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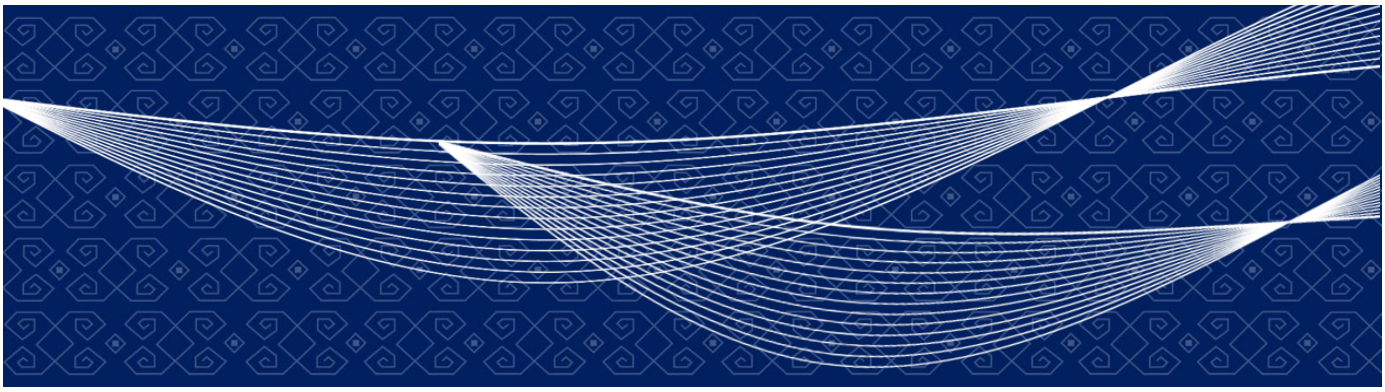

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CAPITAL FLOW AMID THE COVID-19 PANDEMIC: CROSS-COUNTRY CONTAGION EFFECT AMONG ASEAN5 AND PROJECTION OF THE IMPACTS FOR THE INDONESIAN ECONOMY

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Capital Flow amid the COVID-19 Pandemic: Cross-Country Contagion Effect among ASEAN5 and Projection of the Impacts for the Indonesian Economy

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Abstract

Worldwide investment flow has been greatly disturbed by the pandemic, especially for emerging economies. this paper aims to: (1) Investigate the contagion effect of foreign portfolio investment, foreign direct investment, financial derivatives investment, and other investment flow among ASEAN5 countries in the context of pre and during the COVID-19 Pandemic, and (2) study the effects of the Pandemic on sectoral foreign direct investment and GDP of Indonesia. We use spatial econometrics, local projection, and panel vector autoregressive methods to achieve the objectives of this study. The data used are quarterly country-level data for ASEAN5 member countries from 2015Q1 to 2020Q4 and sectoral and regional-level data of Indonesia from 2000Q1 to 2021Q2. Out spatial model estimation results show that Equity FPI tends to be the most contagious type of investment both during the Pandemic period and in the normal period. The derivative investment follows in second with debt FPI in third. FDI tends to only be contagious during the Pandemic period while another investment is not found to have a contagiousness effect at all both in normal times and in the Pandemic period. In regards to sectoral FDI, this research finds that the impacts of the Pandemic vary among the economic sectors. Agricultural and manufacturing sectors tend to experience mixed effects from the Pandemic, while all sub-sectors in the utility and service sector were negatively and significantly affected by the COVID-19 Pandemic in at least one quarter from 2020Q1 to 2021Q1. Moreover, the COVID-19 Pandemic also affects the relation between FDI and GDP: The COVID-19 Pandemic causes FDI to have less impact on GDP. Furthermore, the signaling of the possibility of economic crises caused by the COVID-19 Pandemic masked the effect of the GDP on the FDI.

JEL Code: E22, F21, G11, G15

Keywords: COVID-19, Capital Flow, Spatial Econometrics, ASEAN, Indonesia

1 Introduction

The COVID-19 Pandemic is a health crisis that has introduced an unprecedented shock to the global economy. The Pandemic disrupts supply chains, hinders global manufacturing and service sectors (Kouam, 2020; Sapulette and Santoso, 2021). The pandemic has also adversely affected global capital flows. Altogether, the change of international gross capital inflow and

outflow plunged from 975 billion USD and 1065 billion USD in 2019 to 359 billion USD and -38 billion USD in 2020, respectively.

Authorities took various fiscal, monetary, and public health measures to help the financial sector rebound from the sharp economic decline caused by the pandemic (Kouam, 2020). Fiscal and monetary stimulus as a response to COVID-19 effectively encourages investors' confidence by reducing bond yields and boosting stock prices (Beirne *et al.*, 2020). In contrast, Sapulette and Santoso (2021) and Shanaev et al. (2020) found that national lockdown policies and monetary and fiscal stimulus give counterproductive measures or have no significant effect on the financial market. Therefore, there is still much ongoing debate concerning the impact of policy interventions on capital inflow.

The Pandemic severely impacts both emerging and developed economies Fernandes (2020). Yet, emerging countries are more at risk of a large negative impact because of "lower health care capacity, larger informal sectors, shallower financial markets, less fiscal space, and poorer governance" (Loayza and Pennings, 2020). The adverse impact of the COVID-19 Pandemic on capital flow can be more harmful to the economy of emerging countries. This is due to the essential role of capital flow in supporting their economic growth (Abbes *et al.*, 2015).

When countries are highly connected or have similar economic characteristics, there could exist contagiousness of capital flow movements. This is highly likely especially when a similar shock happen in that group of countries (Goldstein and Pauzner, 2004). The high degree of interdependence in economic activity between countries opens up opportunities for adverse economic consequences from the spread of COVID-19 through the infected workers, the shattered supply chains, and the fall of aggregate demand for commodities (Tisdell, 2020). The adverse economic contagion consequences from the spread of COVID-19 are especially a vital issue in an economically connected region of developing countries with a high population and high COVID-19 infection rate like southeast Asia. The COVID-19 shock is a completely of an unexpected and unimaginable kind-different from pervious shocks such as the trade war between the U.S. and China in the Trump era and the 2008-2010 global financial crisis. Due to the novel nature of the COVID-19 Pandemic, we expect countries to show more contagiousness in terms of their capital flow movements.

The Association of Southeast Asian Nations (ASEAN) is composed of 11 economies. Together, the 11 economies of ASEAN account for the fifth largest GDP in the world in 2019. Population-wise, ASEAN accounts for around 9% of the world population. Of the 11 ASEAN countries, Indonesia, Malaysia, Philippines, Thailand, and Singapore are grouped as ASEAN5. These five countries are the most powerful economies in the region. (ASEAN Secretariat, 2019).

The COVID-19 Pandemic has caused a great disturbance for the investment climate and cross-country flow of capital in ASEAN countries. Even before the pandemic, foreign investment in ASEAN has already slowed down. This is due to the increased risk of trade tension. In 2018, foreign equity portfolio stock decreased by 25.1% while debt portfolio stock was stagnant, as major US and E.U. investors pulled out. U.S. and E.U. investors hold about 65.5% of the ASEAN equity portfolio and 65.2% of the debt portfolio in 2019 (Association of Southeast Asian Nations (ASEAN), 2020).

The severity of the COVID-19 Pandemic shock on investment and the overall economy is made worse by the interconnectivity of ASEAN economies, especially because the same groups of investors dominate ASEAN economies. This is especially the case with regards to the flow of equity and debt portfolio investment (Association of Southeast Asian Nations, 2020).

Previous studies have discussed the cross-country contagion effect of a financial crisis like the shock on foreign investment flow. Goldstein and Pauzner (2004) studied the contagion of self-fulfilling financial crises. They found that "Following a crisis in one country, agents' wealth is reduced. They are less willing to bear the strategic risk that originates in the unknown behavior of other agents in the other country. As a result, they have a higher tendency to run in the second country. This means that the occurrence of a crisis in one country increases the probability of a crisis in the other."

Yarovaya *et al.* (2020) studied the financial contagion effect of the COVID-19 Pandemic. They highlighted four main levels of information transmission, which are: (i) the state of COVID-19 Pandemic, (ii) media attention, (iii) spillover effect of the financial market, and (iv) the macroeconomic fundamentals. Ruiz Estrada, Koutronas, and Lee (2020) formulated an analytical framework to comprehend "the spatiotemporal patterns of epidemic disease occurrence, its relevance, and implications to financial markets activity." Their analytical framework highlights the same pattern of the impact of the COVID-19 Pandemic across the ten stock markets used in their sample. Nguyen *et al.* (2021) investigated the effect of the U.S and China equity markets on global equity markets during the COVID-19 Pandemic. Their study found a significant contagion effect across the global equity market during the pandemic.

However, these existing studies have not given much focus the contagiousness of foreign investment (direct, portfolio, financial derivatives, and other) flow of emerging economies. Empirical studies that compare investment contagiousness during and before the Pandemic are also currently nonexistent.

On another note, foreign direct investment (FDI) has important roles for emerging economies like Indonesia. Based on the Neoclassical Growth Theory, the FDI may bring many benefits to the economy such as bringing new technologies and absorbing employment. Despite this, the contribution of the FDI has been only about 2% to the gross domestic product in the Indonesian economy since 2010 (Badan Pusat Statistik, 2021). To increase capital inflow from FDI, the Indonesian government issued Law No. 11 the Year 2020 which aims to accelerate more capital inflow from FDI. This may be an indication that the government acknowledges FDI as an important engine to drive Indonesia's economy.

Thus far, the implementation of the new regulation might have not given a significant impact on FDI in Indonesia. The COVID-19 pandemic might have slowed FDI flow to Indonesia. In 2020, the total realized FDI in Indonesia amounted to USD 28,67 billion, a 1.62% increase compared to USD 28.21 in 2019 (Badan Pusat Statistik, 2020). Since the FDI also plays an important role in the economy, the lower growth of the FDI is expected to lower the economic growth in Indonesia. Moreover, there is still uncertainty about the end of the COVID-19 Pandemic. This raises an issue about the impact of the COVID-19 Pandemic on the FDI in the short and long run in the Indonesian economy.

Regarding the impact of the COVID-19 pandemic on FDI, few literature have investigated such issue. OECD (2020b) investigated the impact of the COVID-19 Pandemic on FDI using global data in the early periods of the pandemic. Camino-Mogro and Armijos (2020) investigated the impact of mobility restrictions caused by the COVID-19 Pandemic on FDI in Ecuador. Chaudhary, Ghimire and Ghimire (2020) investigated the impact of the COVID-19 pandemic on FDI in Nepal. Moreover, Ho and Gan (2021) also investigated the impact of the COVID-19 pandemic on the FDI using general samples of 142 countries. However, currently, there is hardly any research about this issue for the Indonesian economy specifically. Thus, it is relevant to investigate the effect of the COVID-19 pandemic on the FDI in Indonesia.

The COVID-19 Pandemic may also affect the relationship between GDP and FDI. Previous literature has investigated the relationship between FDI and GDP, but the effect of the COVID-19 pandemic has never been investigated on such a relationship. For example, Abbes *et al.* (2015), Sinha and Sengupta (2018), Sinha, Tirtosuharto and Sengupta (2019), and Owusu-Nantwi and Erickson (2019) only investigated the relation between FDI and GDP. Investigating the impact of the COVID-19 Pandemic on the relation between FDI and GDP is important to see the effectiveness of the impact of the FDI on the GDP or the impact of the GDP on the FDI during the Pandemic.

The COVID-19 Pandemic also has triggered recessions with varying severity in most sectors. The pandemic impacted the flow of investment to economic sectors differently: Many are harmed, yet the Pandemic does not even harm some. This is due to the nature of the Pandemic that mainly restricts human mobility. Thus, the impacts mostly happened to sectors that rely heavily on this, such as the transportation and tourism sectors (Loayza and Pennings, 2020; Ozili and Arun, 2020). The impact of the pandemic can also be different for the sectors having abundant investment from FDI such as manufacturing and primary products sectors (OECD, 2020b). Moreover, the different sectors may vary in the relationship between GDP and FDI (Chenery, 1959; Gönel and Aksoy, 2016). Thus, it is important to see the effect of the COVID-19 Pandemic on the FDI as well as the Pandemic's impact on the relationship between GDP and FDI among Indonesia's economic sectors.

All in all, this paper aims to: (1) Investigate the contagion effect of foreign portfolio investment, foreign direct investment, financial derivatives investment, and other investment flow among ASEAN5 countries in the context of pre and during the COVID-19 Pandemic, and (2) study the effects of the Pandemic on sectoral foreign direct investment and GDP of Indonesia.

We use spatial econometrics, local projection, and panel vector autoregressive methods to achieve the objectives of this study. The data used are quarterly country-level data for ASEAN5 member countries from 2015Q2 to 2020Q2 and sectoral and regional-level data of Indonesia from 2000Q1 to 2021Q2. Out spatial model estimation results show that Equity FPI tends to be the most contagious type of investment both during the Pandemic period and in the normal period. The derivative investment follows in second with debt FPI in third. FDI tends to only be contagious during the Pandemic period while another investment is not found to have a contagiousness effect at all both in normal times and in the Pandemic period. In regards to sectoral FDI, this research finds that the impacts of the Pandemic vary among the economic sectors. Agricultural and manufacturing sectors tend to experience mixed effects from the

Pandemic, while all sub-sectors in the utility and service sector were negatively and significantly affected by the COVID-19 Pandemic in at least one quarter from 2020Q1 to 2021Q1. Moreover, the COVID-19 Pandemic also affects the relation between FDI and GDP: The COVID-19 Pandemic causes FDI to have less impact on GDP.

This paper is organized into five sections. The following section discusses the conceptual foundation of this paper. Data end methods are explained in the third section. Section four contains the estimation results and their analysis. Finally, conclusions are presented in the last section.

2 Literature

This section lays out the theoretical and empirical basis from previous studies for this research. We provide a theoretical framework of the contagion effect of crisis through capital flow channels and the underlying theory of the relationship between FDI and economic growth. Furthermore, we also draw from previous literature the behavior of capital flow and the policy responses that might affect it during the pandemic period. Our conceptual framework, along with our hypotheses, is also presented in this section.

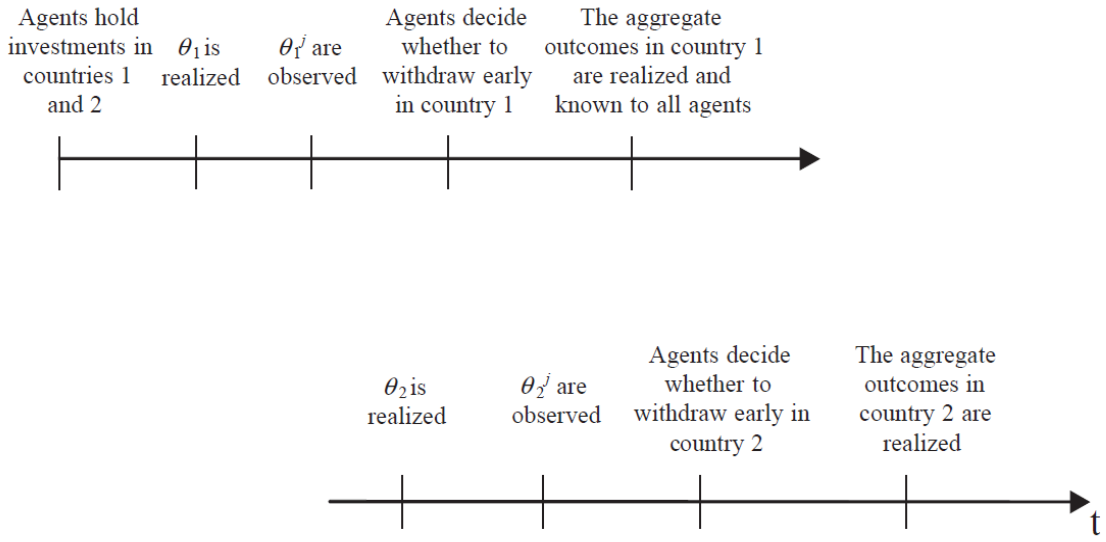


Figure 1 Financial Contagion Model
Source: Goldstein and Pauzner (2004)

2.1 Transmission of Crisis Through Capital Flow

Goldstein and Pauzner (2004) built and examined a model of financial contagion between two countries that have independent fundamentals but share the same group of investors. Their model shows that a financial crisis in one country will increase the likelihood of a financial crisis in the second country. Their reasoning lies in the "wealth effect."

According to the model of Goldstein and Pauzner (2004) (Figure 1), "An agent decides when to withdraw her investment in country i after receiving information about the fundamentals in that country. The fundamentals θ_1 and θ_2 are independent and drawn from a

uniform distribution on [0,1]." They thus assume that "the fundamentals are not publicly reported. Instead, each agent *j* obtains a noisy signal θ_i^j on the fundamentals of country *i*, where $\theta_i^j = \theta_i + \varepsilon_i^j$ with ε_i^j being error terms which are uniformly distributed over the interval $[-\varepsilon, \varepsilon]$ and independent across agents and countries." This model states that in most instances, if no one withdraws their investment in one country early, then everyone will obtain a higher return by keeping their investment until the investment matures. On the other hand, if everyone withdraws early, the long-term return is reduced to below early withdrawal. Because of this, investors might coordinate on withdrawing early in a country, i.e., a mass withdrawal of investments, thus causing a financial crisis. And since different countries share the same group of investors, the realization of investment withdrawal in one country can induce the same even in another country because of worldwide portfolio diversification. This theory highlights the increased contagion effect through the channel of capital flow for countries that share the same group of investors, especially in a crisis period.

Using panel data estimation of a dataset comprised of emerging and developing economies, Hannan (2017) studied the determinants of, and nature of various instruments of capital flow post the 2008 global financial crisis. His findings highlight the different behavior of capital flow and its determinants during normal and crisis periods, "sensitivity of some flows, towards push and pull factors, increases during periods of extreme capital flows. The gap between the U.S. long- and short-term maturity bond yields — insignificant during normal times — is important during high capital flow episodes."

Ramelli and Wagner (2020) investigated the impact of the COVID-19 shock on U.S. firms' stock prices. They found that the U.S. exposure to COVID-19 created uncertainty in U.S. financial markets and prompted investors to withdraw their shares from the U.S. to Chinese financial markets.

Baker *et al.* (2020) discussed that the U.S. stock market volatility reaction affected by COVID-19 is greater than previous pandemics. Ali, Alam, and Rizvi (2020) also suggested that the volatility of stock markets in China is relatively calm, with lower volatility during both epidemic and pandemic periods. However, the volatility of the U.S., UK, Germany, and South Korea stock markets increases when Coronavirus moves from epidemic to pandemic stage, supporting recent work (Al-awadhi *et al.*, 2020).

Zhang, Hu, and Ji (2020) suggested that the negative shock in the U.S. market encourages the plunge of stock markets in Europe and Asia, which means that the COVID-19 Pandemic has a spillover effect through the global financial markets. With a more focus on the contagion effect during the pandemic, Okorie and Lin (2021) investigated proves the existence of fractal contagion effect of the COVID-19 Pandemic in the stock markets of the top 32 COVID-19 affected economies. Their analysis using DCMA and DCCA shows the existence of a "significant but short-lived contagion effect in the stock markets as a result of the COVID-19 pandemic, which is observed both in the stock market returns and volatilities."

In studying international capital flow, we can distinguish among push and pull factors. In the context of a financial crisis Fratzscher (2012) found that push factors (or common factors) are the main drivers of capital flow during crisis, while country specific determinants (“pull factors”) are more dominant during non-crisis period. Similar findings are presented in the paper by Baek (2006) which studies push and pull factors affecting capital flow in Asian

economies during and post the 2008 GFC. Baek (2006) furthermore elaborates on the tendencies of Asian economies to experience large swings during crisis because of the dominant push factors during crisis.

Despite the number of studies that have focused on the contagion effect of COVID-19 in the financial market, there has not been much focus on capital flow. Moreover, the investigation with a focus on developing countries has yet to exist.

2.2 FDI and Growth

Researchers worldwide use multitudes of approaches across the globe in empirically examining the relationship between these two variables. An analysis of the relationship between FDI and economic growth was carried out by Abbes *et al.* (2015) using a country-level aggregate of FDI and GDP. They used Co-integration and panel Granger causality test to empirically test the relationship. A unidirectional causality from FDI to GDP is found. A matching finding is put forward by Owusu-Nantwi and Erickson (2019). They used data from 10 South American countries and employed a panel VECM model. A long-run positive and significant relationship from FDI to GDP growth is found using the Pedroni cointegration test. Using a more traditional approach of Pooled OLS estimation, Adams (2009) found a positive and significant impact of FDI on economic growth in a panel of Sub-Saharan African economies from 1990 to 2003.

Using regional-level data of FDI in certain countries, evidence of the impact of FDI on economic performance has been displayed in literature. Yao (2006) investigates the effect of FDI on economic performance in China by using an unbalanced panel of province-level data from 1978 to 2000. By employing Pedroni's panel unit root test and Arellano and Bond's dynamic panel data estimation, he found that FDI has a strong and positive effect on economic growth. A similar study by Hong (2014) that uses data of 254 prefecture-level cities in China from 1994-2010 with dynamic GMM estimation also found a positive and significant impact of FDI on economic growth. However, a slightly different result was found in a study conducted using regional-level data from Egypt by Hanafy and Marktanner (2019). They found that aggregate and sectoral FDI do not have an unconditional effect on economic growth. Instead, the positive and significant impact of service sector FDI on economic growth only exists when the host governorate "has a minimum threshold of domestic private investment to absorb foreign knowledge and technology."

In an industry and firm-level data setting, a host of empirical articles has investigated the relationship between industry-level FDI and the performance of that industry. Using the static panel data method, Vu, Gangnes and Noy (2008), Vu and Noy (2009), Wang (2009), Cipollina *et al.* (2012) all found a strong, robust, positive, and significant impact of sectoral FDI on the sectoral economic growth. Khaliq and Noy (2007) studied the impact of FDI on economic growth using sectoral data for FDI inflow to Indonesia spanning 1997 to 2006. Their research found a positive and significant relationship of FDI on sectoral growth at the aggregate level. However, when accounting for the differences in sectoral growth, the significant impact of FDI is no longer apparent.

On the other side of the literature body, several articles that employ the dynamic panel data method in estimating the relationship between sectoral FDI and sectoral economic output are also present. Sinha and Sengupta (2018) investigate the sector-specific dynamic impacts of FDI inflow on industrial productivity on a comparative basis between developed and

developing countries. Using dynamic GMM with sampled global data from 1970 to 2015, they found that FDI inflows significantly support industrial growth in developed and developing countries; however, the relationship is bi-directional. The degree of influence is higher in developed countries. Using cross-country industry-level data and the same method, Doytch and Uctum (2011) examined the effect of manufacturing and service FDI (foreign direct investment) on their sector growth, the spillover to the other sectors, and the overall economy in host countries. They concluded that a shift from manufacturing to service FDI is likely to lead to deindustrialization in certain regions and types of economies if nonfinancial FDI spearheads this shift.

Chakraborty and Nunnenkamp (2008) used panel VECM to assess industry-specific relation between FDI and economic growth in one country setting with industry-level data. Their empirical estimation result suggests a variation of the impact of FDI: FDI stocks and output are mutually reinforcing in the manufacturing sector, whereas any causal relationship is absent in the primary sector. FDI in the services sector appears to have promoted growth in the manufacturing sector through cross-sector spillovers.

The COVID-19 Pandemic also has triggered recessions with varying severity in most countries. The Pandemic impacted economic sectors' growth and the flow of investment to those sectors differently: Many are harmed, yet the Pandemic does not even harm some. This is due to the nature of the Pandemic that mainly restricts human mobility. Thus, the impacts mostly happened to sectors that rely heavily on this, such as transportation and tourism (Loayza and Pennings, 2020; Ozili and Arun, 2020). Therefore, the different sectoral FDI may also vary in their effect on economic growth.

Research investigating the impact of the COVID-19 Pandemic on the sectoral FDI and economic growth has not been conducted for the Indonesian economy. Several previous studies, such as one by Khaliq and Noy (2007), have investigated the relationship between sectoral FDI and sectoral growth. However, the impact of the COVID-19 Pandemic on the FDI has not been investigated. Most of them also do not employ a dynamic panel approach. Thus, the previous research could not assess the impact of shocks on these two variables of interest, especially in the sectoral-level setting.

2.3 The behavior of Capital Flow

A large body of literature has investigated capital flow determinants, especially in developing and emerging countries. These studies have identified several country-macroeconomic and also international factors that affect the flow of capital across countries.

Tille and van Wincoop (2010) developed the implications of portfolio choice for net and gross international capital flows in a simple two-country setting using the dynamic stochastic general equilibrium model. They focused on the time-variation in portfolio allocation following shocks and the resulting flows. Their research finds that the endogenous time variation in expected return is the key determinant of capital flows.

De Vita and Kyaw (2008) investigated the relative significance of the determinants of FDI and portfolio flows to developing countries using a sample of five countries from 1976 to 2001 and by employing the structural vector autoregression method. Their research emphasizes the importance of real economic variables such as output in source and destination country as the most important forces explaining capital flows to developing countries. In line with De Vita

and Kyaw (2008), several other studies have also emphasized the importance of links between countries when studying capital flows. With a focus on emerging economies, Vo (2018) examined the determinants of capital flows by analyzing the flow of FDI into Vietnam by employing a fixed effect panel and dynamic GMM estimator. His research is focused on country characteristics and the bilateral relationship between the source and destination country. His findings highlight the importance of inflationary risk, bilateral trade link, and stock market volatility.

Similarly, by using a dataset from emerging economies, Byrne and Fiess (2016) considered global and national determinants of capital flows. Using panel data estimation, his research found commodity prices, U.S. rates of return, uncertainty, and growth in advanced economies as the global determinants of capital flows. Financial openness and institutions' quality are the key national factors affecting capital flows.

2.4 Capital Flow, COVID-19, and Policy Responses

In responding to the economic shock caused by the Pandemic, several studies have laid out evidence of the effect of fiscal, monetary, and public health policies on capital flows and the overall economy. Kouam (2020) found that the different policy interventions would create varying financial effects for emerging and developing economies.

Gormsen and Koijen (2020) stated that fiscal stimulus helped lift the negatively shocked stock markets in the U.S. and the E.U. during the COVID-19 Pandemic. This is in line with Beirne *et al.* (2020) that highlighted fiscal and monetary stimulus effectiveness in reducing capital flow dynamics during the Pandemic.

Regarding the public health policies, Zhao (2020) found that the containment measures made by governments lead to employment and investment decline, while the expansionary monetary policy temporarily reduces the negative impact of those containment policies on employment investment.

Hördahl and Shim (2020) examined the dynamics of capital flow during the COVID-19 Pandemic from the side of the bond portfolio outflows. They found a link between bond portfolio outflows with currency depreciation and long-term domestic interest rate increases in emerging market economies (EMEs). Moreover, they also highlighted policy responses in playing an important role in stabilizing the financial system during the bond outflows period in EMEs. On the other hand, Shanaev, Shuraeva, and Ghimire (2020) found that national lockdown policies and monetary or fiscal stimulus give counterproductive measures to the financial market, while targeted regional lockdowns can be an effective policy.

OECD (2020b) investigated the foreign direct investment flows in the time of COVID-19 using a world dataset. The research projected that the FDI fell by more than 30% in 2020 using an optimistic scenario. Moreover, the FDI flows to developing countries were expected to drop even more than developed countries since the sectors that had been severely impacted by the COVID-19 pandemic, including manufacturing and primary sectors, had a larger share of their FDI.

Ho and Gan (2021) investigated the impact of the COVID-19 pandemic on the FDI using 142 samples of countries. The research applied a world pandemic uncertainty index (WPUI) to

measure the pandemic, including the COVID-19 pandemic. The research found that the COVID-19 pandemic had a negative effect on the FDI.

Camino-Mogro and Armijos (2020) investigated the impact of the COVID-19 pandemic on the FDI in Ecuador. The research found that the restriction in mobility caused by the COVID-19 reduced the FDI inflows. Also, Chaudhary, Ghimire, and Ghimire (2020) investigated the impact of the COVID-19 pandemic on the FDI in Nepal. The research found that the COVID-19 pandemic could reduce the FDI commitment in Nepal. Most of the research limited the analysis only to the effect of the COVID-19 pandemic on the FDI. The research did not answer the short-run and long-run effects of the COVID-19 Pandemic on the FDI. Also, the impact of the COVID-19 pandemic on the sectoral FDI was not investigated.

3 Empirical Strategy

This section explains the empirical strategy that we use to achieve the two objectives of this study.

3.1 Empirical Strategy: Transmission of Crisis Through Capital Flow

3.1.1 Econometrics Specifications

In investigating the impact of the COVID-19 Pandemic on the flow of capital among neighboring countries, we adopted the two-regime spatial Durbin model developed by Paul Elhorst and Fréret (2009). The spatial Durbin model occupies an interesting position in the field of spatial econometrics. It is the reduced form of a model with cross-sectional dependence in the errors, and it may be used as the nesting equation in a more general model selection approach. The spatial Durbin model is of great value to access either a static model, a dynamic model, or a model with residual dependence.

The two-regime spatial econometrics approach allows us to investigate the degree of connectivity of capital flow among countries in the normal (before the Pandemic) period and during the COVID-19 Pandemic. Dummy variable approach is used in this two-regime model, where the value of one indicates the COVID-19 Pandemic period and 0 indicates the normal period. The econometrics specification of our model is shown by equation (1).

$$y_{it} = \delta_1 d_{it} \sum_{j=1}^{N} w_{ij} y_{jt} + \delta_2 (1 - d_{it}) \sum_{j=1}^{N} w_{ij} y_{jt} + \alpha + \boldsymbol{X}_{it}\beta + \sum_{j=1}^{N} w_{ij} x_{jt}\,\theta + \mu_i + \tau_t + \varepsilon_{it} \quad (1)$$

Where y_{it} represents either one of the six types of foreign investments that are the focus of this study (direct, portfolio-total, portfolio-debt, portfolio-equity, financial derivatives, and other) of country i $(i = 1, \dots, N)$ at time t $(t = 1, \dots, T)$. x_{it} is a 1 × K vector of the independent variables, with the associated parameters β contained in a K × 1 vector. d_{it} is defined as a binary variable that takes the value of 0 if no covid periods (normal times) country i at time t, and 1 for covid periods. The variables $d_{it} \sum_{j=1}^{N} w_{ij} y_{jt}$ and $(1 - d_{it}) \sum_{j=1}^{N} w_{ij} y_{jt}$ denote the interaction effects of the foreign capital flow in the host country with the foreign capital flow in neighboring countries, which belong, respectively, to the first and second regimes. Whereas w_{ij} is the spatial weight matrix NxN, where j ≠ i (j = 1,…, N) row-normalized, $\sum_{j=1}^{N} w_{ij} x_{jt}$ denotes a 1 × K vector of spatially lagged control variables

representing the interdependence of country *i* with the control variables of countries *j*. Lastly, α is the intercept, ε_{it} are independently and identically normally distributed error terms for all i and t with zero mean and variance σ^2, $\mu_i \; and \; \tau_t$ are the spatial units of fixed effect and time-period fixed effect. To avoid dummy variable traps, we assume that $\sum_i \mu_i = \sum_t \tau_t = 0$. The main parameters of interest, δ_1 and δ_2, respectively, are the coefficients of spatial lag dependent variable related to the first (d_{it}) and the second regime $(1 - d_{it})$, where:

$$d_{it} = \begin{cases} 1 \text{ for covid periods} \\ 0 \text{ for no covid periods} \end{cases}$$

We specifically focus on the parameters δ_1 and δ_2. The significance and magnitude of these two parameters help us in answering hypothesis 1 in section two. If δ_2 is significantly greater than δ_1 then our hypothesis of increased contagion effect through portfolio investment flow during the COVID-19 Pandemic is proven. Otherwise, if δ_2 is significantly greater than δ_1 then the pandemic instead decreases the contagion effect through the channel of portfolio investment. If both of these parameters are insignificant, then there is no significant difference of contagion effect among the countries in our sample during normal or the pandemic period. It is worth noting that there are three separate dependent variables (either equity flow, debt flow, and the combination of both) which will be estimated separately.

3.1.2 The Model: Data and Variables

The data used in this paper is comprised of quarterly data of foreign investment position growth (quarter-to-quarter) from Indonesia, Malaysia, Philippines, Thailand, and Singapore spanning from the second quarter of 2015 to the second quarter of 2020.

The independent variables are selected based on the model developed by Baek (2006) and from the theory of financial contagion of Goldstein and Pauzner (2004). *gdp_qtq* Represents the level of economic growth. *ch_ir* is the change in the money market rate. The change in the money market rate represents the increase or decrease in the return expected by the investors. But on the other side, the money market rate can also represent the cost of the loan for the real sector, which can give negative sentiment for the investors in the long run (Hofmann, Shim and Shin, 2020; Hördahl and Shim, 2020; Li *et al.*, 2020; Zhao, 2020). Similarly, the level of inflation as measured by the quarterly growth of GDP deflator (*def_qtq*) can have to opposite impact on investors. On the one hand, an increased level of inflation can signal a better-performing economy, while on the other hand, it can also erode investors' real returns on their investments (Byrne and Fiess, 2016; Vo, 2018). For the change in real effective exchange rate variable (*ch_xr*), an upward movement (appreciation) is expected to draw in capital flow to a country since investors have more to gain compared to in their home country (Vo, 2018). The ratio of a country's current account balance to its GDP represents the degree of economic openness of that country. The more open an economy is, the higher is the likelihood for a investment to flow into that country (Baek, 2006).

Table 1 Variable Description

Variable Symbol	Variable Name	Unit	Source	Expected Sign	Reference
fpi	QTQ Foreign Portfolio Investment Growth	Percent	IMF IFS		(De Vita and Kyaw, 2008; Tille and van

Variable Symbol	Variable Name	Unit	Source	Expected Sign	Reference
debt	QTQ Foreign Debt Portfolio Investment Growth	Percent	IMF IFS		Wincoop, 2010; Hördahl and Shim, 2020)
equity	QTQ Foreign Equity Portfolio Investment Growth	Percent	IMF IFS		
fdi	QTQ Foreign Direct Investment Growth	Percent	IMF IFS		
other	QTQ Foreign Other Investment Growth	Percent	IMF IFS		
derivative	QTQ Foreign Financial Derivative Investment Growth	Percent	IMF IFS		
gdp_qtq	QTQ GDP Growth	Percent	ADB	Positive	(De Vita and Kyaw, 2008)
ch_ir	Change in Money Market Rate	Percent	IMF IFS	Positive or Negative	(Hofmann, Shim and Shin, 2020; Hördahl and Shim, 2020; Li *et al.*, 2020; Zhao, 2020)
def_qtq	QTQ GDP Deflator Growth (Inflation)	Percent	BIS	Positive or Negative	(Byrne and Fiess, 2016; Vo, 2018)
ch_xr	Change in Effective Exchange Rate Broad Index	Change in Index (upward movement is appreciation)	BIS	Positive	(Byrne and Fiess, 2016; Vo, 2018)
5spread	5-Year Country i Sovereign Bond Yield Minus 5-Year U.S. Sovereign Bond Yield	Percentage Point	Investing.com	Positive or Negative	(Vo, 2018)
cab_gdp	Current Account Balance Per GDP	Percent	IMF IFS, CEIC, ADB	Positive	(Baek, 2006)

3.1.3 Estimation Methods and Robustness Checking Strategy

To check for the robustness of the estimation results, we use two different weighting matrices and two distinct estimation methods. For the main estimation (for each of the three separate dependent variables) we use the bilateral goods trade matrix and fixed-effect estimation of equation (1) following (Behrens, Ertur and Koch, 2010). The weighting matrix is formed using the total USD value of goods traded among the five ASEAN countries in the sample from 2015 to 2019. The year corresponds to the start of the observation sample and the latest available data for bilateral trade, respectively. The weighting matrix is row-normalized as per (Elhorst *et al.*, 2014). A set of secondary estimations are also performed to show the robustness of the first estimation. These estimations alter the weighting matrix used, the estimation method, or both. Additional weighting matrix used for robustness checking is the

total number of airplanes travelers among the five countries from 2015 to 2019. In comparison, the other estimation method is the pooled estimation. Thus, there are four estimations performed for each of the dependent variables, with estimation using trade matrix and fixed-effect method is taken as the main estimation for inference.

3.2 Empirical Strategy: FDI and Growth

3.2.1 Method

This research uses a Local Projection Estimation (LPE) to investigate the effect of the COVID-19 pandemic on the FDI for each sector. The uncorrected Local Projection Estimation (LPE) is applied using the approach by Teulings and Zubanov (2014) since the corrected LPE model could not be estimated because of the perfect multicollinearity problem. The LPE is modeled as follows:

$$y_{t+k-1} = \delta_{0k} + \sum_{m=1}^{M} \delta_{1mk}\, y_{t-m} + \sum_{l=1}^{L} \delta_{2lk}\, d_{t-l} + {}_{v_{tk}} \qquad (2)$$

Where y is the vector of FDI variable, t is time trend, d is the dummy variable (1 if the period of COVID-19 Pandemic and 0 otherwise), m is number lag of y, l is number lag of d, k is the time horizon of the impact of the COVID-19 pandemic[1]. Since the time horizon for k is not long enough, it is expected to create less bias in the LPE estimation (Teulings and Zubanov, 2014). Moreover, equation (2) is estimated for each economic sector.

Furthermore, the impact of the shock from the COVID-19 Pandemic on FDI and GDP is estimated using the model, as follows.

$$\begin{aligned} FDI_{jt} &= \alpha_j + \sum_{k=1}^{K} \beta_k GDP_{j,t-k} + \sum_{k=1}^{K} \gamma_k FDI_{j,t-k} + w_{jt} \\ GDP_{jt} &= \phi_j + \sum_{k=1}^{K} \chi_k GDP_{j,t-k} + \sum_{k=1}^{K} \theta_k FDI_{j,t-k} + e_{jt} \end{aligned} \qquad (3)$$

Equation (3) will be estimated using a panel vector autoregression (PVAR) using three groups of periods: (1) Including all periods, (2) periods of before pandemic only, and (3) periods after the start of the COVID-19 Pandemic. The estimation for each sector using groups of periods as applied in equation (2) cannot be applied because the insufficient of observation after the COVID-19 Pandemic. Equation (3) is estimated using the Arrelano-Bond estimator to control for the endogeneity problem by applying the Generalized Method of Moment (GMM). The error term in these two equations is uncorrelated with past values of the regressors, and the estimator exploits additional moment conditions by using a list of instruments that vary with t (see Setiawan et al. (2012)). Thus, the model uses instrumental variables of the lags of the endogenous variables, assuming that these are uncorrelated with the error terms at time t. The number of appropriate lags in the PVAR model is determined using the criteria of coefficient of modified Akaike Information Criterion as proposed by Andrew and Lu (2001). Because this research uses an unbalanced panel dataset, a Fisher-type test of Augmented

[1] The time horizon is limited only for 5 periods, since the COVID-19 affected Indonesian economy from quarter 1 of 2020 until quarter 2 of 2021.

Dickey-Fuller (ADF) (Maddala and Wu, 1999; Choi, 2001) is applied to test whether the null hypothesis of a unit root (nonstationary) for all panels of each variable in (2)-(3) is rejected in the level form. Panel cointegration test and panel error correction model will be applied if one or more variables are not stationary at the level form (see Pedroni, 1999; Kao, 1999; Shin et al., 1999).

3.2.2 Data

The FDI is a foreign capital inflow taken from the Indonesian Investment Board (BKPM). This research uses the quarterly period of data from 2000Q1 to 2021Q2. From quarter 1 of 2020 to quarter 2 of 2021 is identified as the COVID-19 Pandemic period. Gross domestic product is taken from the Indonesian Central Statistics Agency. The GDP and FDI are deflated by the consumer price index. The FDI variable applied in the model is measured by the ratio between FDI inflows and GDP (Wang, 2009). The model applies the natural logarithm of the GDP as the measure of the GDP.

This research uses 19 subsectors in which the FDI has been reported and matched with sectoral data of GDP in BPS. The 19 subsectors are grouped into extracting sector, manufacturing sector and utility and service sector. Table 2 shows the descriptive statistics of the GDP and FDI variables across sectors and periods. The GDP and FDI variables had high variation across sectors and periods (larger than 1). GDP and FDI had coefficients of variation of 1.373 and 1.849, respectively.

Table 2 Descriptive Statistics (in Billion Rp)
for 19 Indonesian Economic Sectors from 2000Q1-2021Q2

Variable	Mean	Standard Deviation	Coefficient of Variation	Minimum	Maximum
GDP	168174.51	230944.45	1.373	1816.759	1493461.8
FDI	5832.669	10783.263	1.849	0	101456.51

Notes: FDI = foreign direct investment.
GDP = Gross Domestic Product.
Source: Indonesian Bureau of Central Statistics and authors' calculation

4 Result and Analysis

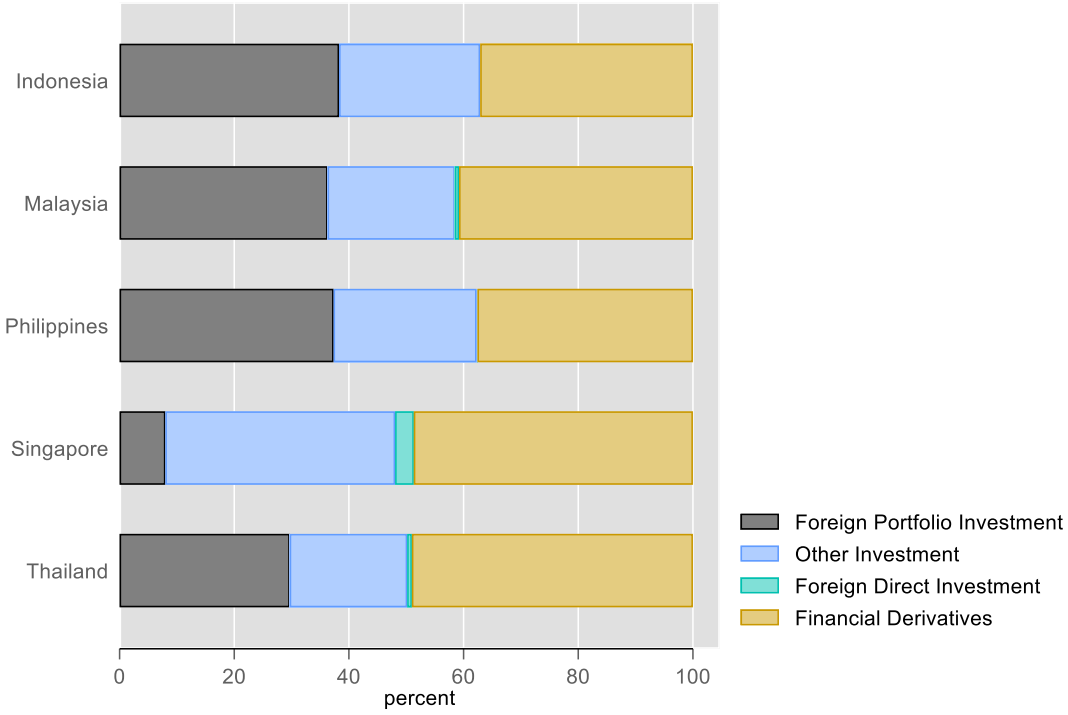


Figure 2. Average Composition of Foreign Investment of ASEAN5 Countries 2015Q2-2021Q2

This figure presents the quarterly average of foreign investment position from the (liability section of) international investment position account of Indonesia, Malaysia, Philippines, Thailand, and Singapore from 2015Q2-2021Q2.

Foreign investment of ASEAN5 economies is dominated by portfolio investment and other investment. Portfolio investment includes debt and equity investment while other investment includes trade credits, loans, currency, deposits, etc. The different pattern of foreign investment composition for Singapore, which can be seen to have larger domination of other investment composition, can be linked to its position as one of Asia's main financial hubs. From Figure 3, we can also infer that more liquid investment tends to have larger composition in a country's liability side of its international investment position.

In regards to the foreign investment development (Figure 4), portfolio, other, and financial derivatives investments tend to show decline in their flows. This can be seen from the flatter slope of these three graphs in Figure 4 since 2018. During the Pandemic period, these three investments also experienced sharp decrease from their base level (2015q2 value in the graph) in the early periods but then recovers in 2021.

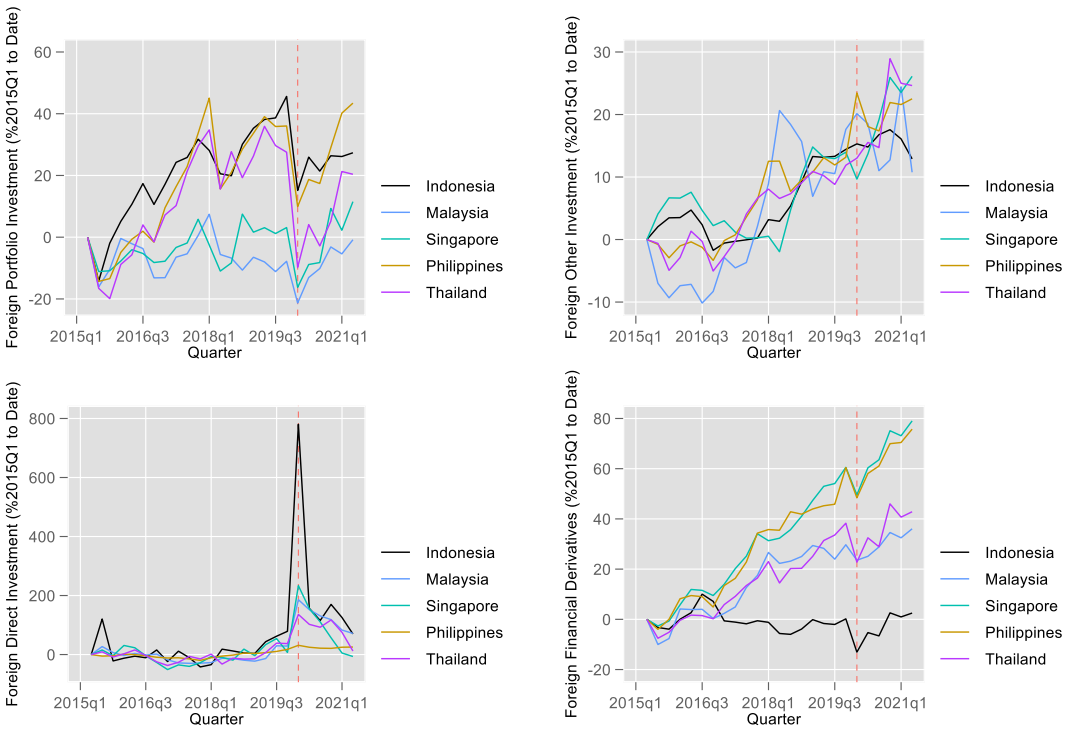


Figure 3. Foreign Investment Development

This figure presents the growth of foreign portfolio, other, direct, and financial derivative investments relative to their respective values in 2015Q2 (first period in the observation). The red-dotted, vertical line signifies the start of the COVID-19 Pandemic.

4.1 COVID-19 Pandemic and FPI Contagion Effect among ASEAN5

4.1.1 Estimation Result

Table 3 present the two-regime spatial econometrics estimation of equation (1). The estimation results include the result for the estimation where the dependent variables are the total FPI quarterly growth, total debt FPI quarterly growth, total equity FPI quarterly growth, FDI quarterly growth, foreign other investment quarterly growth, and foreign financial derivative investment quarterly growth. Each model with a different dependent variable is estimated with a spatial fixed effect. The estimation result presented in Table 3 uses the total trade matrix among the five countries. Estimation results in Table 3 are taken as the main estimations for analysis. In addition to these estimations, other estimations that alter the weighting matrix and estimation method from Table 3, as mentioned in section three, are presented in the Appendix. The estimations presented in the Appendix show that the results are robust to the changes in the weighting matrix and estimation method.

Table 3 Main Estimation Result

This table presents the main estimation result. The estimation method used is fixed effect. The weighting matrix used is the bilateral total goods trade from 2015 to 2019. ***), **), *) indicates significance at 1%, 5%, and 10% significance level, respectively.

Variable	**Coefficient (*t-statistics*)**					
	y = total FPI	***y = Debt FPI***	***y = Equity FPI***	***y = FDI***	***y = Other Investment***	***y = Financial Derivatives***
constant	1.266	1.65	0.92	-0.506	1.075	0.192
	(0.941)	(1.331)	(0.5)	(-0.053)	(1.31)	(0.265)
gdp_qtq	0.051	0.016	0.069	-0.052	-0.014	0.038
	(0.836)	(0.283)	(0.833)	(-0.081)	(-0.253)	(0.774)
ch_ir	0.355	-0.766	1.15	10.208	2.435***	0.804
	(0.445)	(-1.048)	(1.055)	(0.668)	(1.874)	(0.696)
def_qtq	0.471***	0.529***	0.641***	-0.887	0.072	0.003
	(3.056)	(3.797)	(3.056)	(-0.569)	(0.543)	(0.026)
ch_xr	0.115	0.182***	0.024	3.679***	0.366***	0.73***
	(0.958)	(1.67)	(0.148)	(1.651)	(1.93)	(4.318)
5spread	1.668***	1.252	2.02***	28.252***	-1.341	-0.664
	(1.861)	(1.523)	(1.647)	(2.584)	(-1.457)	(-0.806)
cab	0.216**	0.343***	0.131	1.846	-0.248**	-0.099
	(2.446)	(4.26)	(1.082)	(1.293)	(-2.054)	(-0.921)
*w*gdp_qtq*	-0.058	-0.072	-0.09	1.816	-0.02	-0.15***
	(-0.546)	(-0.739)	(-0.619)	(1.543)	(-0.205)	(-1.679)
*w*ch_ir*	-0.046	0.137	-0.53	-18.293	-0.067	-0.951
	(-0.048)	(0.156)	(-0.405)	(-0.838)	(-0.036)	(-0.576)

Variable	Coefficient (*t-statistics*)					
	y = total FPI	***y = Debt FPI***	***y = Equity FPI***	***y = FDI***	***y = Other Investment***	***y = Financial Derivatives***
*w*def_qtq*	0.9**	0.479	1.055**	-6.58**	-0.333	-0.168
	(2.399)	(1.43)	(2.103)	(-1.977)	(-1.19)	(-0.669)
*w*ch_xr*	0.375***	0.091	0.617**	-6.703***	-0.01	0.137
	(1.932)	(0.523)	(2.339)	(-1.661)	(-0.03)	(0.424)
*w*5spread*	-0.288	-1.033	0.255	62.231***	-1.928	-3.989**
	(-0.192)	(-0.756)	(0.124)	(2.813)	(-1.102)	(-2.471)
*w*cab*	0.176	0.001	0.41***	7.13***	-0.339	-0.051
	(1.135)	(0.004)	(1.937)	(1.91)	(-1.076)	(-0.184)
regime 1	0.537***	0.298***	0.531***	0.006	0.112	0.353***
	(7.604)	(2.929)	(7.41)	(0.045)	(0.926)	(3.74)
regime 2	0.696***	0.445***	0.728***	0.387***	0.072	0.696***
	(7.499)	(2.65)	(8.563)	(2.838)	(0.332)	(8.842)
regime 2-regime 1	0.159	0.146	0.197	0.381	-0.04	0.343

Looking at the general pictures, the estimation results in Table 3 show that the contagion effect of foreign portfolio investment in ASEAN5 is more prevalent during the COVID-19 Pandemic period, i.e., more contagious during the Pandemic, thus confirming the hypothesis of this paper. This is shown by the coefficients of the Regime two (pandemic period) variable that is significant and larger than the Regime one variable in all models but the model for other investment quarterly growth. Figure 6 to Figure 10 further solidify this claim. The figures all show a significant decline and almost identical pattern for FPI (toal, equity, and debt), FDI, and Financial Derivative. These results confirm the arguments put forward by Al-awadhi et al. (2020), Baker et al. (2020), and Ramelli and Wagner (2020).

In analyzing the estimation result for our independent variables, we can distinguish the pull and push factors that affect foreign portfolio investment. The pull factors are variables specific to each host country (the x parameter in equation (1)); the push factors are variables related to the neighboring countries (parameter xw in equation (1)) (Goldstein and Pauzner, 2004; Hannan, 2017).

For the model in which the dependent variable is the total FPI quarterly growth, the quarterly inflation (*def_qtq*), 5-Year bond spread (*5spread*), and the ratio of the current account balance to GDP (*cab*) appear to be the significant pull determinants of total FPI flow. The quarterly inflation affects FPI positively, which means that an increase in the inflation level is likely to cause an increase in the growth of total FPI flow (Byrne and Fiess, 2016; Vo, 2018). This suggests that the signalling of economic growth by the level of inflation is seen as positive sentiment by foreign investors, offsetting the erosion of real return from an increased level of inflation. The bond spread variable is also positive and significant. The means higher spread (more risk) tends to attract foreign investors. The higher spread (risk) can also mean higher relative return. This shows that foreign investors in the ASEAN5 countries tend to be risk-taker (Vo, 2018). The ratio of the current account balance to GDP, which represents the degree of economic openness, is also positive and significant, showing the expected result that a more open economy tends to attract more foreign investors (Baek, 2006). On the other hand, from the pull side (neighbouring countries). Two independent variables are shown to be significant determinants of total FPI quarterly growth: the level of inflation and change in the real effective exchange rate (*w*ch_xr*). The positive signs and significance of these two variables show that as the level of inflation (which can be associated with economic recovery) increases and the exchange rate appreciates in the region, foreign investors will take this as positive sentiment and invest.

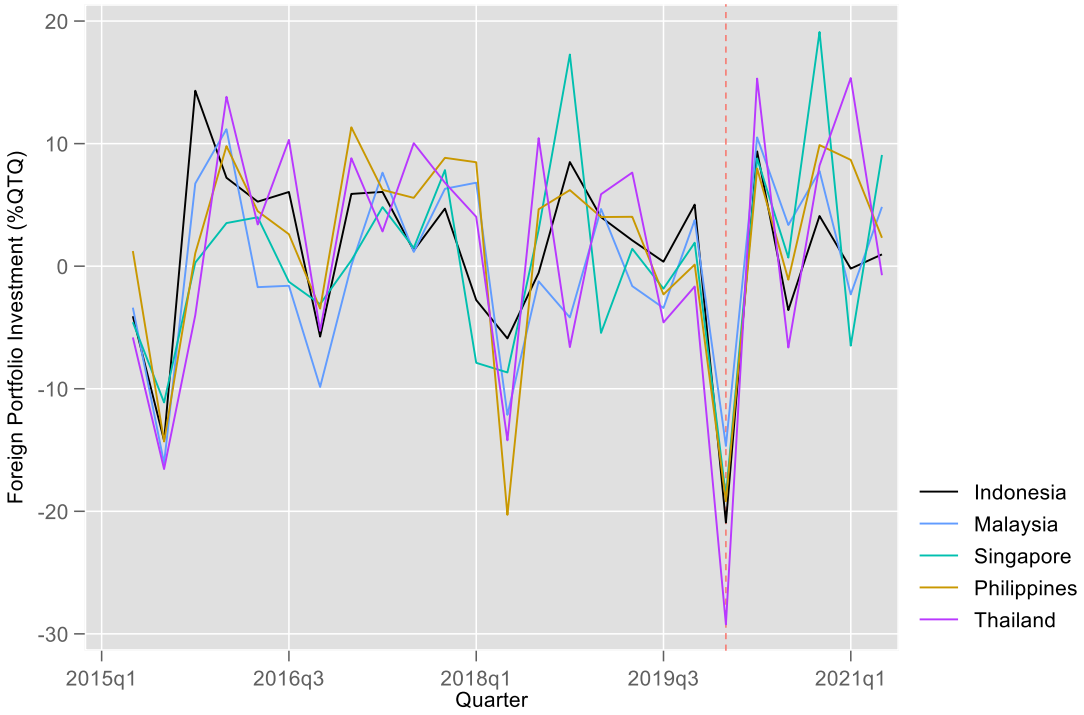


Figure 4 Quarterly FPI Growth

An opposite to the first model, the model in which the dependent variable is the debt FPI quarterly growth shows no significant effect from any of the push factors. Only three pull variables are shown to be significant. They are the quarterly inflation, the change in the real effective exchange rate, and the ratio of the current account balance to GDP. These three variables are positive and significant, similar to their effect in the first model. The dominance of pull (domestic) factors as the main determinants of debt FPI quarterly growth signals that investors tend not to give significant consideration for the regional factors when considering an investment to a country. The internal macroeconomic factors of that country are ones considered important by these foreign investors (Baek, 2006; De Vita and Kyaw, 2008; Byrne and Fiess, 2016). This finding, however, does not mean that debt FPI flow does not behave contagiously in ASEAN5. The regime coefficients are significant, with regime two (pandemic period) having higher coefficient values, which means the flow of debt FPI in the region is contagious, even more during the pandemic period. It is just that the flow is more affected by regional factors.

As evident in Figure 7 and as supported by the estimation result, the movement of debt FPI among ASEAN5 countries only shows similar patter during the COVID-19 Pandemic period. Before this period, the debt FPI movement among the five countries tends to differ in each country, although a general less volatile negative pattern can be inferred from 2015 to 2019. This graphical inference support how push factors tend not to be significant in model two and how model two has the lowest difference between regime two and regime one.

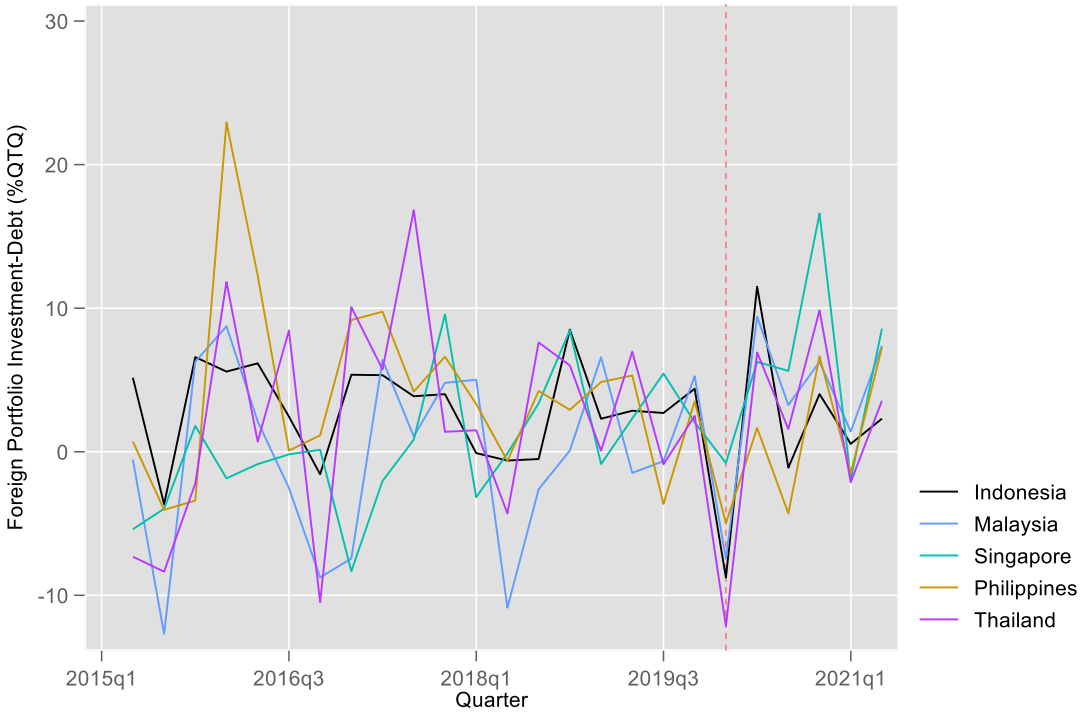


Figure 5 Quarterly Debt FPI Growth

For the model where the dependent variable is quarterly growth of equity FPI, the pull and push factors are equally balanced in affecting the aforementioned dependent variable. From the pull side, quarterly inflation and sovereign bond yield spread are significant factors. While on the push side, the quarterly inflation, the change in the real effective exchange rate, and the ratio of the current account balance to GDP are the significant determinants. These differences in the significances of the determinants between the equity and debt FPI model highlight the different behavior of the investors in these two instruments. While debt FPI investors tend to focus more on the domestic macroeconomic factors, equity FPI investors tend to pay more attention to the regional factors (Baek, 2006).

Figure 8, which displays the movement of equity FPI quarterly growth, suggests how equity FPI tends to move more synchronously compared to debt FPI in Figure 7. This is also supported by the estimation result of model three, which has the largest coefficient for both regime one dan regime two variables. Equity FPI also experienced more significant highs and lows during the pandemic period.

For the model in which the dependent variable is other investment (foreign), we do not find evidence to support our hypothesis of increased contagiousness during the Pandemic. Even in the normal period, we do not find significant statistical proof of the existence of contagious effect. This may be linked with the facts that this category of investment consists of various sub-categories, thus further declassification for this category of investment is needed but is a limit to this study due to data unavailability. Figure 9 solidifies this claim.

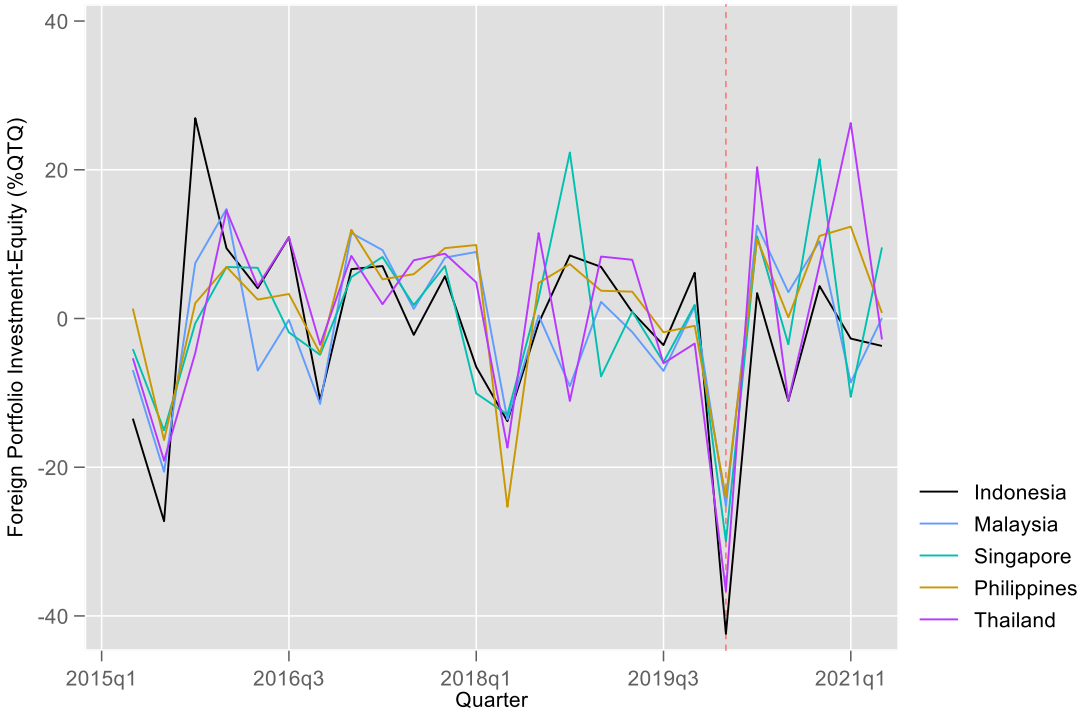


Figure 6 Quarterly Equity FPI Growth

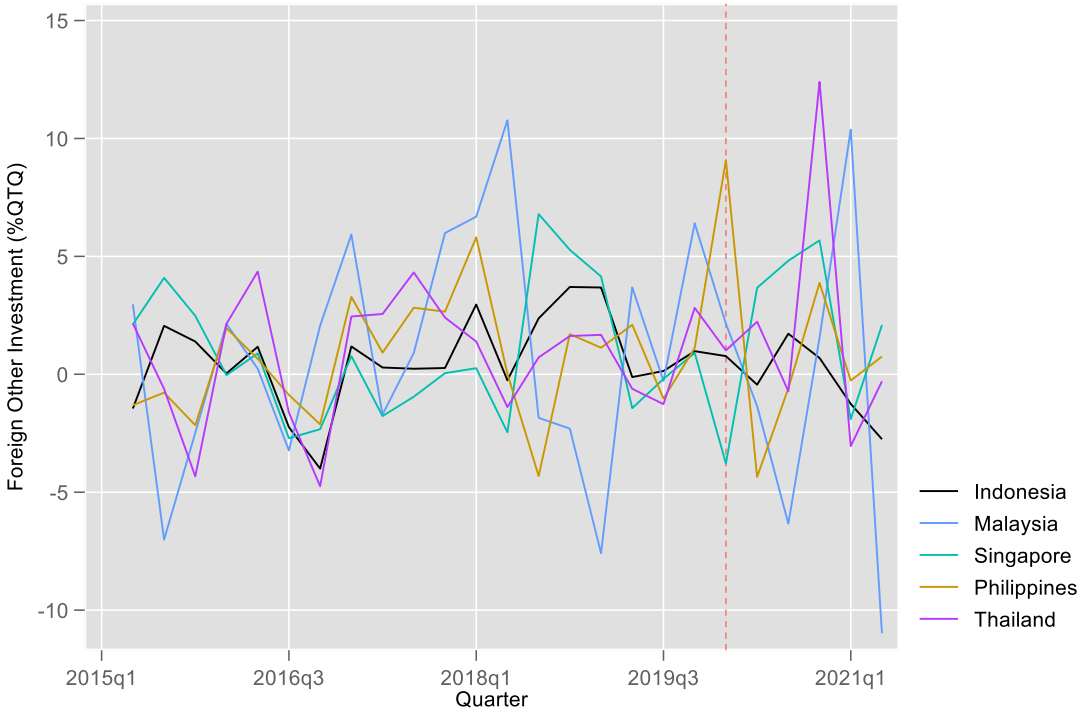


Figure 7 Quarterly Foreign Other Investment Growth

For the FDI and financial derivative models, they both show increased level of contagiousness (with FDI being the largest of the two) from normal to the Pandemic period that are larger than any of the three FPI models. This can be linked with how these two types

of investment tend to not have significant contagiousness effect (FDI) or relatively low level of contagious effect (foreign financial derivative investment) during pre-pandemic period, but then significant and high contagiousness effect during the Pandemic period. In regards to the factors affecting the growth of these two investments types, we find an equally strong contribution from pull and push factors, with economic openness, risk, and exchange rate being the three most contributing factors (from both push and pull sides).

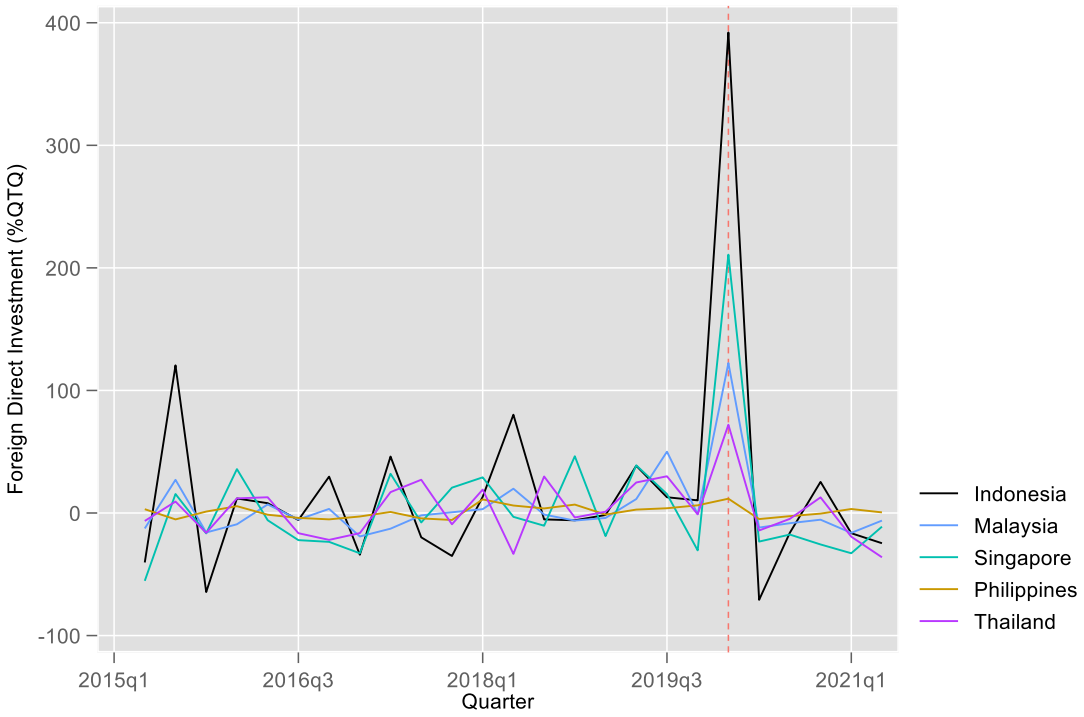


Figure 8. Quarterly FDI Growth

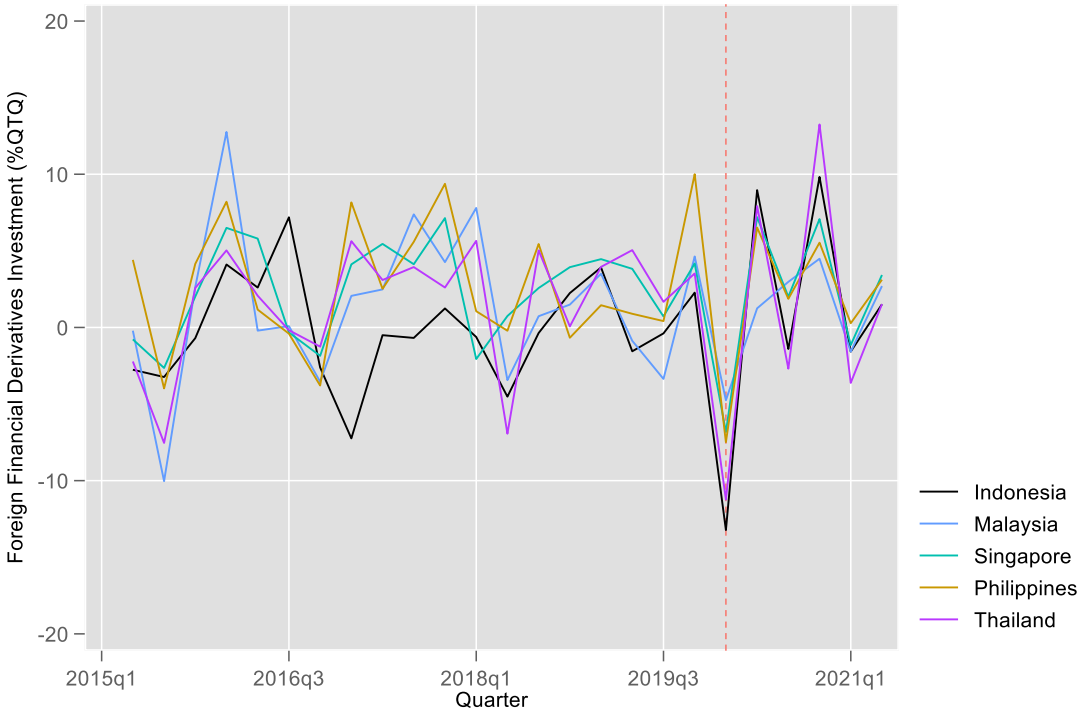


Figure 9. Quarterly Foreign Financial Derivative Investment Growth

Besides the main estimation results and the accompanying robustness checking estimations, we also plot the coefficients of regime two variable from all the models. To show the dynamics of contagiousness effect during Pandemic period, we modify our models to estimate five sets of data: (1) up to 2020Q2, (2) up to 2020Q3, (3) up to 2020Q4, (4) up to 2021Q1, and (5) up to 2021Q2 (the original data). We then plot the regime two coefficient obtained from each estimation. This process results in Figure 11.

Figure 12 shows that the level of contagiousness tend to decrease as the pandemic continue. This correlates with the divergence in policies among economies. At the beginning of the Pandemic, most countries tend to take similar measures. However, divergences appeared as countries need to cater for their domestic condition.

All in all, the estimation results show that the COVID-19 Pandemic has significantly affected the contagiousness of capital flow in ASEAN5, be it the total FPI, debt FPI, equity FPI, foreign direct investment, and foreign financial derivative investment. Foreign other investment is the only investment type to not show any significant contagious effect in pre and during the Pandemic period. Regime two variable (COVID-19 Pandemic period) is significantly greater in magnitude compared to regime one variable, with the gap for FDI being the largest. These results confirm the hypothesis of this paper. This research also finds that equity FPI flow is more contagious than others both before and during the Pandemic, which supports the findings of Okorie and Lin (2020) and Zhang et al. (2020).

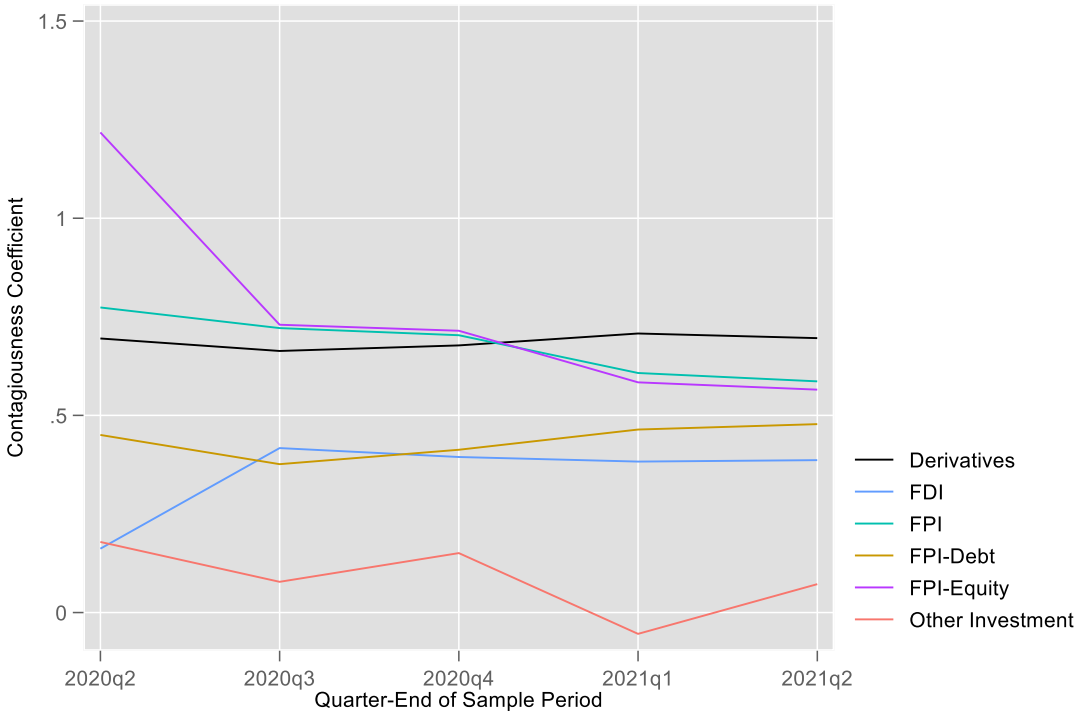


Figure 10. Dynamics of COVID-19 Pandemic Contagiousness Effect

4.1.2 Global Sentiments, Policy Responses, and Foreign Investor Share

The volatility and contagiousness in the financial market are even greater than during the 2008 Global Financial Crisis (International Monetary Fund, 2021). This shows the magnitude of the impact of the COVID-19 Pandemic that is truly a global financial market catastrophe in a sense.

Given its nature as a global calamity, shock waves in capital flow caused by the Pandemic are littered with dominating global sentiments. Although domestic factors also play some roles, global sentiments can be seen as the dominating factors (International Monetary Fund, 2021).

Findings by Kamaludin et al. (2021) show that most investors in these ASEAN5 countries take signals of future market movement from the DowJones, thus contributing to the high coherence between DowJones and the country-specific equity market movements. The oil price disaster further exacerbated the financial market volatility across ASEAN5 countries during this Pandemic. Furthermore, U.S.'s quantitative easing policy aimed at reducing its domestic investors' panic caused turbulences in the emerging market. "U.S.' policies may introduce further uncertainty into the global markets and create trouble for emerging economies" (Zhang, Hu and Ji, 2020).

Besides these global factors, domestic factors, especially concerning the Pandemic handling, have been shown to affect investors' confidence and thus the portfolio investment flow. In the early stage, southeast Asian countries tend to show policy divergence in responding to the pandemic. The increasing policy convergence was facilitated by discussions in the context of ASEAN and its several response mechanisms that had already been in place. ASEAN high-level officials met as early as January 2020 to prepare a region-wide response, as seen in the ASEAN Collective Response to the Outbreak of COVID-19. ASEAN5 countries

have issued similar public health response policies, monetary easing, and also fiscal policies to counter the negative effects of the Pandemic and to restore investors' confidence. This effort for a coherent policy response among ASEAN member states contributes to the contagiousness of portfolio flow (OECD, 2020a; Chong, Li and Yip, 2021).

Besides strong global sentiments and similar policy responses across ASEAN5 countries, a third factor contributes to the contagiousness of capital flow even before the Pandemic. The severity of COVID-19 Pandemic shock on ASEAN5 states capital flow is made worse by the interconnectivity of ASEAN economies, especially because the same groups of investors dominate ASEAN economies. Even before the Pandemic in 2018, ASEAN's foreign equity portfolio stock decreased by 25.1% while debt portfolio stock was stagnant, as major US and E.U. investors pulled out. U.S. and E.U. investors hold about 65.5% of the ASEAN equity portfolio and 65.2% of the debt portfolio in 2019 (Association of Southeast Asian Nations (ASEAN), 2020).

All things considered, there are three critical reasons outlined in this section that contribute to the increased contagiousness of capital flow among ASEAN5 countries. We believe negative global sentiment because of the Pandemic is the most dominant factor. The other two factors are the fact that ASEAN5 countries share the same group of investors that have steadily been exiting the ASEAN market from three to four years ago and the effort for coherent regional handling of the COVID-19 Pandemic.

4.2 Projection of the COVID-19 Pandemic Impact on Indonesian Sectoral GDP and FDI

Table 4 shows the trend of the variables based on the grouped of the interval periods. Two-year groups of periods are applied in the model. Average gross domestic product increased from the period interval of 2000Q1-2001Q4 to the period interval of 2020Q1-2021Q1. The average GDP decreased in the period interval of 2020Q1-2021Q2 compared to the period interval of 2018Q1-2019Q4. From Table 4 it is seen that the FDI fluctuated in the period interval from 2000Q1-2001Q4 to 2020Q1-2021Q2. Based on the groups of periods, the FDI during the pandemic of COVID-19 (2020Q1-2021Q2) was larger compared to the FDI in the period interval of 2018Q1-2019Q4[2]. This may be an indication that the impact of the FDI may not be the same for all the economic sectors in Indonesia.

Table 4 Trend of Average GDP and FDI (in Billion Rp)
for 19 Indonesian Economic Sectors from 2000Q1 to 2021Q2

Period	GDP	FDI
2000Q1-2001Q4	1971657	131591.5
2002Q1-2003Q4	2061578	49753.4
2004Q1-2005Q4	2365544	62524.2
2006Q1-2007Q4	2791091	61769.8
2008Q1-2009Q4	3522653	107285.9
2010Q1-2011Q4	3852723	102177.6

[2] Using the depreciated exchange rate in 2020 and 2021, the total FDI in 2020 was larger compared to the total FDI in 2019.

Period	GDP	FDI
2012Q1-2013Q4	4281417	157976.8
2014Q1-2015Q4	4577181	191556.5
2016Q1-2017Q4	4919147	193106.9
2018Q1-2019Q4	5425066	182040.4
2020Q1-2021Q2	5340288	186191.0

Notes: FDI = foreign direct investment.
GDP = Gross Domestic Product.
Source: Indonesian Bureau of Central Statistics and authors' calculation

Table 5 shows the trend of average GDP and average FDI variables for sectors of extracting, manufacturing and utility and service using the two-year interval period. Before the COVID-19 Pandemic, there was an increasing trend of the average GDP for all sectors including the extracting sector, manufacturing sector and utility and service sector. The average GDP of all sectors decreased during the COVID-19 Pandemic. The highest decrease in GDP occurred in the utility and service sector. The average GDP decreased about -0.27%, -0.39% and -2.69% for the extracting sector, manufacturing sector and utility and service sector during the COVID-19 Pandemic compared to the period of 2018Q1-2019Q4, respectively[3].

Table 5 Trend of the GDP and FDI (in Billions Rp) for Three Main Indonesian Economic Sectors (Extraction, Manufacturing, Utility and Service) from 2000Q1 to 2021Q2

Period	GDP			FDI		
	1	2	3	1	2	3
2000Q1-2001Q4	290972.3	264089.3	430766.8	887.8778	33490.77	31417.1
2002Q1-2003Q4	266954.9	275184.9	488649.2	1910.921	12287.54	10678.25
2004Q1-2005Q4	304257.8	295955.5	582558.8	1615.166	14934.18	14712.74
2006Q1-2007Q4	366756.4	336267.0	692521.8	2242.542	15725.52	12916.83
2008Q1-2009Q4	480151.1	426748.9	854426.3	1535.219	18992.46	33115.25
2010Q1-2011Q4	588003.6	434355.9	904002.0	11246.66	14327.75	25514.37
2012Q1-2013Q4	653133.9	472731.1	1014844	18351.9	41078.73	19557.76
2014Q1-2015Q4	630604.1	513489.3	1144497	21801.54	40968.68	33008.03
2016Q1-2017Q4	637132.4	555357.6	1267084	16645.83	47217.61	32689.99
2018Q1-2019Q4	695380.0	599113.1	1418040	12901.93	31444.28	46674.01
2020Q1-2021Q2	693504.4	596759.3	1379880	11074.23	45082.65	36938.63

Notes: FDI = foreign direct investment.
GDP = Gross Domestic Product.
1 = Extracting Sector
2 = Manufacturing Sector
3 = Utility and Service Sector
Source: Indonesian Bureau of Central Statistics and authors' calculation

[3] Having the comparison between the periods of 2018Q1-2019Q4 and 2020Q1-2021Q2, the decline of GDP from 695380 to 693504.4 resulted in the decrease of GDP by -0.27% (extracting sector); the decline of GDP from 599113.1 to 596759.3 resulted in the decrease of GDP by -0.39% (manufacturing sector); and the decline of GDP from 1418040 to 1379880 resulted in the decrease of GDP by -2.69% (utility and service sector).

From Table 5 it is also seen that the FDI only increased in the manufacturing sector during the COVID-19 Pandemic of 2020Q1-2021Q2. The extracting and utility and service sectors had a significant reduction in the FDI during the COVID-19 Pandemic. For example, the FDIs of extracting and utility and service sectors declined about 14.17% and 20.86% during the COVID-19 Pandemic compared to the period of 2018Q1-2019Q4[4]. In the manufacturing sector, there was an increase in the FDI from 31444.28 to 45082.65 or there was an increase of 43.37% in the COVID-19 Pandemic period compared to the period of 2018Q1-2019Q4. This can be an indication that the manufacturing sector was still seen to have a good performance during the COVID-19 Pandemic.

Table 6 to Table 8 shows the impulse responses from the local projection estimation (LPE) to evaluate the sectoral impact of the COVID-19 Pandemic on the FDI. Table 9 also estimated the impact of the COVID-19 Pandemic on the FDI in the Indonesian regions including Jawa; Bali and Nusa Tenggara; Sumatera; Kalimantan; Sulawesi and East Indonesia. The LPE models were estimated using one-year lag based on the least value of Modified Akaike Information Criterion. Moreover, the FDI variable was stationary at the level form at the 1% critical level based on the Fisher-type test of ADF. The stationary condition indicated that modeling the dependence structure in the LPE models is valid using the variables at the level form.

Table 6 shows the impulse responses from the local projection estimation (LPE) to evaluate the sectoral impact of the COVID-19 Pandemic on the FDI in the extracting sector including food crops, plantation and livestock; forestry; fishery and mining. From Table 6 and Figure 13 it can be seen that the COVID-19 Pandemic hit the extracting sector except for the fishery sector. Although it was not significant, the FDI in fishery sector tended to have negative relations with the COVID-19 Pandemic. It was shown by the negative coefficients of impulse responses for most of the quarters. The shock coming from the COVID-19 Pandemic was projected to decrease the FDI in the food crops, plantation and live stocks in the quarter 1-quarter 2 and quarter 4-quarter 5 after the shock. The decrease of the FDI caused by the impact of COVID-19 Pandemic also happened in quarter 2 – quarter 5 (fishery) and quarter 1-quarter 4 (mining) after the introduction of the shock of the COVID-19 Pandemic. From the results, it can be concluded that the impact of the COVID-19 Pandemic can be different among the subsectors of extracting sector, although the impact was mostly negative to all subsectors of the extracting sector.

Table 6 Impulse Responses of the Pandemic Impacts on the FDI in Extracting Sector

	Sector			
Period	1	2	3	4
1	-0.012***	-0.0018	-0.0006	-0.0156***
2	-0.0082***	-0.0011	-0.0013**	-0.0127**
3	-0.0004	-0.0002	-0.0011**	-0.0158**

[4] Comparing the periods of 2018Q1-2019Q4 and 2020Q1-2021Q2, the decline of FDI from 12901.93 to 11074.23 resulted in the decrease of FDI by 14.17% (extracting sector) and the decline of FDI from 46674.01 to 36938.63 resulted in the decrease of FDI by 20.86% (utility and service sector).

4	-0.0063***	0.0042	-0.0012***	-0.0201***
5	-0.0105***	-0.0023	-0.0012***	-0.0041

Source: BKPM and authors' calculation

Notes: 1 = Food crops, plantation and livestock
2 = Forestry
3 = Fishery
4 = Mining
* Significant at 10% critical level
** Significant at 5% critical level
*** Significant at 1% critical level

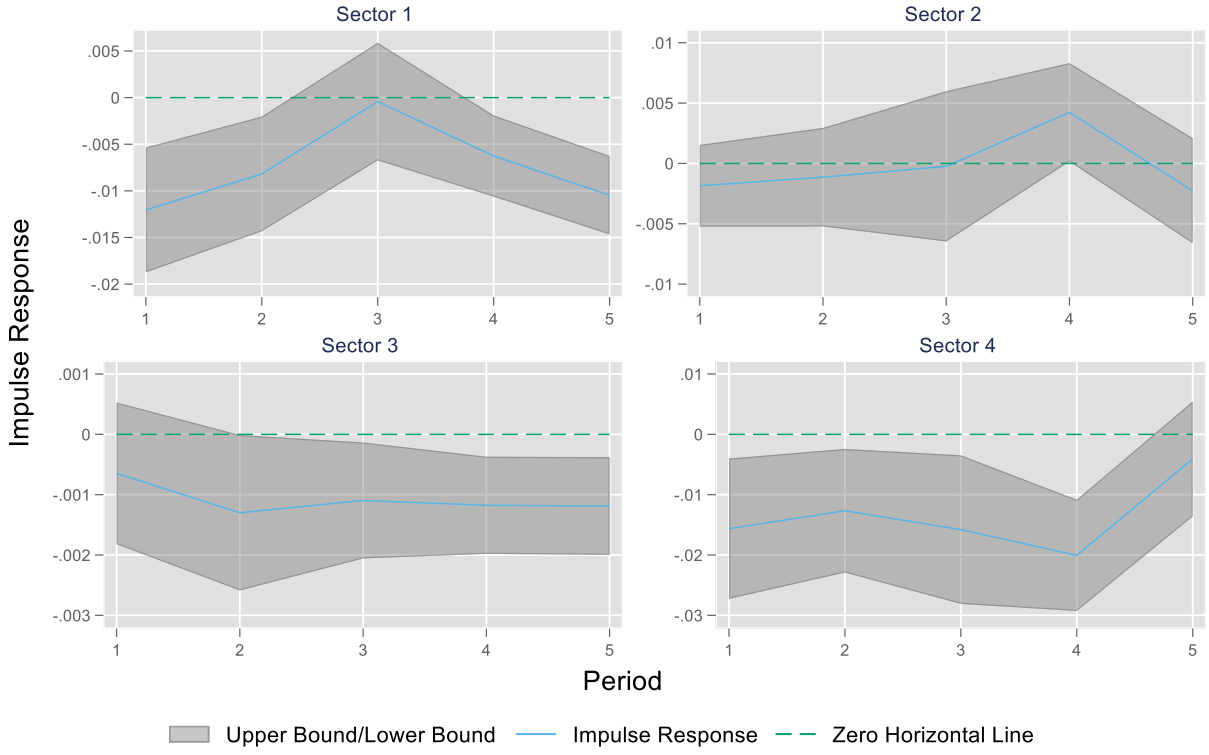


Figure 11 Impulse Responses of the Pandemic Impacts on the FDI in Extracting Sector

Source: BKPM and authors' calculation

Table 7 and Figure 14 show the impulse responses of the FDI on the shocks coming from the COVID-19 Pandemic in the manufacturing sector. The shock of COVID-19 Pandemic reduced the FDI significantly in four subsectors including textile, leather goods and footware industry; wood industry; paper and printing industry; chemical and pharmaceutical industry, rubber and plastic industry; and non-metallic mineral industry. The FDI in food industry and other industry were not affected significantly by the shock of the COVID-19 Pandemic. The FDI in the sectors of metal industry, machinery, electronic, equipment had a positive relation with COVID-19 Pandemic in all five quarters ahead after there was a shock of COVID-19 Pandemic. The effects were significant at the 1% critical levels. Other industry tended to have a weak positive relationship with the COVID-19 Pandemic (all coefficients of impulse responses were positive for the five-quarter ahead, although the impact was not significant).

Table 7 Impulse Responses of the Pandemic Impacts on the FDI in Manufacturing Sector

	Sector							
Period	5	6	7	8	9	10	11	12
1	-0.0043	-0.0093	-0.0062	-0.0302	-0.0362*	-0.0451***	0.0739***	0.8978
2	-0.0067	-0.007	0.0073	0.0105	-0.0278	-0.0459***	0.0846***	0.8747
3	0.003	-0.0133**	-0.0262***	0.1219	-0.0683***	-0.0521***	0.0644***	0.8538
4	0.0214	0.0028	-0.0212**	-0.0987**	-0.0341**	-0.0312***	0.1018***	0.0009
5	-0.0003	0.004	-0.0146*	-0.1026**	-0.0563***	-0.0178**	0.0566***	0.0891

Source: BKPM and authors' calculation

Notes: 5 = Food industry
6 = Textile, leather goods and footware industry
7 = Wood
8 = Paper and printing industry
9 = Chemical and Pharmaceutical Industry, Rubber and Plastic Industry
10 = Non-Metallic Mineral Industry
11 = Metal Industry, Machinery, Electronic, Equipment
12 = Other Industry
* Significant at 10% critical level
** Significant at 5% critical level
*** Significant at 1% critical level

From Figure 14 it is shown the shock of COVID-19 Pandemic decreased the FDI in the sector of non-metallic mineral industry from the first quarter until the five quarters ahead. Furthermore, the shock of COVID-19 Pandemic decreased the FDI at quarter 3 (Textile, leather goods and footwear industry); quarter 3-quarter 5 (wood); quarter 4 and quarter 5 (Paper and printing industry); and quarter 1, quarter 3 – quarter 5 (Chemical and Pharmaceutical Industry, Rubber and Plastic Industry).

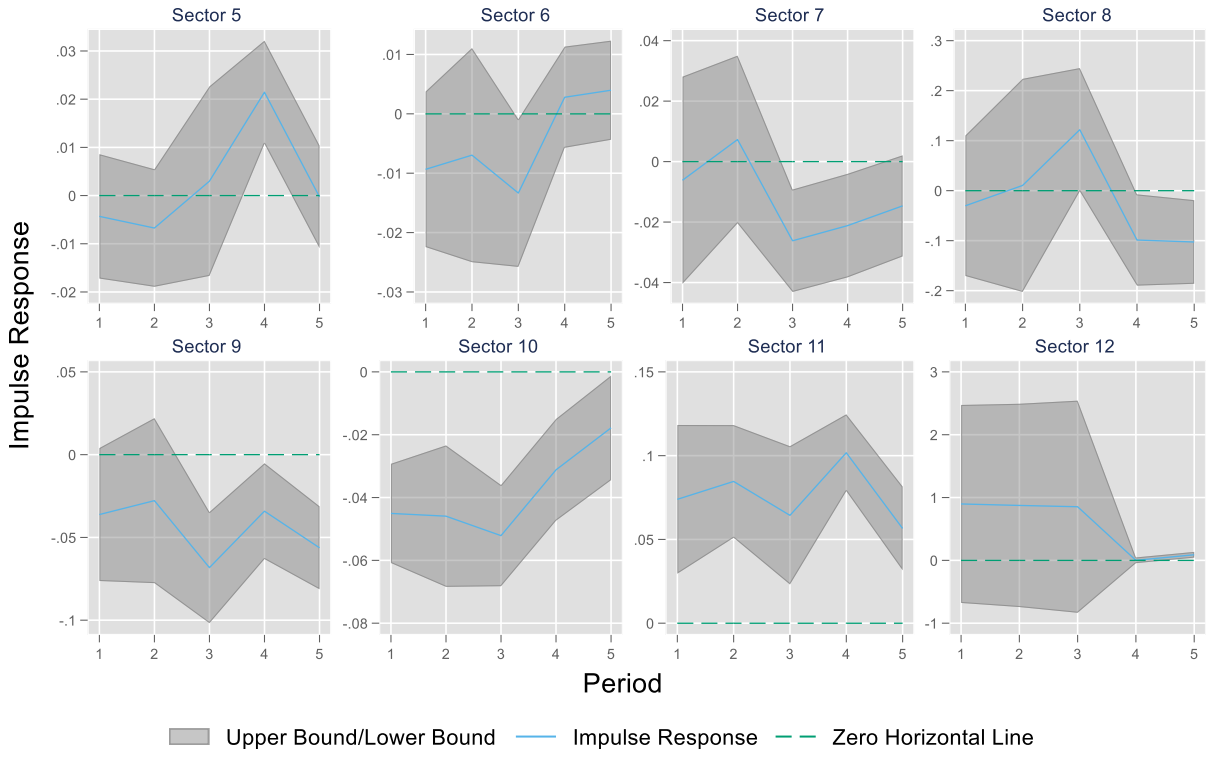


Figure 12 Impulse Responses of the Pandemic Impacts on the FDI in Manufacturing Sector

Source: BKPM and authors' calculation

Table 8 and Figure 15 show the impulse response of the pandemic impacts on the FDI in the utility and service sector for five quarters ahead after there was a shock from the COVID-19 Pandemic. The shock of the COVID-19 Pandemic mostly reduced the FDI during the COVID-19 Pandemic partly or whole parts of the quarters in the subsectors of utility and service sectors including electricity, gas and water supply; construction; trade and repair industry; hotel and restaurant; real estate, industrial estate and business activities; and other services. The FDI in the subsectors of construction and transport, storage and communication were not affected significantly by the COVID-19 Pandemic. Although it was not significant, the weak impacts were positive. While the performance of transport sector was negatively impacted by the COVID-19 Pandemic, the weak positive impact can be caused by the high performance of the communication during the COVID-19 Pandemic. From the results, it can be seen that the impact of the COVID-19 Pandemic on the FDI could be different among the subsectors in the utility and service sector. For example, the shock of the COVID-19 Pandemic affected negatively the FDI in the subsector of hotel and restaurant for all five quarters ahead. The shock from the COVID-19 Pandemic affected the FDI only at the quarter 4-quarter 5 (subsector of electric, gas and water supply); quarter 2-quarter 4 (subsector of trade and repair industry); quarter 1, quarter 3-quarter 4 (real estate, industrial estate and business activities); and quarter 3, quarter 5 (other services).

Table 8 Impulse Responses of the Pandemic Impacts on the FDI in Utility and Service Sector

Period	Sector						
	13	14	15	16	17	18	19
1	0.2548	0.0025	-0.001	-0.0201***	0.0068	-0.0267*	0.0145
2	-0.0902	0.0012	-0.0029***	-0.0161***	0.0045	-0.0281	0.0044
3	0.1682	-0.0004	-0.0023**	-0.0215***	0.0084	-0.0472***	-0.021**
4	-0.206***	-0.0003	-0.002**	-0.018***	0.0036	-0.0355***	0.0003
5	-0.1299***	0.0006	0.0007	-0.0124***	0.0069	-0.014	-0.0086*

Source: BKPM and authors' calculation

Notes: 13 = Electric, gas and water supply
14 = Construction
15 = Trade and repair industry
16 = Hotel and restaurant
17 = Transport, storage and communication
18 = Real estate, ind. estate and business activities
19 = other services
* Significant at 10% critical level
** Significant at 5% critical level
*** Significant at 1% critical level

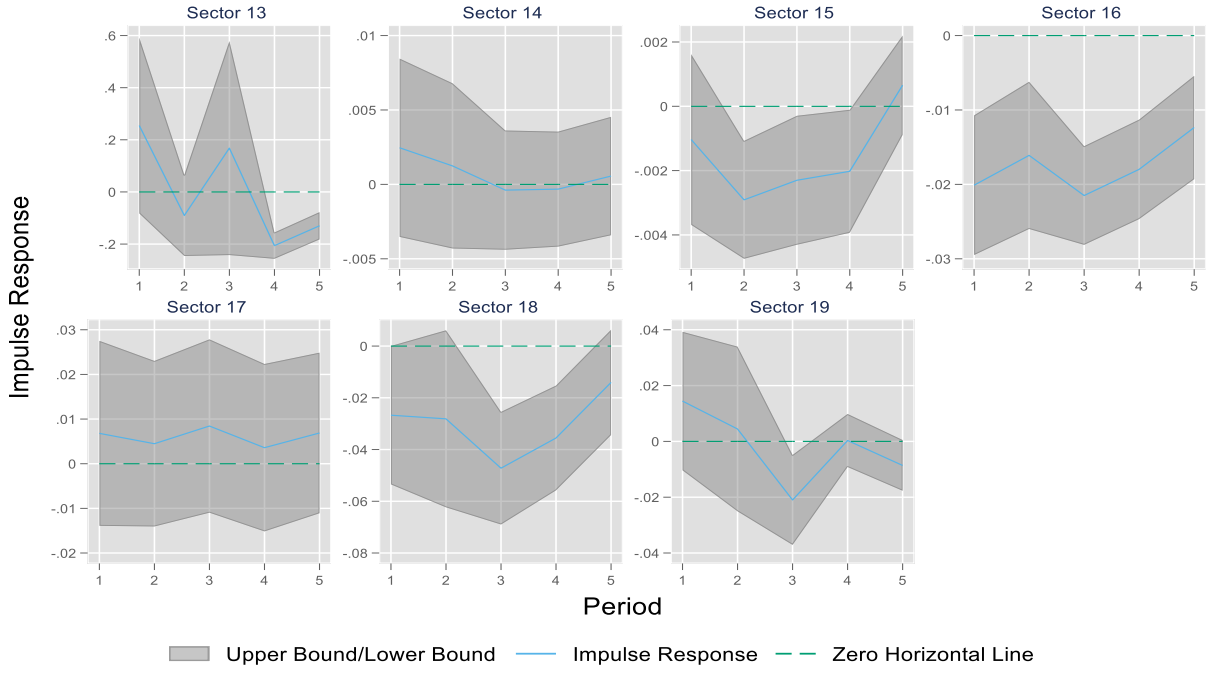


Figure 13 Impulse Responses of the Pandemic Impacts on the FDI in Service and Utility Sector

Source: BKPM and authors' calculation

The results from Table 6 to Table 8 or Figure 13 to Figure 15 indicated that the impact of the COVID-19 Pandemic on the FDI was not the same for all sectors. This might support

the projection of OECD (2020) which suggested that the impact of the COVID-19 Pandemic can be different among countries and sectors. Also, the results indicated that the impact of the COVID-19 Pandemic on the FDI was not the same between quarters for the impacted sectors. These impact differences might be caused by how important the FDI is to the economy as well as how a country could deal with the COVID-19 Pandemic over time.

Table 9 and Figure 16 show the impulse responses of the pandemic impacts of the FDI in the Indonesian regions including Jawa; Bali and Nusa Tenggara; Sumatera; Kalimantan; Sulawesi and East Indonesia. COVID-19 Pandemic in most regions in Indonesia did not have a significant effect on the FDI, except for Kalimantan and Sulawesi. The COVID-19 Pandemic had a significant effect on the FDI the quarter 2 until quarter 4 (Kalimantan) and quarter 1 and quarter 5 (Sulawesi) after there is a shock from COVID-19 Pandemic. The FDI in the regions was affected by the COVID-19 Pandemic since the regions had limited sectors of the economy. Although the COVID-19 Pandemic did not affect significantly the FDI in most of the regions, the effect of the COVID-19 Pandemic on the FDI could be varied between regions. For example, the COVID-19 Pandemic impacted the FDI positively in quarter 1 – quarter 5 after there is a shock from the COVID-19 Pandemic in Java and East Indonesia. Other regions including Sumatera, Sulawesi, Kalimantan dan Bali and Nusa Tenggara experienced negative effect from the COVID-19 Pandemic on the FDI in most of the quarters. The insignificant effect of the COVID-19 Pandemic on the FDI in most of the regions can be caused by the contribution of FDI which was still not significant to the Indonesian economy. The contribution of the FDI was only about 2% to the GDP since 2010 and it was spread among the regions. The FDI also might not have reached its potential. Thus, the FDI was not significantly affected by the COVID-19 Pandemic in most of the regions.

Table 9 Impulse Responses of the Pandemic Impacts on the FDI in Indonesian Regions

	Sector					
Period	Jawa	Bali and Nusa Tenggara	Kalimantan	Sulawesi	Sumatera	East Indonesia
1	-0.0003	-0.0085	-0.0074	-0.0079*	0.0033	0.0176
2	0.0031	-0.0038	-0.0172***	-0.0018	-0.0040	0.1376
3	0.0029	-0.0073	-0.0163***	-0.0029	-0.0003	0.0365
4	0.0005	0.0057	-0.0147***	0.0197	-0.0049	0.0346
5	0.0012	-0.0031	0.0023	-0.0129***	-0.0046	0.1199

Source: BKPM and authors' calculation

Notes: * Significant at 10% critical level
** Significant at 5% critical level
*** Significant at 1% critical level

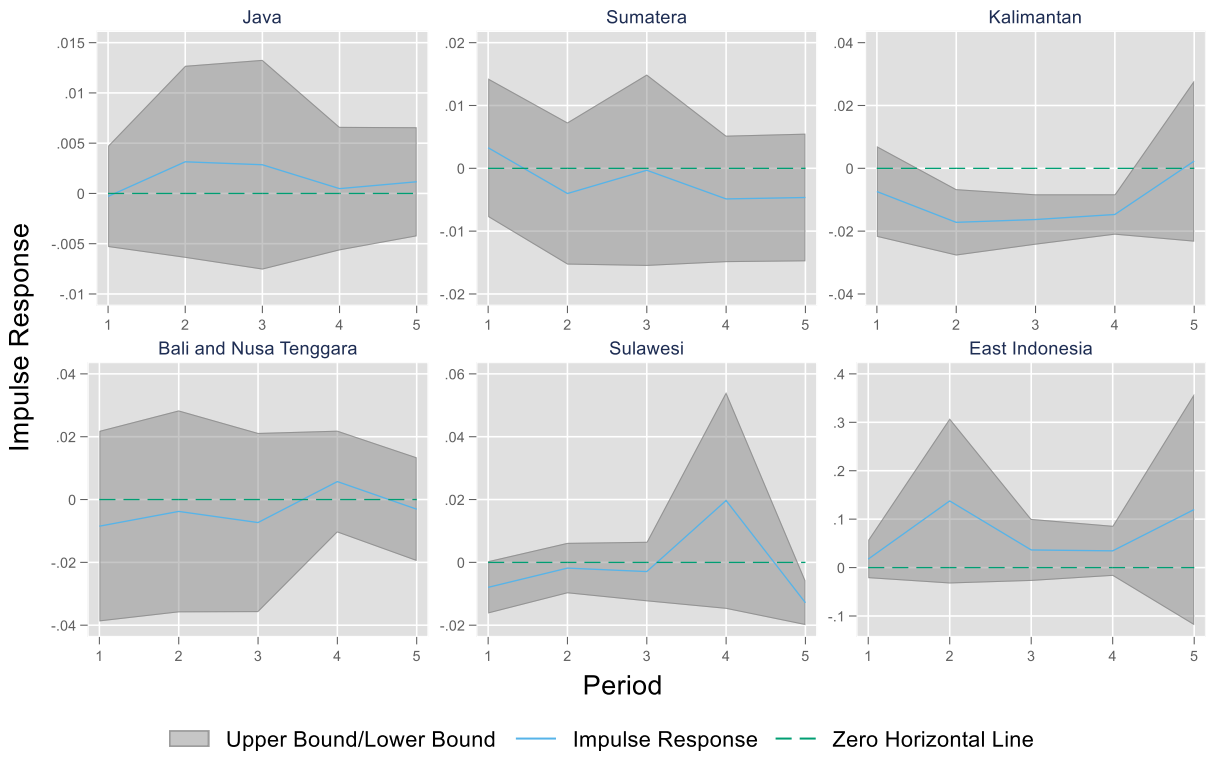


Figure 14 Impulse Responses of the Pandemic Impacts on the FDI in Indonesian Regions

Figure 9 shows the impulse response function of the impact of the COVID-19 Pandemic on the relation between FDI and GDP using the groups of periods including all periods, COVID-19 Pandemic period and before COVID-19 Pandemic period. The impulse response function is estimated based on the panel vector autoregression as shown in Table 10. The panel vector autoregression (PVAR) for all models was estimated using one-year lag based on the least coefficient of modified Akaike Information Criterion. The Hansen *J*-test did not reject the orthogonality conditions at the 10% critical level for both the *GDP* and *FDI* models. Moreover, all variables in (1)-(2) were stationary at the level form at the 1% critical level based on the Fisher-type test of ADF. These results indicate that modeling the dependence structure between the variables in PVAR is valid using the variables at the level form. The results of the panel VAR were stable since the modulus of all roots was less than 1.

From Table 9 it is seen that the FDI was significantly affecting the GDP in all periods and pre-COVID-19 pandemic at 1% critical level, respectively. The FDI did not affect significantly the GDP during the COVID-19 Pandemic at a 10% critical level. Moreover, GDP had no significant effect on the FDI in all periods and pre-COVID-19 pandemic at 10% critical level. The GDP had a significant effect at a 1% critical level during the COVID-19 Pandemic.

Table 10 Dynamic Relation Between GDP and FDI

	All Periods	Pre COVID-19 Pandemic	COVID-19 Pandemic
lrgdp			
L.lrgdp	0.9661***	0.9663***	0.5772***
	-0.011	-0.015	-0.12

	All Periods	Pre COVID-19 Pandemic	COVID-19 Pandemic
L.sfdi	0.0024***	0.0023***	0.1099
	-0.001	-0.001	-0.116
sfdi			
L.lrgdp	0.0281	0.0296	-0.0906***
	-0.02	-0.02	-0.033
L.sfdi	-0.0017**	-0.0019*	-0.0412
	-0.001	-0.001	-0.107
N	1539	1425	57

* p<0.1, ** p<0.05, *** p<0.01

Figure 17 is the impulse response of the COVID-19 Pandemic impact on the relationship between GDP and FDI using the PVAR estimation in Table 10. From Figure 17 it is shown that the shock of GDP affected foreign direct investment significantly only during the COVID-19 Pandemic (mid graph of Figure 17). During the COVID-19 Pandemic, GDP had a significant negative impact on the FDI until four quarters. This indicates that the COVID-19 Pandemic might create a signal of crisis to the economy causing the impotence of the GDP in attracting the FDI. Furthermore, the FDI had a significant positive impact on the GDP in the periods before and after the COVID-19 Pandemic. During the COVID-19 Pandemic, the positive shock from the FDI did not impact the GDP significantly. This also might be an indication that there was still high uncertainty during the COVID-19 Pandemic reducing the impact of the FDI in the short and long run.

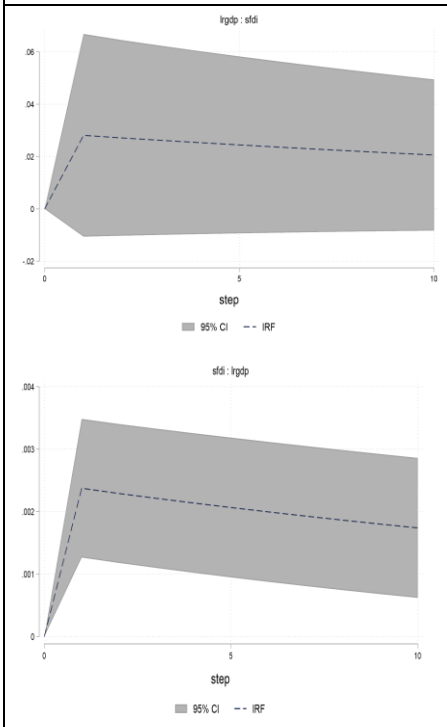
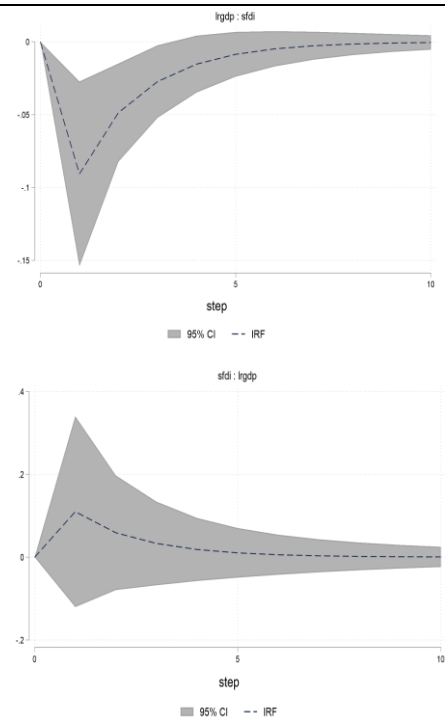
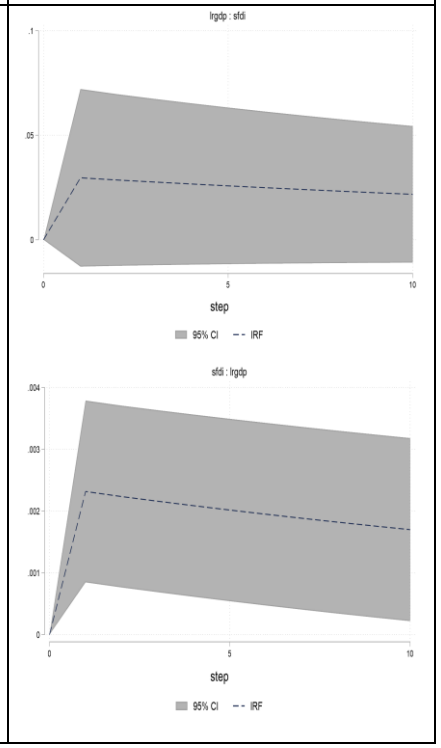
Impulse Responses For All Periods	Impulse Responses During COVID-19 Pandemic	Impulse Responses Before COVID-19 Pandemic
		

Figure 15 Impulse Responses Function from the HHI or Dynamic Technical Inefficiency Shocks

5 Concluding Remarks

The COVID-19 Pandemic is a global health crisis that has introduced an unprecedented shock to the global economy. The Pandemic disrupts supply chains, hindering global manufacturing and service sectors (Kouam, 2020; Sapulette and Santoso, 2021). The pandemic has also adversely affected global capital flows. Altogether, the change of international gross capital inflow and outflow plunged from 975 billion USD and 1065 billion USD in 2019 to 359 billion USD and -38 billion USD in 2020, respectively.

The high degree of interdependence in economic activity between countries opens up opportunities for adverse economic consequences from the spread of COVID-19 through the infected workers, the shattered supply chains, and the fall of aggregate demand for commodities (Tisdell, 2020). The adverse economic contagion consequences from the spread of COVID-19 are especially a vital issue in an economically connected region of developing countries with a high population and high COVID-19 infection rate like southeast Asia.

Investments play important roles for emerging economies. The instability of investment flow could exacerbate the instability of economic growth (Combes *et al.*, 2019). Indonesia, Malaysia, the Philippines, Thailand, and Singapore have experienced a sharp decline in investment during the COVID-19 Pandemic. These countries are economically and geographically connected in the context of ASEAN. Moreover, these countries rely on the same

group of investors for most of their investments. With these facts in mind, added with significant negative global sentiment during the Pandemic, we hypothesize that investment flow; in terms of the portfolio (debt and equity), financial derivatives, direct, and other investment; among ASEAN5 is more contagious during the COVID-19 Pandemic.

Furthermore, in regards to foreign direct investment, investigations of the impact of the COVID-19 pandemic on FDI and the impact of the COVID-19 pandemic on the relation between FDI and GDP at the sectoral level have not been conducted for the Indonesian economy using both short and long-run approaches. Thus, such research can give a contribution to the literature. Based on the Neoclassical Growth Theory, the FDI may bring many benefits to the economy such as bringing new technologies and absorbing employment. Despite this, the contribution of the FDI has been only about 2% to the gross domestic product in the Indonesian economy since 2010 (Badan Pusat Statistik, 2021). To increase capital inflow from FDI, the Indonesian government issued Law No. 11 the Year 2020 which aims to accelerate more capital inflow from FDI. This may be an indication that the government acknowledges FDI as an important engine to drive Indonesia's economy.

All in all, this paper aims to: (1) Investigate the contagion effect of foreign portfolio investment, foreign direct investment, financial derivatives investment, and other investment flow among ASEAN5 countries in the context of pre and during the COVID-19 Pandemic, and (2) study the effects of the Pandemic on sectoral foreign direct investment and GDP of Indonesia.

We use spatial econometrics, local projection, and panel vector autoregressive methods to achieve the objectives of this study. The data used are quarterly country-level data for ASEAN5 member countries from 2015Q2 to 2020Q2 and sectoral and regional-level data of Indonesia from 2000Q1 to 2021Q2.

Out spatial model estimation results show that Equity FPI tends to be the most contagious type of investment both during the Pandemic period and in the normal period. The derivative investment follows in second with debt FPI in third. FDI tends to only be contagious during the Pandemic period while another investment is not found to have a contagiousness effect at all both in normal times and in the Pandemic period. These results confirm the arguments put forward by Al-awadhi et al. (2020), Baker et al. (2020), and Ramelli and Wagner (2020).

Existing literature has shown the dominant force of global factors in affecting capital outflow from emerging economies, including ASEAN5. Besides this factor, the fact that ASEAN5 countries share a similar group of investors (from the U.S. and E.U.) and similar policy responses to the Pandemic also contribute to the significant contagiousness of portfolio flow and its increase during the Pandemic. These facts can also explain the decline in contagiousness as we expand our Pandemic period sample. ASEAN5 countries responded similarly in terms of economic and public health policies early in the Pandemic period, but as the Pandemic continues, countries diverged on how to respond to the Pandemic (OECD, 2020a; Zhang, Hu and Ji, 2020; Chong, Li and Yip, 2021; Kamaludin, Sundarasen and Ibrahim, 2021).

In regards to sectoral FDI, this research finds that the impacts of the Pandemic vary among the economic sectors. Agricultural and manufacturing sectors tend to experience mixed

effects from the Pandemic, while all sub-sectors in the utility and service sector were negatively and significantly affected by the COVID-19 Pandemic in at least one quarter from 2020Q1 to 2021Q1. Moreover, the COVID-19 Pandemic also affects the relation between FDI and GDP: The COVID-19 Pandemic causes FDI to have less impact on GDP. Furthermore, the signaling of the possibility of economic crises caused by the COVID-19 Pandemic masked the effect of the GDP on the FDI.

The findings of this research suggest that more attentions are needed towards the diversification of the sources of portfolio investment, especially for equity FPI. Due to the similarity of investors' origins in ASEAN economies (US and Europe), their behavior during crisis has caused significant contagious swings in FPI flow of ASEAN economies. Furthermore, strong macroeconomic must also be carefully maintained during crisis period in regards to debt FPI flow since domestic stability is shown by our result to be the dominant factor affecting debt FPI flow. The third implication of our research emphasis on sector-by-sector and region-by-region approaches in mitigating the negative impact of the COVID-19 Pandemic. This is based on the high heterogeneity of sectoral and regional responses during the COVID-19 Pandemic.

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7 Appendix: Alternative Estimations for Robustness Checking

This table present the alternative estimation results for robustness checking as mentioned in section three. The estimation method and weighting matrix used is indicated in the first and second row of the table, respectively. ***), **), *) indicates significance at 1%, 5%, and 10% significance level, respectively.

Variable	**Weighting Matrix: Bilateral Trade** **Estimation Method: Pooled**			**Weighting Matrix: Airline Travellers** **Estimation Method: Pooled**			**Weighting Matrix: Airline Travellers** **Estimation Method: Fixed Effect**		
	Coefficient ***(t-statistics)***			**Coefficient** ***(t-statistics)***			**Coefficient** ***(t-statistics)***		
	y = QTQ total FPI	***y = QTQ debt FPI***	***y = QTQ equity FPI***	***y = QTQ total FPI***	***y = QTQ debt FPI***	***y = QTQ equity FPI***	***y = QTQ total FPI***	***y = QTQ debt FPI***	***y = QTQ equity FPI***
constant	0.883	1.017	0.495	-0.088	0.509	-0.727	0.561	1.36	0.03
	(0.658)	(0.793)	(0.267)	(-0.067)	(0.416)	(-0.392)	(0.417)	(1.108)	(0.016)
gdp_qtq	0.045	0.01	0.066	0.044	0.016	0.061	0.053	0.023	0.068
	(0.726)	(0.168)	(0.773)	(0.713)	(0.284)	(0.712)	(0.864)	(0.424)	(0.816)
ch_ir	0.183	-0.839	0.842	0.09	-1.021	0.723	0.24	-0.98	1.011
	(0.227)	(-1.134)	(0.763)	(0.112)	(-1.391)	(0.648)	(0.299)	(-1.338)	(0.914)
def_qtq	0.464***	0.517***	0.647***	0.452***	0.516***	0.607***	0.456***	0.534***	0.59***
	(2.997)	(3.686)	(3.059)	(2.921)	(3.723)	(2.848)	(2.971)	(3.873)	(2.802)
ch_xr	0.065	0.158	-0.045	0.055	0.168	-0.066	0.099	0.192***	-0.006
	(0.548)	(1.443)	(-0.276)	(0.46)	(1.55)	(-0.399)	(0.826)	(1.768)	(-0.039)
5spread	0.002	0.21	-0.514***	0.048	0.283	-0.465	1.601***	1.157	2.04
	(0.008)	(1.003)	(-1.645)	(0.217)	(1.403)	(-1.52)	(1.749)	(1.389)	(1.621)
cab	0.212***	0.338***	0.151	0.2**	0.338***	0.127	0.183**	0.342***	0.079
	(2.86)	(4.955)	(1.484)	(2.542)	(4.748)	(1.166)	(2.045)	(4.205)	(0.637)
*w*gdp_qtq*	-0.072	-0.069	-0.12	-0.093	0.025	-0.194	-0.082	0.023	-0.171
	(-0.676)	(-0.695)	(-0.813)	(-1.04)	(0.308)	(-1.564)	(-0.933)	(0.287)	(-1.402)
*w*ch_ir*	-0.47	0.025	-1.17	-0.658	0.371	-1.489	-0.483	0.457	-1.252

Variable	Weighting Matrix: Bilateral Trade Estimation Method: Pooled Coefficient *(t-statistics)*			Weighting Matrix: Airline Travellers Estimation Method: Pooled Coefficient *(t-statistics)*			Weighting Matrix: Airline Travellers Estimation Method: Fixed Effect Coefficient *(t-statistics)*		
	y = QTQ total FPI	***y = QTQ debt FPI***	***y = QTQ equity FPI***	***y = QTQ total FPI***	***y = QTQ debt FPI***	***y = QTQ equity FPI***	***y = QTQ total FPI***	***y = QTQ debt FPI***	***y = QTQ equity FPI***
	(-0.519)	(0.03)	(-0.943)	(-0.776)	(0.482)	(-1.273)	(-0.564)	(0.585)	(-1.064)
*w*def_qtq*	0.743**	0.352	0.849***	0.503	0.082	0.595	0.588***	0.167	0.689
	(2)	(1.068)	(1.694)	(1.586)	(0.297)	(1.367)	(1.867)	(0.601)	(1.609)
*w*ch_xr*	0.254	0.057	0.432***	0.009	0.031	0.069	0.085	0.062	0.182
	(1.418)	(0.346)	(1.768)	(0.063)	(0.233)	(0.344)	(0.556)	(0.446)	(0.875)
*w*5spread*	-0.846**	-0.684***	-0.63	-0.576	-0.514	-0.263	-0.878	-0.861	-0.884
	(-2.066)	(-1.841)	(-1.12)	(-1.618)	(-1.6)	(-0.533)	(-0.639)	(-0.689)	(-0.468)
*w*cab*	-0.045	-0.083	0.059	-0.034	-0.128	0.087	0.167	-0.033	0.382***
	(-0.455)	(-0.873)	(0.437)	(-0.365)	(-1.442)	(0.672)	(1.119)	(-0.239)	(1.871)
regime 1	0.559***	0.29***	0.557***	0.57***	0.306***	0.567***	0.555***	0.313***	0.55***
	(8.21)	(2.809)	(8.146)	(8.98)	(3.183)	(8.86)	(8.537)	(3.299)	(8.376)
regime 2	0.69***	0.483***	0.712***	0.734***	0.578***	0.721***	0.74***	0.538***	0.742***
	(7.325)	(3.024)	(7.953)	(9.53)	(4.46)	(8.822)	(9.828)	(3.863)	(9.785)
regime 2-regime 1	0.131	0.193	0.155	0.164	0.272	0.154	0.185	0.225	0.192