
	-3.223	-0.936	-2.615	-2.475	-1.697	-2.783
GDPGROWTH	0.053	0.646***	0.700***	0.060	0.760***	0.821***
	0.632	4.523	4.756	0.712	4.805	4.984
SP	0.667**	-0.394*	0.273	0.932**	-0.721	0.211
	2.777	-2.152	1.255	2.880	-1.056	0.377
OPENNESS	-0.014*	0.008	-0.006	-0.008	-0.017	-0.025
	-2.071	0.547	-0.461	-0.596	-0.833	-1.227

Notes: The t-values are given in the parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance levels, respectively.

Table 5. *The direct and indirect effects of spatial panel model with inverse distance 1-order contiguity weighting*

The coefficient ρ generated in the SDM estimation with W2 is mainly significant and negative at the 1% level. The SDM model using binary contiguity weighting shows that the results of the estimation of the effect of the interest rate differential and the government debt ratings in the host country on FPI inflows into the host country are the same as the model with W1, i.e., positive and significant. Furthermore, exchange rate volatility and the exchange rate change variables, as well as the host country's economic growth does not affect FPI inflows significantly. However, inflation and trade openness in the host country have a considerable negative effect on FPI flows into the host country at significance levels of 1% and 5%. The negative relationship between inflation and FPI inflows is also reported by Waqas et al. (2015) in China and India, as well as Al-Smadi (2018) in Jordan. It is rational that the higher the inflation in the host country, the lower is the real interest rate. This decreases the returns of foreign portfolio investors, thus discouraging them from investing in the host country. I find no systematic evidence of a negative relationship between trade openness and FPI inflows when using the unexpected exchange rate risk as an independent variable with the model W2 as the spatial weight matrix. This is in line with Ahmed Hannan (2017), which establishes a negative relationship between trade openness and FPI in 34 emerging markets and developing economies. In addition, according to Fratzscher (2012), there are several indications that the more open a country's finances are, the greater the capital outflows. According to Alwafi (2017), the trade openness of a country negatively impacts the economy in developing countries that specialize in low-quality export products (primary consumer products), which are vulnerable to trade shocks. However, when using the expected exchange rate risk as an independent variable with the model W2 as the spatial weight matrix, I find that the trade openness variable does not significantly affect FPI inflow.

I also analyze direct and indirect effects for the model with W2, results for which are presented in Table 5. The estimation of the direct effects in the model with W2 are different from the W1 model. The variable of interest rate differential, inflation, and government debt ratings have a significant effect at the 5% level. Meanwhile, the variable interest rate differential and government debt ratings have a significant effect at the 5% level when using the expected exchange rate risk as to the independent variable

The feedback effects of the variable interest rate differential, inflation, and government debt ratings are relatively small, amounting to -0.017, -0.022, and 0.053 when using unexpected exchange rate risk and the feedback effect of the variable interest rate differential and government debt rating 0.153 and 0.091 when using expected exchange rate risk. For the estimated spillover (indirect) effect in the model with W2, only the economic growth variable is significant and positive, which is the same as the SDM estimate. This is because investors think that increased economic growth in the host country will increase the economic growth of neighboring countries.

In comparing the estimation results of SDM with SAR and SEM, I also conduct a robustness test for the model using 1-order binary contiguity (W2) as the spatial weight matrix. The results are the same as SDM, except for the trade openness variable when using the unexpected exchange rate risk as an independent variable, showing that it did not significantly affect FPI inflows into ASEAN. Similar to SDM, the estimation results of the SAR-FE model show that the coefficient ρ is significant at the 1% level with a negative sign. Likewise, the SEM-FE model shows the results of the coefficient λ which is negative.

Second, I estimate the spatial panel model with economic distance (W3) as the spatial weight matrix. Results from the Wald and likelihood ratio (LR) test from the model with W3 show that the spatial Durbin model specification with the fixed effect is used when using both of the exchange rate risks, as reported in Table 6. The coefficient ρ generated in the SDM estimation with W3, is the same as the model with W1 and W2 as the spatial weight matrices, i.e., significant, and negative at the 1% level.

The SDM model using economic distance weighting shows that the results derived from the estimation of the effect of the interest rate differential and the government debt ratings in the host country on FPI inflows into the host country are the same as those for the model with W1 and W2, which are positive and significant. Furthermore, exchange rate volatility and the exchange rate change variables, as well as economic growth in the host country do not affect FPI inflows significantly. On the other hand, inflation, economic growth, and trade openness in the host country have a pronounced effect on FPI inflows into the host country at the significance level of 1%.

Variable	Economic distance weighting (W3) with UNEXPSXR as independent variable							Economic distance weighting (W3) with EXPSXR as independent variable						
	OLS	SAR_FE	SAR_RE	SEM_FE	SEM_RE	SDM_FE	SDM_RE	OLS	SAR_FE	SAR_RE	SEM_FE	SEM_RE	SDM_FE	SDM_RE
IRD	0.547***	0.591***	0.285*	0.612***	0.345**	0.993***	0.972***	0.637***	0.665***	0.361***	0.675***	0.431***	1.063***	1.031***
	2.717	2.824	1.934	3.316	2.123	3.906	4.484	3.294	3.312	2.565	3.735	2.752	4.458	5.003
UNEXPSXR	1.341	1.236	0.101	1.441	0.320	1.594	1.559							
	1.487	1.321	0.113	1.398	0.355	1.208	1.365							
EXPSXR								0.003	0.005	-0.012	0.008	-0.013	0.015	0.013
								0.294	0.475	-1.281	0.633	-1.321	0.961	1.039
SXRGROWTH	0.076	0.068	-0.039	0.086	-0.024	0.033	0.050	0.055	0.051	-0.043	0.071	-0.032	0.027	0.044
	1.401	1.210	-1.059	1.403	-0.557	0.469	0.785	1.048	0.939	-1.190	1.174	-0.752	0.380	0.697
INF	-0.440***	-0.412***	-0.338***	-0.431***	-0.406***	-0.408**	-0.411***	-0.414***	-0.389***	-0.331***	-0.406***	-0.389***	-0.380**	-0.387**
	-3.210	-2.888	-3.192	-2.825	-3.201	-2.318	-2.699	-3.007	-2.729	-3.129	-2.669	-3.068	-2.187	-2.556
GDPGROWTH	0.050	0.093	0.284***	0.167*	0.260***	0.334***	0.325***	0.060	0.099	0.269***	0.171*	0.253***	0.313***	0.308***
	0.573	1.018	3.578	1.810	3.105	3.099	3.532	0.682	1.088	3.355	1.848	3.025	2.894	3.363
SP	0.477*	0.580**	-0.025	0.714**	-0.066	1.521***	1.422***	0.462*	0.578**	-0.017	0.733***	-0.086	1.588***	1.478***
	1.819	2.125	-0.422	2.558	-0.304	4.007	4.428	1.739	2.095	-0.288	2.605	-0.399	4.087	4.564
OPENNESS	-0.006	-0.008	0.003	-0.017**	0.004	-0.040**	-0.038***	-0.007	-0.008	0.003	-0.017**	0.005	-0.040**	-0.039***
	-0.510	-0.595	0.772	-1.996	0.581	-2.498	-4.050	-0.525	-0.599	0.860	-1.977	0.728	-2.476	-4.181
W*IRD						1.380**	1.456***						1.336**	1.418***
						1.957	2.895						1.994	2.994
W*UNEXPSXR						0.069	0.103							
						0.027	0.045							
W*EXPSXR													0.026	0.026
													0.922	1.030
W*SXRGROWTH						-0.144	-0.130						-0.093	-0.081
						-0.954	-0.955						-0.628	-0.615
W*INF						0.015	-0.063						0.029	-0.054
						0.035	-0.168						0.065	-0.143
W*GDPGROWTH						1.642***	1.485***						1.496***	1.344***
						4.452	4.630						4.109	4.289
W*SP						2.751***	2.733***						2.984***	2.976***
						3.334	3.732						3.582	4.063
W*OPENNESS						-0.048	-0.020						-0.045	-0.023
						-0.689	-0.549						-0.661	-0.621
W*dep.var.		-0.262***	0.280***			-0.324***	-0.435***		-0.274***	0.273***			-0.335***	-0.444***
		-3.769	5.403			-4.701	-6.382		-3.941	5.242			-4.857	-6.524
spat.aut.				-0.503***	0.272***						-0.511***	0.265***		
				-7.337	5.114						-7.471	4.942		
teta			0.997		0.000		0.997***			0.997***		0.000		0.997***
			3.134		0.000		3.134			3.134		0.000		3.134
R^2	0.450	0.495	0.146	0.441		0.563	0.278	0.447	0.494	0.148	0.436		0.562	0.274
LM spatial lag	13.451***							13.742***						
LM spatial error	16.277***							16.624***						
Robust LM spatial lag	5.963**							7.033***						
Robust LM spatial error	8.789***							9.915***						
Wald test spatial lag						40.956***	46.082***						40.552***	46.082***
LR test spatial lag						42.111***	43.312***						41.766***	43.281***
Wald test spatial error						34.492***	35.938***						33.712***	35.398***
LR test spatial error						31.648***	34.958***						30.669***	34.553***
Hausman Test		208.4702***		-353.6599***		107.5210***			210.4253***		-363.4490***		94.8957***	

Notes: The t-values are given in the parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance levels, respectively. LM means Lagrange multiplier. LR means likelihood ratio. All testing results of Lagrange multiplier and robust Lagrange multiplier are under the spatial fixed effect.

Table 6. *Estimation results of spatial panel model with economic distance weighting*

	Economic distance weighting (W3) with UNEXPSXR as independent variable			Economic distance weighting (W3) with EXPSXR as independent variable		
	Direct Effects	Indirect Effects	Total Effects	Direct Effects	Indirect Effects	Total Effects
IRD	0.570**	0.125	0.695*	0.797**	-1.199*	-0.402
	3.393	0.520	2.239	3.647	-2.379	-0.756
UNEXPSXR	1.421	-1.121	0.300			
	1.855	-0.779	0.189			
EXPSXR				0.010	0.020	0.030
				0.942	1.025	1.496
SXRGROWTH	0.069	0.051	0.120	0.047	0.070	0.118
	1.373	0.967	2.013	0.899	1.105	1.796
INF	-0.405**	-0.189	-0.594**	-0.332*	-0.417	-0.749**
	-3.223	-0.936	-2.615	-2.475	-1.697	-2.783
GDPGROWTH	0.053	0.646***	0.700***	0.060	0.760***	0.821***
	0.632	4.523	4.756	0.712	4.805	4.984
SP	0.667**	-0.394*	0.273	0.932**	-0.721	0.211
	2.777	-2.152	1.255	2.880	-1.056	0.377
OPENNESS	-0.014*	0.008	-0.006	-0.008	-0.017	-0.025
	-2.071	0.547	-0.461	-0.596	-0.833	-1.227

Notes: The t-values are given in the parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance levels, respectively.

Table 7. *The direct and indirect effects of spatial panel model with economic distance weighting*

I further analyze the direct and indirect effects for the model with W3 and the results are presented in Table 7. In the estimation of the direct effects of the model with W3, I find that the variables of interest rate differential, inflation, government debt ratings, and trade openness have impacts. However, the feedback effects of interest rate differential, inflation, government debt ratings, and trade openness are relatively small, amounting to 0.094, -0.016, 0.199, and 0.002 when using unexpected exchange rate risk and 0.093, -0.018, 0.225, and 0.002 when using expected exchange rate risk. The estimated spillover effect (indirect) in the model with W3 shows that economic growth and the government debt ratings are significant and positive.

In comparing the estimation results of the SDM with SAR and SEM, I conduct a robustness test in the model using economic distance (W3) as the spatial weight matrix. The results are similar to the SDM, except for the variables of trade openness and economic growth, wherein for the SEM, I see that trade openness of the host country significantly affects the inflow of FPI into ASEAN while it is not significant for the SAR. The economic growth of host countries does not significantly affect FPI inflows into ASEAN for the SAR and SEM. The estimation results of the SAR and SEM models with spatial fixed effects and time periods (SAR-FE and SEM-FE) are presented in Table 6. The estimation results of ρ in the SAR-FE model show a significant coefficient of 1% with a negative sign. In addition, the sign of the coefficient λ for the SEM-FE model is negative.

There is evidence that when the inverse distance matrix is used as a spatial weight; the feedback effect is relatively large. Conversely, when the 1-order binary contiguity matrix is used as a spatial weight, the feedback effect is relatively small. This is probably because the use of the inverse distance weight places a value for the distance between capital cities for neighboring countries and hence, the effect of passing through neighboring countries and returning to the country is greater. Meanwhile, the weightage that uses the 1-order binary contiguity only has a spatial impact for countries that share state boundaries. Therefore, the effect of passing through neighboring countries and returning to the country is smaller. When considering spatial correlation based on the economy (economic distance), the results of the spillover effect show more linkages between the macroeconomic variables of the host country and changes in FPI flows into neighboring countries, as compared to using the geographical correlation. This is understandable because investors are more considerate of economic linkages between neighboring countries than the geographical linkages in their decisions to invest in a country.

4 Conclusions and Policy Implications

Our empirical investigations have derived several crucial findings. First, there is a competitive relationship in FPI between ASEAN countries, implying a crowding out of FPI in the host country, which is most likely to occur when the third country also experiences a crowding out in its FPI inflows. Second, I found that exchange rate volatility and exchange rate changes, both in the host country and neighboring country, have no significant impact on FPI inflows for the host country. Third, this study shows a spatial correlation between the independent variables and FPI inflows. This indicates that the factors attracting foreign portfolio investment flow into the host country are conditionally determined by the macroeconomic conditions in the host as well as the neighboring countries. Such macroeconomics imbalance, overheating economics and unstable currency, are prone to encourage FPI outflow. Lastly, I found that the results are sensitive to the structure of the weight matrices since the effects of the independent variables on FPI inflows are inconsistent among the different weight matrices.

In terms of policy practices, our empirical results have several implications. First, the negative spillover effects of foreign portfolio inflows into neighboring countries imply that there is strong competition between countries in ASEAN vying for FPI. In cases where the neighboring countries have better prospects, foreign capital may exit the host country and flow into those neighboring economies. It is, therefore, imperative for a country to maintain and enhance its competitiveness, investment business environment as well as macroeconomic conditions. This could be happened by improving ease of doing business such as easier tax administration, international-trading facilities, and strong investor legal protection.

Second, in order to increase the positive spillover effects for economic growth, there is a need for cooperation among the ASEAN countries for greater economic integration. This could take many forms such as free trade area, investment agreement, and union of the respective country's customs. Third, the positive spillover effect on inflation and the negative result on the host inflation variable implies that a country should try to maintain its inflation rate. In particular, central banks play an important role in controlling the inflation rate through their mandate of upholding price stability which would ultimately lead to attracting foreign portfolio investments. Last, the role of the government is important for encouraging foreign portfolio capital inflows into the ASEAN countries, through its role in maintaining and consistently improving the quality of its debt securities and government bond ratings as well the differentials in the bond interest rates with the United States.

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