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FOREIGN AND PRIVATE DOMESTIC INVESTMENTS IN INDONESIA: CROWDING-IN OR CROWDING-OUT?

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ABSTRACT

This study aims to investigate the empirical relationship between Foreign Direct Investment (FDI) to Private Domestic Investment (PDI) in Indonesia by using quarterly data from 1990Q2 to 2020Q2. It tests the crowding-in effect (which suggests complementarity between FDI and PDI) and crowding out effect (which indicates a substitution effect between FDI and PDI) at the sectoral level. Our results imply the prevalence of the crowding-in effect in the primary and secondary sectors, with the tertiary sector exhibiting a neutral relationship. No rational reason was observed for the restriction of foreign investment. Therefore, it is suggested that Indonesia's government needs to actively engage in FDI to increase the growth of new investments in the primary and secondary sectors of the domestic economy.

Keywords: Investment; FDI; Crowding-in; Crowding-out.
JEL Classifications: C32; E22; F21.

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I. INTRODUCTION

Foreign investment has become an integral part of the international economic system, and is widely known as one of the main catalysts for the enhancement of developing countries. According to the neoclassical growth theory (Solow, 1956), the importance of capital accumulation was emphasized to drive economic development to an optimal level of capital stock per worker. As the main determinant of growth, foreign investment complements the domestic capital supply to facilitate financing of local projects (Jude, 2019). This process is observed from two perspectives, namely financial and knowledge flow, which accompanies capital (Jude, 2019). Regarding the impact of FDI on the domestic economy, these perspectives lead to the two important evaluations, (1) the effect of FDI on private (domestic) investment, and (2) the positive externalities to the domestic economy through knowledge transfer. Based on the initial perspective, FDI is found to generate "crowding-in" effect which increases domestic investment, by displacing local producers or "crowding-out" effect which reduces domestic investment by obtaining their business opportunities. The crowding-in effect is important for the economy when the presence of foreign investment stimulates new downstream or upstream businesses (Agosin and Machado, 2005). However, the "crowding out" effect is found to be very ambiguous (Farla *et al*., 2016). The entry of foreign firms into the market also eliminates less-efficient domestic organizations from the market. This leads to a negative impact on investment and productive capacity in the short run, despite being productively beneficial. In this condition, the market becomes less efficient when foreign firms establish dominance, with a potentially negative effect on growth and investment.

The effect of FDI on private domestic investment also ignites skepticism, especially in Indonesia, where the government is consistently reforming regulations to attract foreign investors. For instance, Government Regulation No. 20 of 1994 concerning Share Ownership in Foreign Investment, Law No. 25 of 2007 concerning Foreign Investment, Economic Policy Package Stage XVI November 2018, and most recently, Law 11 of 2020 concerning Work Creation 5 October 2020.[1] Besides, the reaction of local investors to FDI needs to be considered by policymakers. If the increase in FDI displacesprivate domestic investors, the evaluation of the government's policy is necessary to attract FDI into the country. Meanwhile, this study provides empirical evidence of a positive effect on local investment, where policymakers may maximize different sectors to increase production capacity in the domestic economy.

This study contributes to the literature in the following ways. First, although most studies show that foreign capital benefited domestic investment, these results are mainly unreliable. Most scholars used the Gross Fixed Capital Formation (GFCF) to derive the net FDI inflow and public investment data.[2]. However, these two data are conceptually different. FDI is a concept of financial balance of

[1] Government Regulation Number 20 of 1994 simplifies the requirements for foreign capital ownership, which generally provides legal certainty to promote economic growth. Law Number 25 of 2007 contains a guarantee that foreign investors are to be treated the same as domestic stakeholders. Law 11 of 2020/omnibus law aims to streamline and simplify various regulations, including simplification of business licensing, investment requirements, and employment.

[2] For subsequent discussion, check Agosin and Machado (2005) and Farla *et al*., (2016).

payments while the gross fixed capital formation being part of a country's national fiscal sheet, serves as a proxy for domestic investment (Agosin and Machado, 2005; Farla *et al*., 2016). This study uses realized PDI and FDI.

Second, this study investigates the effect of primary, secondary, and tertiary sectors' FDI on private domestic investment. A few studies have also examined the impact of FDI on domestic investment based on disaggregation, although none of them has evaluated its sectoral effects on private domestic investment.[3]Avoiding aggregation bias and providing a better insight into the sectoral impact of FDI is also essential, to enable clearer policy implications in the local economy. To this effect, the empirical frameworks of Agosin and Machado (2005) and Chen *et al*. (2017) are extended by including the real cost of capital and also imports in examining the relationship of these variables to private domestic investment in Indonesia.

To analyze FDI and private domestic investment nexus, the AutoRegressive Distributed Lag (ARDL) Bounds Test from Pesaran *et al*., (2001) is applied to the 1990 to 2020 quarterly data. This provides better sample properties and places slightly limited conditions on the order of model integration (Chen *et al*., 2017; Narayan and Smyth, 2005; Pesaran *et al*., 2001). Moreover, a dynamic Unrestricted Error Correction Model (UECM) is expected to be obtained by applying a simple linear transformation to the defined ARDL model, to obtain short-run dynamics and long-run equilibrium without significant loss of information (Baek, 2016; Chen *et al*., 2017; Sbia *et al*., 2014). For robustness, we also report the structural break cointegration test by Gregory and Hansen (1996) and apply a dummy structural break in the model. Based on these analyses, we found a crowding-in relationship between the FDI and the private domestic investment. This effect is specifically found in the primary and secondary sectors, with the tertiary sector indicating a neutral relationship. To this effect, there is no reason to expect the restriction of foreign investment in Indonesia, although the government needs to be more active in encouraging FDI in the primary and secondary sectors. This is to increase the growth of new investment in the domestic economy.

The rest of the paper is organized as follows. Section II provides a brief description of foreign and domestic investment in Indonesia while Section III provides a literature review of the FDI - domestic investment nexus is provided. Section IV describes the utilized methodology and data and Section V presents the results and discussion are presented. The final section provides the concluding remarks.

II. FDI AND PDI IN INDONESIA

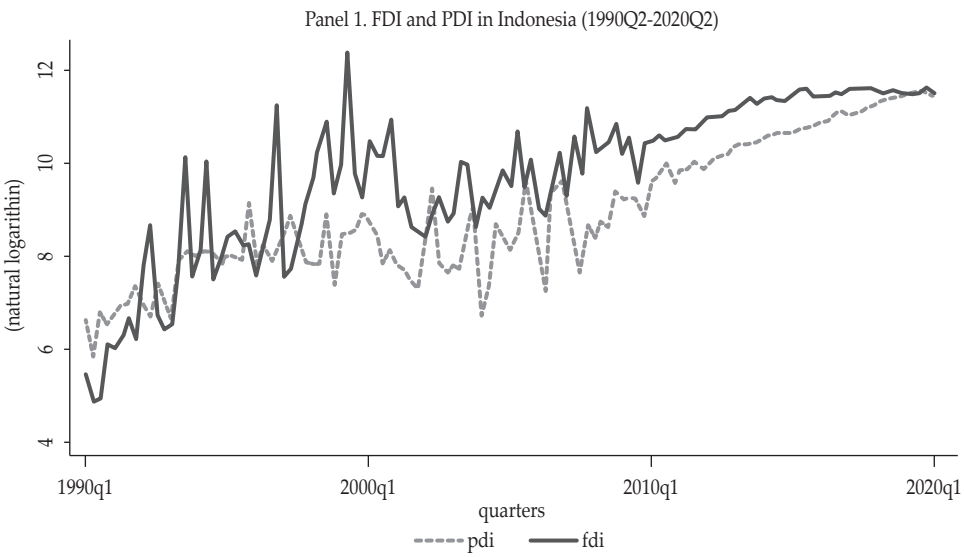
Since the issuance of Law Number 1 of 1967 concerning Foreign Investment, the flow of FDI has mostly been within the extractive sector in Indonesia. In early 1983, this investment began to expand into the manufacturing sector, which was marked by the shift of Western multinational investors to Asian newcomers, especially

[3] Check Ashraf and Herzer (2014) and Chen *et al*., (2017), which investigated the effect of entry mode on the FDI–domestic investment nexus in China, as well as Nguyen *et al*., (2020), which analyze the dynamic relationship between greenfield and domestic investments, cross-border M&As, and economic growth in Vietnam.

Japan (Lindblad, 2015). The issuance of Government Regulation Number 20 of 1994 was also considered to have played an important role in making Indonesia one of the most promising host countries for foreign investors. This was conducted by combining liberal policies, potential natural resources, as well as a large and rapidly growing domestic market (Lindblad, 2015). Between 1991-1997, Indonesia was ranked the 17th largest recipient of FDI, with an investment value of US $ 23.684 billion (Thomsen, 1999). The positive flow of this policy to the country was unsustainable in the 1990s, with the 1997-1998 Asian financial crisis and national political turmoil leading to a collapse in the real sector, as well as an increase in the FDI outflows. After this crisis and the beginning of the reform era, the Government adopted a policy to attract foreign investors back into the domestic economy.[4] Through this adoption, various improvements were continuously carried out for FDI and PDI services, including the development of the National Single Window for Investment (NSWi) system. Fig. 1 shows that both FDI and PDI have increased, especially since 2010. Panel B shows the relationship patterns between FDI and PDI in a scatter diagram. The plot of the graph is still far from conclusively drawing any clear relationship between the two variables. Therefore, a formal econometric analysis is required.

Figure 1.
FDI and PDI in Indonesia

Panel 1 describes realization of FDI and PDI using quarterly data throughout 1990-2020 in natural logarithm, while Panel 2 depicts a scatter diagram of FDI versus PDI. Source: BKPM (compiled by the author)



[4] The Phase XVI Economic Policy Package contains an expansion of tax holiday coverage, relaxation of the Negative Investment List, and an increase in Export Proceeds from natural resources. The Omnibus Law Policy in 2020 remains controversial.

Figure 1.
FDI and PDI in Indonesia (Continued)

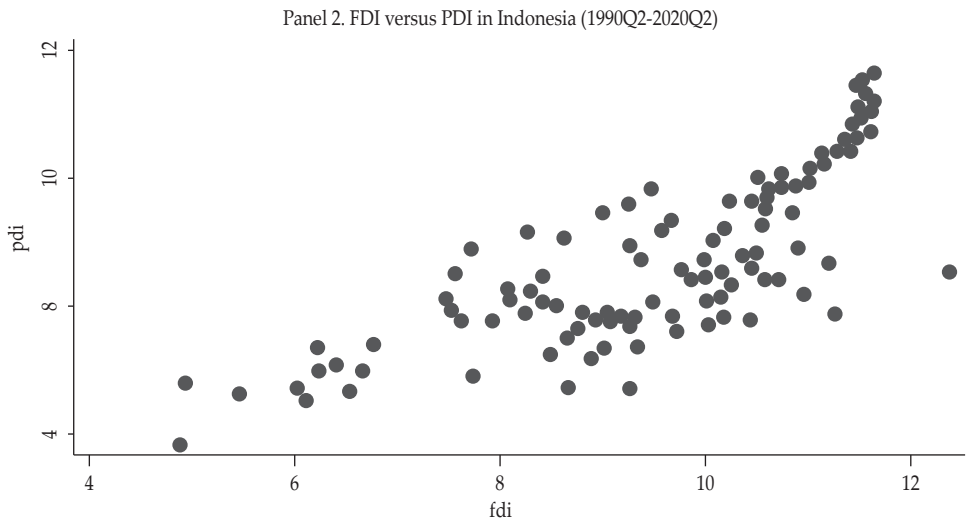


Table 1 (Panel A) presents the composition of primary, secondary, and tertiary sectors to the total FDI. Between 1990-2020, the secondary sector contributed the most to total FDI, valued at 53.62% , followed by the tertiary (32.17%) and primary (14.21%) sectors. During the 1990s, sectoral contribution to FDI was different, with the secondary aspect contributing much more (84%) to total FDI than over the period 1990-2020. Meanwhile, the primary and tertiary foreign direct investment as a share of total FDI have increased over the recent years, given lower levels of 10.08% and 5.92% respectively, reported during the 1990s. The declining contribution of the secondary sector should be of great concern for policymakers in the recent years, as this trend suggests that the sector's ability to support the acceleration of economic transformation towards industrialization has diminished. Meanwhile, although the primary sector continues to grow, it is highly vulnerable to commodity price volatility.

Table 1.
Composition of FDI & PDI

This table presents the relative composition of sectoral FDI/PDI to total FDI/PDI and the relative composition of each sector in detail to the total sector, over ten years from 1990 – 2020 (in percent). We used ten years to simplify the trend during the observation period.

Sector	Panel A: FDI				Panel B: PDI			
	1990-1999	2000-2009	2010-2020	1990-2020	1990-1999	2000-2009	2010-2020	1990-2020
Primary Sector:								
Forestry	0.15	4.79	0.76	0.86	6.11	6.76	3.98	4.24
Fishery	0.80	2.72	0.70	0.82	6.54	2.88	0.24	0.59
Mining	78.68	41.88	68.44	68.93	33.58	23.75	39.55	38.21
Food Crops, Plantations, and Livestock	20.36	50.62	30.10	29.38	53.77	66.61	56.23	56.95
Total Primary Sector	**10.08**	**4.19**	**19.31**	**14.21**	**8.57**	**12.33**	**17.02**	**16.17**
Secondary/Industrial Sector:								
Machinery, Electronics, Medical Instruments, Electrical Equipment, Precision, Optics and Clocks	3.35	10.85	7.25	6.20	2.81	2.01	1.63	1.79
Leather and Footwear	1.52	1.50	1.73	1.61	1.40	0.35	0.15	0.29
Rubber and Plastic	28.25	4.99	4.31	14.16	6.15	4.28	4.47	4.58
Wood	0.35	2.13	1.16	0.97	5.26	2.62	1.63	2.10
Motor Vehicles and Other Transportation Tools	3.73	9.99	13.69	9.09	3.12	1.77	2.07	2.11
Paper and Printing	1.25	6.81	7.56	4.88	13.60	21.50	8.10	10.77
Chemical and Pharmaceutical	13.29	25.67	18.82	17.59	20.21	12.96	17.68	17.11
Other Industries	0.38	9.71	1.43	2.23	0.50	0.48	0.83	0.75
Basic Metal Industry, Metal Goods, Non Machinery and Equipment	5.68	6.95	19.95	12.21	10.37	8.22	10.55	10.15
Food	37.43	14.00	15.35	24.14	8.87	26.45	35.95	32.12
Non Metallic Minerals	0.66	1.89	5.26	2.88	9.66	12.89	12.88	12.61
Textile	4.13	5.51	3.48	4.05	18.05	6.46	4.06	5.62
Total Secondary/Industrial Sector	**84.00**	**44.70**	**42.40**	**53.62**	**70.72**	**65.43**	**34.27**	**39.02**
Tertiary Sector:								
Hotels and Restaurants	29.93	3.73	6.30	6.70	30.75	6.13	4.47	5.11
Other Services	11.64	7.99	5.76	6.68	7.66	17.67	5.34	5.99
Construction	14.48	7.56	4.72	5.99	14.20	21.29	20.68	20.58
Electricity, Gas, and Water	7.74	17.57	28.39	24.33	13.85	19.56	23.50	23.11
Trade and Repair	2.16	7.54	6.94	6.88	1.80	10.82	4.31	4.58
Housing, Industrial Estate, and Offices	17.53	3.34	18.60	14.22	13.04	2.43	10.71	10.36
Transportation, Warehouse, and Telecommunication	16.52	52.26	29.29	35.20	18.70	22.09	30.98	30.28
Total Tertiary Sector	**5.92**	**51.11**	**38.29**	**32.17**	**20.70**	**22.24**	**48.71**	**44.82**

Over the period 1990-2020, the PDI in the primary, secondary, and tertiary sectors contributed 16.17%, 39.02%, and 44.82%, of total PDI, respectively (Panel B). The primary sector PDI contribution to total PDI has grown in recent years compared to the 8.57% achieved in the 1990s. Similarly, in the tertiary sector, PDI increased rapidly between the 1990s and 2010-2019 from 20.70% to 44.82% of total PDI, with the highest level 60.8% of total PDI achieved in 2019. The primary sector PDI as a share of total PDI was strongest in mining (68.44%) and food crop, plantation, and livestock (30.10%) in the last ten years. This figure in the secondary sector PDI was led by the metal industry and goods, non-machinery, and equipment (19.95%). This was closely followed by chemicals and pharmaceuticals (18.82%), food (15,35%), as well as motor vehicles and transportation equipment (13.69%). As a share of total PDI, the tertiary sector PDI was led by transportation, warehouse, and telecommunications (29.29%), electricity, gas, and water (28.39%), and housing, industrial estate, and offices (18.60%). Figure 2 illustrates the fluctuation in the contributions of each sector to the total FDI and PDI (Panels 1 & 2 with, the secondary sector showing higher fluctuations despite being largest contributors of the FDI and PDI during the period.

Figure 2
Contribution Sectoral FDI to Total FDI (Panel 1) and Sectoral PDI to Total PDI (Panel 2)

Panel 1 describes contribution of primary sector FDI (FDI_prim), secondary sector FDI (FDI_sec) and tertiary sector PDI (FDI_ter) to total FDI in percentage unit. Panel 2 describes contribution primary sector PDI (PDI_prim), secondary sector PDI (PDI_sec) and tertiary sector PDI (PDI_ter) to total PDI in percentage unit. Source: BKPM (compiled by the author)

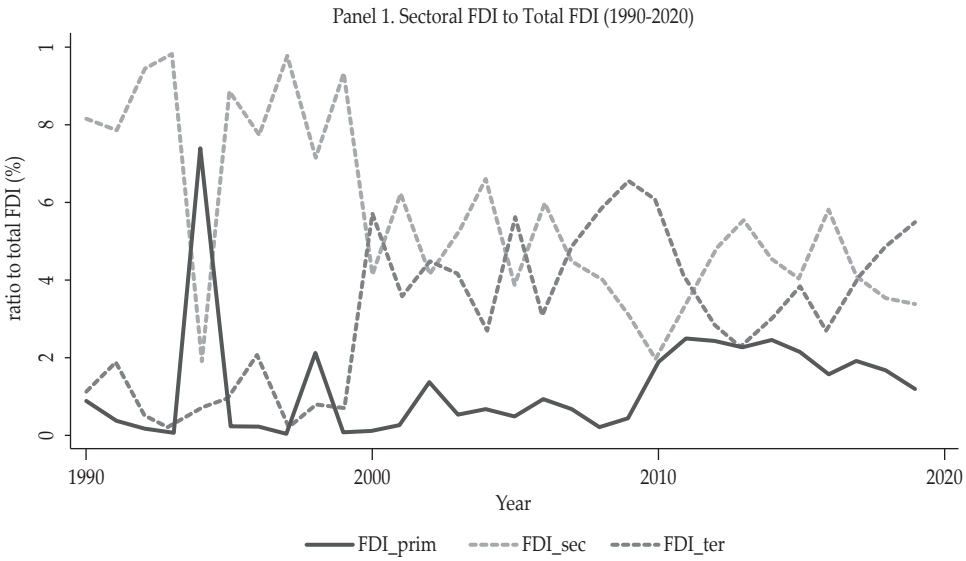
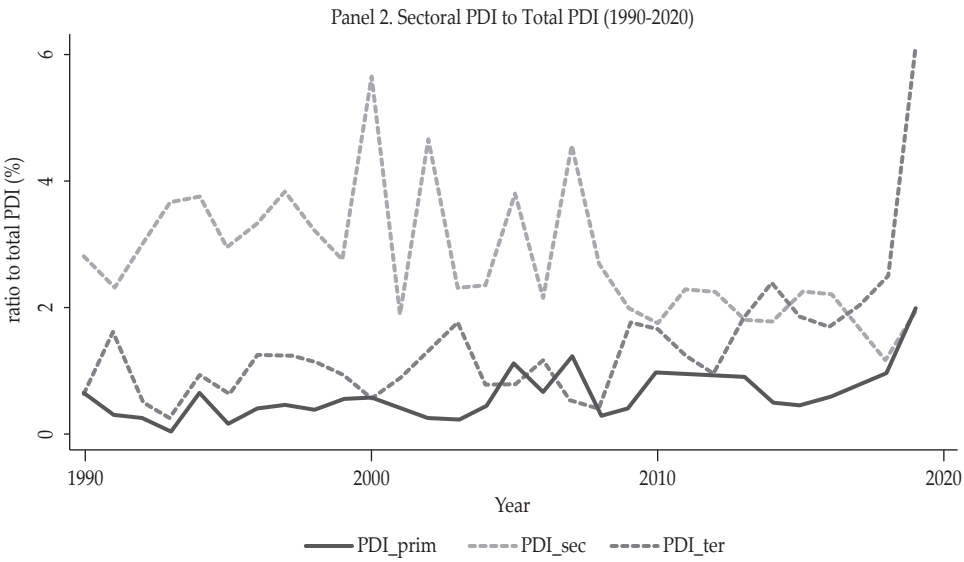


Figure 2
Contribution Sectoral FDI to Total FDI (Panel 1) and Sectoral PDI to Total PDI (Panel 2) (Continued)



III. LITERATURE REVIEW

As a capital flow, the effect of FDI on domestic capital accumulation was observed in several phases, (1) FDI contributes directly to new plants and equipment ("greenfield" FDI), and (2) FDI generates a spillover investment beyond an immediate increase in capital stock, through intercompany relationships. For instance, multinational companies often purchased inputs from domestic suppliers, leading to the encouragement of new investment by local firms (Agosin and Machado, 2005; Mileva, 2008). The relationship between FDI and domestic investment tends to complement each other when investment is in an underdeveloped economic sector. This is due to technological factors or a lack of foreign market knowledge, as a substantial difference is observed in the distribution of sectoral FDI to the existing capital stock (Agosin and Machado, 2005). Meanwhile, this investment does not generally contribute to direct capital formation as mergers and acquisitions (M&A), unless new foreign owners expand their productive capacity or invest in innovative technology (Mileva, 2008). FDI is also found to displace domestic investors when the entry of foreign companies eliminates less efficient local organizations from the market (Farla *et al*., 2016). This is subsequently observed when they enter a competitive sector filled with the domestic companies already producing for the export market). These are because foreign affiliates often have lower marginal costs (Aitken and Harrison, 1999), which enables them to occupy a portion of domestic demand, forcing local firms to reduce output and increase their average costs (Jude, 2019). Irrespective of this condition, some competitive local firms often respond to the inflows of FDI by increasing and renewing their capital stocks (De Mello, 1999). These domestic

firms are still eliminated by foreign investment when multinational companies use imported inputs or enter a sector previously dominated by state-owned organizations.

According to Agosin and Machado (2005), the presence of FDI did not guarantee a positive impact on domestic investment, as a result of a one-step GMM analysis for 36 developing countries between 1971-2000. This suggested that the sectoral pattern of FDI inflows needs to be different from the existing productive stocks in the host country, to obtain an overall crowding-in effect. Misun and Tomsik (2002) also analyzed the effect of this investment in Eastern European countries during 1990-2000, indicating different impacts between several nations, such as the crowding-in and crowding-out in Hungary/Czech Republic and Poland, respectively. Using a larger sample of 46 developing countries and adding governance as a control variable, Morrissey and Udomkerdmongkol (2012) proved that FDI reduced domestic investment during 1996-2009. Despite this, the effect still increased on better governance. This was in line with Mileva (2008), where large and small spillover effects were observed in weaker and stronger countries between 1995-2005, regarding the application of governance. These results were not supported by Farla et al. (2016), which criticized the use of an inaccurate proxy in separating foreign and domestic capital formations, as well as the methodological problems of applying the GMM technique. With alternative proxies and improvements, this literature determined the FDI crowds in domestic investment, with no strong evidence proving that "good governance" encouraged local business. Meanwhile, Jain *et al*. (2014) found crowding-in effects between 1995–2007, using 22 developing Asian countries. To reduce aggregation bias, Ndikumana and Verick (2008) also found a crowding-in effect using a sample of sub-Saharan African countries during 1970-2005. This was in line with Adams (2009), where similar samples were used during 1990-2003. Based on Wang (2010), the cumulative effect of FDI on domestic investment was neutral and positive in developed and underdeveloped countries, respectively. Al-Sadig (2013) also found that the crowding-in effect depended on the availability of human capital in low-income countries, using 91 developing nations in 1970-2000. With a sample of 10 Central and Eastern European Countries (CEEC) in 1990-2010, Jude (2019) concluded that FDI displaced domestic investment, while the effect decreases with time. It also also indicates that greenfield FDI may develop long run complementaries with domestic investment, while mergers and acquisitions do not prove any significant effect on domestic investment.

In China, Tang *et al*. (2008) found a crowding-in effect and unidirectional causality from FDI to domestic investment, using VAR analysis during 1988-2003, with Chen *et al.* (2017) indicating a neutral relationship through ARDL in 1994-2014. Irrespective of these conditions, joint capital ventures still increased domestic investment when the mode of FDI entry was considered, with wholly foreign-funded firms being crowded-out. Regarding the agricultural sector, Djokoto *et al*. (2014) also found a crowding-in effect from 1976 to 2007, using ARDL in Ghana. This was in line with Ang (2009) and Ghazali (2010) in Malaysia and Pakistan, where VAR/VECM and VECM representations were used during 1960-2003 and 1981-2008, respectively. It also supported Huang (2003) and Braunstein and Epstein (2002), which were performed in China.

Based on the mixed evidence, the nature of the FDI-domestic investment relationship in the host country was sensitive to the applied methodology, variables, periods, and aggregation biases. Although the existing literature largely supported the crowding-in hypothesis, the question of the sectoral FDI effect of FDI on PDI remained open, especially in developing countries. Therefore, this study aims to investigate the sectoral impacts of FDI on private domestic investment in Indonesia.

IV. RESEARCH METHOD

A. Research Methods

To analyze whether FDI developed a complementary (crowding-in) or a substitution (crowding-out) effect, an AutoRegressive Distributed Lag (ARDL) Bounds Test established by Pesaran and Shin (1997) and Pesaran *et al*., (2001) were conducted. This was formally initiated by the baseline model of domestic investment as follows (Chen *et al*., 2017),

$$PDI_t = \kappa_1 + \alpha_1 FDI_t + X'\beta + \varepsilon_t \quad (1)$$

where, PDI_t and FDI_t = a private domestic and foreign investment realization in quarter t, X' = the classical determinants of investment, κ_1 = a constant, and ε_t = stochastic error term. In the variable set X, the gross domestic product in constant prices (GDP) was used to capture the effects of growth expectations, and the real interest rate on investment (RATE) was utilized as a proxy for the cost of capital[5]. Imports (IMP) were also used to determine the relationship between IMP and PDI, regarding Indonesia's economy. To test for the complementary or substitution effects of FDI, the coefficient, α_1, was analyzed based on the following, (1) When the coefficient is positive and statistically significant, a crowding-in effect is supported, and (2) When the coefficient is negative and statistically significant, the crowding-out hypothesis is supported (Agosin and Machado, 2005; Chen *et al*., 2017; Farla *et al*., 2016). To investigate the effects of sectoral FDI on PDI, the aggregated foreign investment in Eq. (1) was primarily, secondarily, and tertiarily replaced as shown in Eq. (2),

$$PDI_t = \kappa_2 + \gamma_1 FDIprim_t + \gamma_2 FDIsec_t + \gamma_3 FDIter_t + X'\beta + \varepsilon_t \quad (2)$$

The effect of the sectoral FDI on PDI was examined through the following equations:

$$PDIprim_t = \kappa_3 + \lambda_1 FDIprim_t + X'\beta + \varepsilon_t \quad (3)$$

$$PDIsec_t = \kappa_4 + \lambda_2 FDIsec_t + X'\beta + \varepsilon_t \quad (4)$$

[5] The empirical specification of Agosin and Machado (2005) and Misun and Tomsik (2002) eliminates one of the determinants of investment, namely the cost of capital. They argued that the interest rate was not a significant factor in explaining investment in developing countries. According to Jude (2019), the investment interest rate remained an important factor in accessing investment credit in developing countries

$$PDIter_t = \kappa_5 + \lambda_3 FDIter_t + X'\beta + \varepsilon_t \quad (5)$$

Where, *DIprim*, *FDIsec*, and *FDIter*, *PDIprim*, *PDIsec*, and *PDIter* = the FDI and PDI in the primary, secondary, and tertiary sectors.

In establishing a long-term relationship between two or more variables, the ARDL framework utilized three steps. Firstly, the application of a simple linear transformation to the ARDL model, where a dynamic Unrestricted Error Correction Model (UECM) was observed. The corresponding UECM of Eqs. (1)-(2)[6] is expressed as follows,

$$\begin{aligned}
&\Delta PDI_t \\
&= \psi_1 PDI_{t-1} + \psi_2 FDI_{t-1} + \psi_3 GDP_{t-1} \\
&+ \psi_4 RATE_{t-1} + \psi_5 IMP_{t-1} + \sum_{i=1}^{p} \phi_1 \Delta PDI_{t-i} + \sum_{j=0}^{q} \phi_2 \Delta FDI_{t-j} \\
&+ \sum_{k=0}^{r} \phi_3 \Delta GDP_{t-k} + \sum_{l=0}^{s} \phi_4 \Delta RATE_{t-l} + \sum_{m=0}^{s} \phi_5 \Delta IMP_{t-m} + \varepsilon_t
\end{aligned} \quad (6)$$

$$\begin{aligned}
&\Delta PDI_t \\
&= \chi_1 PDI_{t-1} + \chi_2 FDIprim_{t-1} + \chi_3 FDIsec_{t-1} + \chi_4 FDIter_{t-1} + \chi_3 GDP_{t-1} \\
&+ \chi_4 RATE_{t-1} + \chi_5 IMP_{t-1} + \\
&\sum_{i=1}^{p} \phi_1 \Delta PDI_{t-i} + \sum_{j=0}^{q} \phi_2 \Delta FDIprim_{t-i} \sum_{k=n}^{q} \phi_2 \Delta FDIsec_{t-n} \sum_{o=0}^{q} \phi_2 \Delta FDIter_{t-o} + \\
&\sum_{k=0}^{r} \phi_3 \Delta GDP_{t-k} + \sum_{l=0}^{s} \phi_4 \Delta RATE_{t-l} + \sum_{m=0}^{s} \phi_5 \Delta IMP_{t-m} + \varepsilon_t
\end{aligned} \quad (7)$$

Where Δ = the first difference. In Eq. (6), the short and long-run coefficients were represented by ϕ_1-ϕ_5 and ψ_1-ψ_5, respectively, with ε_t being the error term denoting the residual values that are not serial correlation, homoscedastic, and normally distributed. Furthermore, the stability of the parameters was analyzed using the Sb CUSUM analysis and Ramsey Regression Equation Specification Error Test (RESET), as a general specification measurement for the linear regression model. Based on the relatively small sample size, the Akaike Information Criterion (AIC) was also applied to select the optimal lag structure in the model (Lütkepohl, 2005).

Secondly, the *F*-statistics were computed to establish the presence of cointegration, by testing the null hypothesis (H_0) of no cointegrated relationship. In Eq. (5), H_0: ψ_1=⋯= ψ_5=0 was also analyzed against the alternative hypothesis of cointegrated relationship, H_1: $\psi_1 \neq \cdots \neq \psi_5 \neq 0$. In this condition, the F-statistics were computed and compared with the Critical Values (CV) of upper and lower

[6] This study used the same technique for Eq. (3) - (5), due to limited space, it is not presented in this paper

sample-limited and asymptotic limits provided by Kripfganz and Schneider (2018), where their CVs increased and substantially extended the sets prepared by Pesaran *et al*. (2001) and Narayan (2005). Based on the results, H_0 was rejected and accepted when the F-statistics were above and below the upper and lower bound critical values, respectively. However, the analysis became inconclusive when the F-statistic were within the range of the lower and upper bounds (Chen *et al*., 2017).

Thirdly, the long and short-run coefficients were estimated when the analysis was found to be cointegrated. The suitability and adequacy of the statistical estimations depended on the coefficient Error Correction Term (ECT_{t-1}), which indicated the speed of a short-run adjustment value to the long-term equilibrium (Kaur, 2019; Kripfganz and Schneider, 2018). To ensure convergence towards equilibrium, the $\gamma_1 < 0$ was obtained and found to be significant (Kaur, 2019; Kripfganz and Schneider, 2018). However, the short-term dynamics were not considered regarding the main aim of the report emphasizing the long-run relationship between FDI and PDI.

B. Data

This study uses quarterly data over the period 1990Q2-2020Q2, with a total of 121 observations. FDI and PDI data are sourced from the Investment Coordinating Board (BKPM), which represents the realizations by foreign (joint venture and wholly foreign-funded enterprise) and private domestic investors, respectively. These data are reported quarterly to BKPM as fixed and working capitals in billions of Rupiah. Imports of goods (IMP) and servicesand the total Gross Domestic Product (GDP) are obtained from the Federal Reserve Bank of St. Louis (FRED) in constant values (index 2015=100), respectively. Subsequently, FDI, PDI, GDP, and IMP were converted to the natural logarithm[7]. RATE is obtained from Bank Indonesia. This monthly lending rate of investment was then converted to a quarterly value at State-Owned, Regional Development, and National Private Banks[8]. To obtain the real lending rate, the quarterly inflation data from the FRED database was adopted. Table 2 summarizes the descriptive statistics of the utilized variables.

[7] https://nswi.bkpm.go.id/; https://fred.stlouisfed.org/

[8] https://www.bi.go.id/id/statistik/ekonomi-keuangan/seki/Default.aspx

Table 2.
Descriptive Statistics

This table reports the descriptive statistics of the variables. PDI is total Private Domestic Investment, PDIprim is primary sector PDI, PDIsec is secondary sector PDI, PDIter is tertiary sector PDI, FDI is total Foreign Direct Investment, FDIprim is primary sector FDI, FDIsec is secondary sector FDI, FDIter is tertiary sector FDI, and IMP is imports of goods and services. All in billions of Rupiah. GDP is Total Gross Domestic Product , Index 2015=100, and RATE is the real investment interest rate in percent.

	PDI	PDI_{prim}	PDI_{sec}	PDI_{ter}	FDI	FDI_{prim}	FDI_{sec}	FDI_{ter}	GDP	RATE	IMP
Mean	20,218.54	3,269.309	7,887.202	9,062.03	40,354.13	6,033.74	19,388.35	14,932.04	66.577	5.999	291,796.5
Median	6,149.149	579.068	3,913.995	1,231.451	24,810.32	846.049	8,125.602	6,002.328	57.324	7.496	212,480
Maximum	112,734.2	23,880.64	31,374.19	76,698.1	236,585.1	25,492.34	235,023.9	65,048.12	124.089	18.376	862,682
Minimum	345.867	0	230.276	15.358	130.861	0	83.577	1.901	30.214	-53.125	13,349.93
Std Dev.	27,596.21	5214.037	8,190.64	16,118.61	41,852.26	8,116.133	26,722.48	17,594.43	27.030	9.596	254,308.3
Variance	7.62e+08	2.72e+07	6.71e+07	2.60e+08	1.75e+09	6.59e+07	7.14e+08	3.10e+08	730.598	92.081	6.47e+10
Skewness	1.694	2.063	1.105	2.319	1.294	.980	4.621	1.166	0.634	-4.488	0.575
Kurtosis	4.873	6.708	2.976	7.901	5.326	2.323	36.204	3.338	2.138	25.775	1.934
JB normality	3.9e-17	2.0e-34	4.5e-06	1.4e-50	5.6e-14	2.0e-05	0	8.4e-07	0.003	0	0.002
Observation	121	121	121	121	121	121	121	121	121	121	121

V. EMPIRICAL RESULTS

A. Stationary Test

The ARDL bound tests are valid if all variables are not integrated into second-order or higher categories. This is because the F-statistic calculation emphasizes the assumption that all variables need to be stationary at the level or first difference (Pesaran *et al*., 2001). In this regard, the DF-GLS unit root test developed by Elliott *et al*., (1996) is performed. In Table 3, none of these variables are integrated by an order higher than one. Nonetheless,Clemente-Montanes-Reyes (CMR) (1998) detrended break-unit root test is also performed, since the DF-GLS analysis fails to represent the structural breaks in series. This approach supported an additive outlier model, by plugging out sudden changes in the variable mean. It was also conducted for the gradual changes in the mean of the variables tested by innovative outlier (Chen *et al*., 2017). Tables 4 and 5 present the CMR outputs for two structural breaks at the level and first difference, respectively. These were in line with the DF-GLS test, where the lending rate and other variables were I (0) and I (1), respectively. For many variables, structural breaks at the level occurred around 1997 and 1998 and were related to the monetary crisis in Indonesia during those years.

Table 3.
DF-GLS Unit Root Test Results

This table reports the results of the DF-GLS unit root test at levels [I (0)] and First Difference [I (1)]. The DF-GLS tests the null hypothesis of "unit root". We used a maximum of 4 lags and AIC criterion to determine the optimal lag length. The asterisks **, and *** denote the significance at 5% and 1% levels, respectively.

Variable	Level		First Difference		
	No trend	Trend	No trend	Trend	Conclusion
PDI	-0.585	-5.267***	-5.084***	-8.533***	I(1)
PDI_{prim}	-0.893	-5.873***	-11.004***	-11.313***	I(1)
PDI_{sec}	-1.247	-5.595***	-4.436***	-7.423***	I(1)
PDI_{ter}	-0.934	-5.033***	-13.398***	-13.315***	I(1)
FDI	-0.556	-3.397**	-7.975***	-10.923***	I(1)
FDI_{prim}	-1.468	-6.481***	-8.673***	-9.917***	I(1)
FDI_{sec}	-0.726	-3.355**	-7.820***	-10.385***	I(1)
FDI_{ter}	-0.582	-4.127***	-4.413***	-7.112***	I(1)
GDP	1.448	-1.908	-4.691***	-4.251***	I(1)
RATE	-6.574***	-7.257***	-6.174***	-6.831***	I(0)
IMP	0.767	-1.464	-4.066***	-5.605***	I(1)

Table 4.
Clemente-Montanes-Reyes (CMR) Unit Root Test Results (Level)

This table reports the results of the CMR unit root test at level [I (0)]. The CMR examines the null hypothesis of a "unit root" which allows for two structural breaks in the series. The CMR uses two models: The additive outlier (AO) model which calculates the sudden change in a series, and the Innovative outlier (IO) model which calculates the gradual shift in the mean of the series. TB1 and TB2 refer to the dates of the structural break. We used a maximum of 4 lags and used AIC criterion to determine the optimal lag length. The asterisk ** denotes the significance at the 5% level.

Variable	Additive Outliers (AO)			Innovative Outliers (IO)			Decision
	TB1	TB2	Test Statistic	TB1	TB2	Test Statistic	
PDI	2006q1	2012q1	-4.157	1993q1	2009q4	-3.052	-
PDI_{prim}	2003q2	2010q3	-5.792**	1993q3	2009q3	-5.999**	I(0)
PDI_{sec}	2006q1	2011q3	-6.285**	2006q2	2009q4	-4.834	-
PDI_{ter}	1993q1	2009q2	-3.896	1993q2	2008q3	-5.156	-
FDI	1997q2	2010q4	-4.900	1997q3	2009q4	-4.817	-
FDI_{prim}	1997q3	2009q2	-4.505	1997q4	2009q3	-8.771	-
FDI_{sec}	1996q1	2011q3	-4.328	1996q2	2011q4	-7.689**	-
FDI_{ter}	1997q1	2006q4	-5.095	1997q2	2007q1	-4.918	-
GDP	2005q1	2012q4	-3.080	1998q3	2008q4	-2.921	-
RATE	1997q4	1999q4	-10.893**	1997q3	1998q2	-15.430**	I(0)
IMP	1998q4	2008q3	-4.773	1997q2	2009q1	-3.405	-

Table 5.
Clemente-Montanes-Reyes (CMR) Unit Root Test Results (First Difference)

This table reports the results of the CMR unit root test at First Difference [I (1)]. The CMR examines the null hypothesis of a "unit root" which allows for two structural breaks in the series. The CMR uses two models: The additive outlier(AO) model which calculates the sudden change in a series, and the Innovative model (IO) model which calculates the gradual shift in the mean of the series. TB1 and TB2 refer to the dates of the structural break. We used a maximum of 4 lags and used AIC criterion to determine the optimal lag length. The asterisk ** denotes the significance at the 5% level.

Variable	Additive outliers (AO)			Innovative outliers (IO)			Decision
	TB1	TB2	Test Statistic	TB1	TB2	Test Statistic	
ΔPDI	2006q1	2007q2	-10.728**	2006q2	2007q2	-9.593**	I(1)
ΔPDI_{sec}	2006q2	2007q2	-10.626**	2006q1	2007q2	-10.405**	I(1)
ΔPDI_{ter}	1993q1	1994q1	-14.329**	1993q2	1994q2	-14.435**	I(1)
ΔFDI	1993q2	1996q3	-7.476**	1993q3	1996q4	-16.120**	I(1)
ΔFDI_{prim}	1994q1	1994q4	-6.565**	1994q2	1998q2	-11.020**	I(1)
ΔFDI_{sec}	1993q2	1996q3	-8.874**	1993q3	1996q4	-9.916**	I(1)
ΔFDI_{ter}	2000q3	2002q2	-9.006**	2000q4	2002q2	-10.510**	I(1)
ΔGDP	1997q4	1998q2	-4.122	1997q3	1998q3	-11.519**	I(1)
ΔIMP	1997q3	2008q3	-8.255**	1997q2	1998q3	-10.084**	I(1)

B. ARDL Bound Test

After confirming that all variables are integrated at I (0) or I(1) , an ARDL Bound Test is carried out, as shown in Table 6. The F-statistic corresponding to Eq. (1) was above the critical value provided at the 1% significance level, by Kripfganz and Schneider (2018). This implies rejection of the null hypothesis, in other words, a

cointegrated relationship was observed between aggregate FDI and PDI during 1990-2020. The results are similar for PDI and sectoral based FDIs, as expressed in Eq. (2), and for the individual sector-based PDI and FDI in Eqs. (3-5).

Table 6.
ARDL Bounds Test Results

This table reports the ARDL Bounds Test which examines the null hypothesis of no cointegration against an alternative of cointegration. The table shows that the *F*-statistics in all equations reject the null hypothesis of no cointegration. We use the F-statistic critical value developed by Kripfanz and Schneider (2018) and a maximum of 4 lags under the AIC criterion to determine the optimal lag length. The asterisk *** denotes the significance at the 1% level.

Eq.	(1)	(2)	(3)	(4)	(5)
Optimal Lag (AIC)	2, 1, 3, 0, 0	2, 3, 2, 0, 4, 0, 2	1. 0, 4, 0, 0	1, 2, 2, 4, 0	3, 4, 2, 0, 4
F-statistic	16.519***	12.319***	26.094***	22.486***	6.366***
Critical value (F)					
I (0)	3.915	3.270	3.922	3.897	3.872
I (1)	5.308	4.781	5.302	5.325	5.348

Similar to the CMR test results (Table 4), structural breaks were observed in some of the series affecting the reliability of the Bound Test outputs (Chen *et al*., 2017; Sbia *et al*., 2014). To ensure robustness, the structural break cointegration test of Gregory and Hansen (1996) is estimated, with results in Table 7 suggesting that the null hypothesis of no cointegrated relationship in Eqs. (3)-(4) is rejected.

Table 7.
The Gregory Hansen Structural Break Cointegration Test Results

This table reports the Gregory Hansen structural break cointegration test. They considered three models: (1) level shift; (2) level shift with trend; and (3) regime shift. We examine the null hypothesis of no cointegration against an alternative of cointegration with a single break in an unknown date based on the extension of the traditional ADF, $Z\alpha$, and Zt test types. This table reports Zt value and TB refers to the structural break date. The Gregory–Hansen tests reject the null hypothesis of no cointegrated relationship Eq. (2) is not available considering that the tool analysis we used does not support more than 4 variables on the right side. The asterisk *** denotes the significance at the 1% level.

Eq.	(1)	(3)	(4)	(5)
Model (1) Change in Level				
Zt	-9.87***	-11.41***	-10.51***	-8.99***
TB	2000q4	2001q1	2000q4	2002q3
Model (2) Change in Level & Trend				
Zt	-10.05***	-11.40***	-10.50***	-9.02***
TB	2000q4	2015q4	2000q4	2002q3
Model (3) Change in Regime				
Zt	-10.14***	-12.07	-10.62***	-9.10***
TB	1997q1	1996q4	1997q2	2002q3

Table 8 suggests that the ECT_{t-1} in Eqs. (1)-(5) are negative and statistically significant. This validates the long-run equilibrium between FDI and PDI. The speed of convergence ranged between 0.6 and 1.05, indicating that approximately 4-7% equilibrium deviation was adjusted between 60-100% quarterly. These results are validated by a set of diagnostic tests against serial correlation (Breusch-

Godfrey LM & Durbin-Alternative Test) and heteroscedasticity (White Test), as shown in Panel B, Table 8. They are also in line with Ramsey's RESET and Sb CUSUM tests, where the estimated models are adequately specified and highly stable over the sample period. Although the stochastic error in the estimated model is not normally distributed under classical assumptions, it is still not a requirement for many aspects of time series analysis. The violation of this assumption did not contribute to bias or inefficiency in the regression model, due to being only important for p-value significance analysis when the sample size is very small.[9] The ARDL model provides a consistent estimator of the BLP (Best Linear Predictor), regardless of the normality assumption.

Table 8.
ECT_{t-1} and Diagnostic Test Results

This table reports ECT_{t-1}, and diagnostic test results. Diagnostic tests include adjusted R square, non-autocorrelation test (BGodfrey & Durbin Alternative Test); heteroscedasticity test (White Test); Ramsey Regression Equation Specification Error Test (Ramsey RESET), normality test (Jarque-Bera & Swilk); and Structural Break (SB) CUSUM. The asterisk *** denotes the significance at the 1% level.

	(1)	(2)	(3)	(4)	(5)
Panel A. ECT Coefficient					
ΔPDI	-0.984***	-1.050***			
ΔPDI_{prim}			-1.002***		
ΔPDI_{sec}				-0.978***	
ΔPDI_{ter}					-0.595
Panel B. Diagnostic Test					
Adjusted R^2	0.429	0.567	0.543	0.483	0.435
Breusch-Godfrey	0.318 (1)	0.578 (1)	0.054 (1)	0.760 (1)	0.274 (1)
(χ^2)	0.606 (2)	0.680 (2)	0.137 (2)	0.425 (2)	0.286 (2)
Durbin Alternative	0.342 (1)	0.614 (1)	0.062 (1)	0.775 (1)	0.314 (1)
(χ^2)	0.637 (2)	0.729 (2)	0.157 (2)	0.472 (2)	0.346 (2)
White (χ^2)	0.076	0.457	0.061	0.240	0.457
Ramsey RESET (χ^2)	0.320	0.164	0.573	0.385	0.414
JB-test (χ^2)	1.9e-04	9.9e-13	0.099	5.7e-04	0.006
Swilk (χ^2)	0.001	0.000	0.076	0.020	0.011
SB CUSUM	0.455*** (stable)	0.593*** (stable)	0.642*** (stable)	0.309*** (stable)	0.490*** (stable)

C. ARDL Estimation

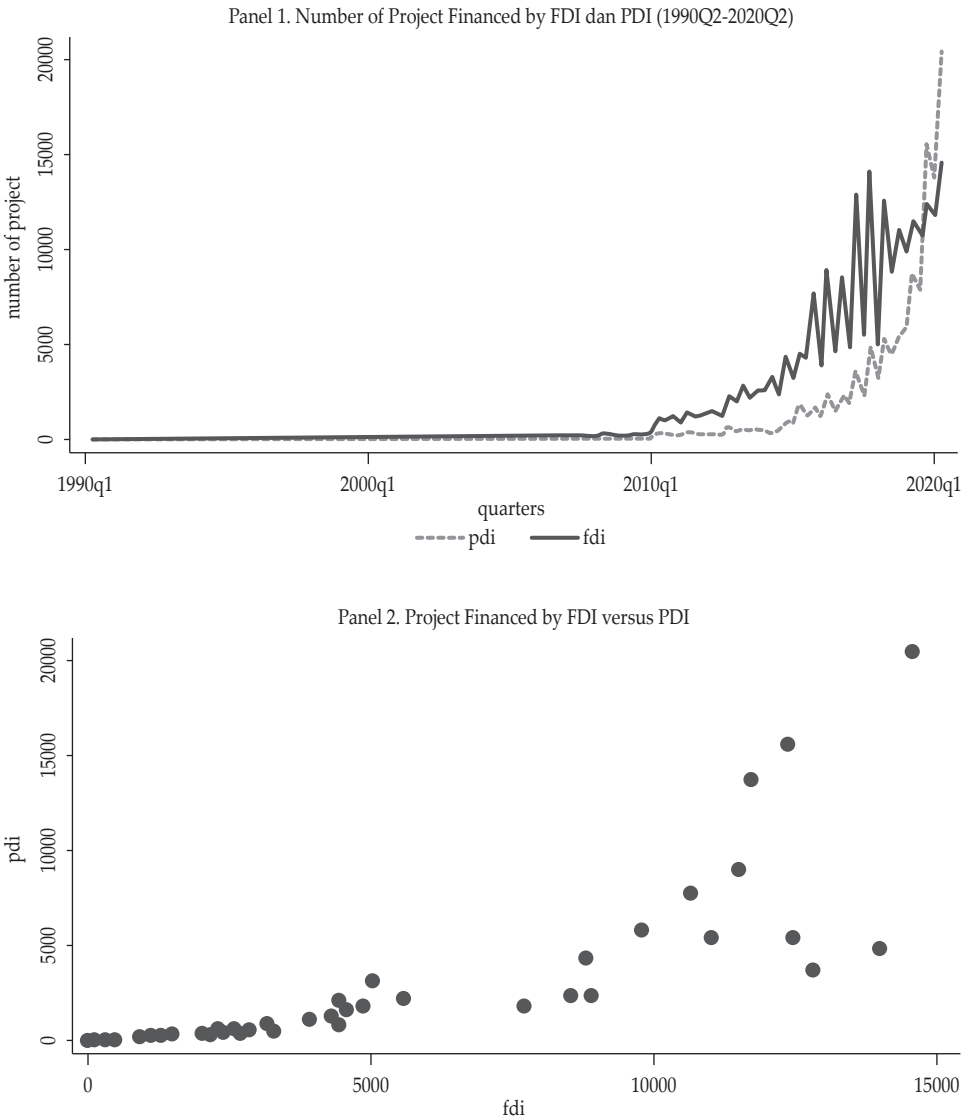
After the identification of cointegration in Eqs. (1)-(5), the long-run relationship between FDI and PDI is examined. Results presented in Table 9, the long-run FDI coefficient is positive and statistically significant (Table 9). In Eq. (1), the value of this variable is 0.28, indicating that a 1% FDI increase elevates PDI by 0.28% when all factors are constant. This result is supported by Fig. 3, where the number of project realizations financed by foreign and domestic investors was observed in

[9] See Schmidt and Finan (2018: Linear regression and the normality assumption, https://www.statisticssolutions.com/free-resources/directory-of-statistical-analyses/normality/, or http://davegiles.blogspot.ro/2013/06/ardl-models-part-ii-bounds-tests.html

1990Q2-2020Q2. In this condition, the complementary support of FDI to PDI in Indonesia is encountered during the sample period.

Figure 3.
Number of Projects Financed by Foreign Investor (FDI) and Domestic Investor (PDI) for Period 1990Q2-2020Q2.

Panel 1 shows line diagram of the number of project finance by FDI and PDI in line diagram, while Panel 2 illustrates a scatter diagram. Source: BKPM (compiled by the author)



The impact of FDI in the primary, secondary, and tertiary sectors is also observed on PDI. From Eq. (2), the sectoral effects of this variable are examined against PDI at the aggregate level. This indicates a positive long-run coefficient of FDI in the primary, secondary, and tertiary sectors, as shown in Table 9. In this condition, the positive impacts in the primary and secondary sectors are statistically significant, with the tertiary level exhibiting insignificance. A stronger impact is also observed in the secondary sector regarding the magnitude of the FDI. Based on these results, the primary and secondary sectors have a complementary/crowding-in effect on PDI, with a neutral/impact being exhibited at the tertiary level.

To ensure robustness, the effect of sectoral FDI on PDI is examined using individual equations. Here, the PDI of the primary, secondary, and tertiary sectors are used as the dependent variable in Eqs. (3)-(5), to avoid aggregation bias and provide better insight into the investment sectoral impacts. In Table 9, the results of the individuals in Eqs. (3)-(5) remain consistent with Eq. (2), where Eqs. (3) and (4) exhibited the positive and statistically significant impacts of FDI on the primary and secondary sectors of PDI. Meanwhile, Eq. (5) shows a weak complementary effect of FDI on PDI in the tertiary sector. As results show, foreign investment has a complementary effect (crowding-in) on PDI, as observed in the primary and secondary sectors, while a neutral impact is found at the tertiary level. When all other factors are held constant, a 1% FDI increase in the primary and secondary sectors elevated PDI by 0.20 and 0.31% (Eq. 3 & 4), respectively. Regarding the estimations in Eq. (2)-(5), FDI flows has a stronger positive effect on PDI in the secondary sector.

In the primary and secondary sectors, the crowd-in effect of FDI are mostly due to the increased demand for local suppliers (spillover effect), leading to the stimulation of new domestic or downstream investment. This is attributed to the abundant domestic stock of raw materials at a more favorable cost, compared to the importation of products from subsidiaries in other countries. However, the contribution of FDI in the industrial/secondary sector has declined over the last 30 years, with the efforts of policymakers adequately needed for improvement. Irrespective of the declination, this sector still plays an important role in the transformation towards economic development.

Table 9.
Long-Run Coefficients of FDI

This table reports the long-run estimation using the ARDL-UECM in five equations. We used a maximum of 4 lags and AIC criterion to determine the optimal lag length.. The asterisks *, **, and *** denote the significance at the 10%, 5%, and 1% levels, respectively.

Independent Variable	Dependent Variable				
	PDI		PDI_{prim}	PDI_{sec}	PDI_{ter}
	(1)	(2)	(3)	(4)	(5)
FDI	0.280***				
FDI_{prim}		0.118**	0.203***		
FDI_{sec}		0.212***		0.313***	
FDI_{ter}		0.060			0.372
GDP	4.235***	4.174***	3.978***	3.180***	7.042***
RATE	0.007	0.012	-0.003	-0.032**	-0.068***
IMP	-0.618***	-0.816***	-0.253	-0.485***	-1.452**
Intercept	-3.642***	-1.582	-7.885***	-1.697***	-3.980*

As often used in the literature, the other factors influencing domestic investment decisions include GDP, interest rates, and imports. Based on Table 9, real GDP has a positive and statistically significant relationship to private domestic investment (Eq. 1). These results remains consistent after the application of the sectoral FDI mode to aggregate and individual PDI (Eqs. 2 & 3-5). When all other factors remain constant, a 1% GDP increase is observed to elevate 4.2% of PDI (Eq. 1). This is in line with the outputs of the individual modes (Eqs. 2-5), where the decision of private domestic investors is strongly influenced by economic growth. These results are in line with Chen *et al*., (2017) and Nguyen *et al*., (2020) in China and Vietnam, respectively. Furthermore, real investment interest rates has a negative impact on PDI, indicating the crowding-out effect on domestic investment. This effect is mainly observed in the secondary and tertiary sectors (Eqs. 4 & 5), where the investment interest rate is still a significant factor in explaining these sectoral PDI in Indonesia's economy. These results are in line with Chen *et al*., (2017).

The value of imports also has a negative and statistically significant effect on PDI, which is consistent with the utilization of the sectoral FDI mode (Eqs. 2, 4, and 5). This impact is consequently not significant in the primary FDI sector. According to Eq. (1), a 1% increase in imports reduced PDI by 0.62%, with other factors being held constant. This indicates that increased imports of consumer goods often forcibly retract the market share of local entrepreneurs at a lower marginal cost. Therefore, these less competitive and limited-capital, domestic entrepreneurs are evicted from the market, leading to reduced PDI (private domestic investment).

D. Robustness Check

Based on Table 4, structural breaks are found for many variables at the level, especially in 1997-1998, where observations emphasized FDI, GDP, & IMP. This is in line with the Asian Financial Crisis 1997-1998 and 2006Q1 for PDI. Using Gregory Hansen's Structural Break Cointegration Test (Table 7), Eqs. (1) and (4) shows similar results in 1997Q1 and 1997Q2. To ensure robustness, the ARDL is

applied by controlling the dummy variable (z=1, when t= 1997Q1-1998Q4, 2006Q1, otherwise = 0) for a structural break in UECM estimates.

Table 10.
Long-Run Coefficients & Diagnostic Test of Dummy Model

This table (Panel A) reports the long run estimation using the ARDL-UECM in five equations including dummy model of the financial crisis (*z*=1997Q1-1998Q2, 2006Q1). We used a maximum of 4 lags and AIC criterion to determine the optimal lag length. Diagnostic test (Panel B) shows that that all models are no serial correlation, homoscedastic, and have stable parameters. The asterisks *, **, and *** denote the significance at the 10%, 5%, and 1% levels, respectively.

Independent Variable	Dependent Variable				
	PDI		PDI_{prim}	PDI_{sec}	PDI_{ter}
	(1)	(2)	(3)	(4)	(5)
Panel A. Long Run Coefficient					
FDI	0.288***				
FDI_{prim}		0.093	0.239***		
FDI_{sec}		0.221***		0.322***	
FDI_{ter}		0.034			0.410
GDP	4.454***	4.273***	3.718***	3.224***	6.962***
RATE	0.018*	-0.004	0.001	0.005	-0.106**
IMP	-0.690***	-0.751***	-0.202	-0.501***	-1.529**
z	0.178	0.247	0.812**	0.445	-1.074
Intercept	-3.870***	-2.419*	-8.014***	-1.773**	-2.980
Panel B. Diagnostic Tests					
ECT_{t-1}	-1.005***	-0.959***	-1.022***	-0.908***	-0.550***
F_{stat}	13.894***	9.550***	23.125***	16.614***	5.771***
Adjusted R^2	0.47	0.50	0.56	0.50	0.44
Breusch-Godfrey (χ^2)	0.339 (1) 0.449 (2)	0.9196 (1) 0.9351 (2)	0.1964 (1) 0.4140 (2)	0.9113 (1) 0.9780 (2)	0.3198 (1) 0.3502 (2)
White (χ^2)	0.457	0.457	0.104	0.437	0.457
Ramsey RESET (χ^2)	0.405	0.257	0.558	0.186	0.428
JB-test (χ^2)	1.3e-09	1.5e-13	0.133	4.6e-04	0.011
SB-CUSUM	0.331*** (stable)	0.494*** (stable)	0.442*** (stable)	0.281*** (stable)	0.717*** (stable)

According to Table 10, the ARDL-UECM outputs for the long-term FDI coefficient are observed. This is accompanied by the controlling Asian Financial Crisis (1997-1998) and the diagnostic results for these estimates. As presented in Panel A, FDI complements PDI in the long run, with the results being consistent with the derivation to the sectoral mode (Eqs. 2-5). Based on the Diagnostic Test (Panel B), the stochastic error in all equations is not serially correlated, homoscedastic, and well-specified. This is in line with the Sb CUSUM test, where the parameters of the models are highly stable over the sample period. In this condition, the structural breaks of the dummy Asian Financial Crisis (1997-1998) continuously support the crowding-in of FDI on PDI in the long run, especially in the Indonesian primary and tertiary sectors.

VI. CONCLUSION

This study examined the empirical relationship between FDI and domestic investment in Indonesia, using quarterly data from 1990Q2 to 2020Q2. To determine the cointegrated relationships between FDI and PDI, the ARDL bound test was adopted. Our results indicate a complementary effect (crowding-in) in the long run. This effect was specifically and mainly found in the primary and secondary sectors, with a neutral relationship exhibited at the tertiary sector.

Based on these results, the Indonesian government needs to be more active in promoting FDI within the primary and secondary sectors, to stimulate the growth of new local investment in the domestic economy. The encouragement of economic transformation is also needed for industrialization, to create a conducive environment for the growth of domestic investment.

REFERENCES

Adams, S. (2009). Foreign Direct Investment, Domestic Investment, and Economic Growth in Sub-Saharan Africa. *Journal of Policy Modeling*, 31, 939–949. https://doi.org/10.1016/j.jpolmod.2009.03.003

Agosin, M. R., & Machado, R. (2005). Foreign Investment in Developing Countries: Does it Crowd in Domestic Investment? *Oxford Development Studies*, 33, 149–162. https://doi.org/10.1080/13600810500137749

Aitken, B. J., & Harrison, A. E. (1999). Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela. *American Economic Review*, 89, 605–618. https://doi.org/10.1257/aer.89.3.605

Al-Sadig, A. (2013). The Effects of Foreign Direct Investment on Private Domestic Investment: Evidence from Developing Countries. *Empirical Economics*, 44, 1267–1275. https://doi.org/10.1007/s00181-012-0569-1

Ang, J. B. (2009). Do Public Investment and FDI Crowd in or Crowd Out Private Domestic Investment in Malaysia? *Applied Economics*, 41, 913–919. https://doi.org/10.1080/00036840701721448

Ashraf, A., & Herzer, D. (2014). The Effects of Greenfield Investment and M&As on Domestic Investment in Developing Countries. *Applied Economics Letters*, 21, 997–1000. https://doi.org/10.1080/13504851.2014.904482

Baek, J. (2016). A New Look at the FDI–income–energy–environment Nexus: Dynamic Panel Data Analysis of ASEAN. *Energy Policy*, 91, 22–27. https://doi.org/10.1016/j.enpol.2015.12.045

Braunstein, E., & Epstein, G. (2002). Bargaining Power and Foreign Direct Investment in China: Can 1.3 Billions Consumers Tame the Multinationals? *(CEPA Working Paper 2002/13).*

Chen, G. S., Yao, Y., & Malizard, J. (2017). Does Foreign Direct Investment Crowd in or Crowd Out Private Domestic Investment in China? The Effect of Entry Mode. *Economic Modelling*, 61, 409–419. https://doi.org/10.1016/j.econmod.2016.11.005

Clemente, J., Montañés, A., & Reyes, M. (1998). Testing for a Unit Root in Variables with a Double Change in the Mean. *Economics Letters*, 59, 175–182. https://doi.org/10.1016/S0165-1765(98)00052-4

De Mello, L. R. (1999). Foreign Direct Investment-led Growth: Evidence from Time Series and Panel Data. *Oxford Economic Papers*, 51, 133–151. https://doi.org/10.1093/oep/51.1.133

Djokoto, J., Srofenyoh, F. Y., & Gidiglo, K. (2014). Domestic and Foreign Direct Investment in Ghanaian Agriculture. *Agricultural Finance Review*, 74, 427–440. https://doi.org/10.1108/AFR-09-2013-0035

Elliott, G., Rothenberg, T. J., & Stock, J. H. (1996). Efficient Tests for an Autoregressive Unit Root. *Econometrica*, 64, 813. https://doi.org/10.2307/2171846

Farla, K., de Crombrugghe, D., & Verspagen, B. (2016). Institutions, Foreign Direct Investment, and Domestic Investment: Crowding Out or Crowding In? *World Development*, 88, 1–9. https://doi.org/10.1016/j.worlddev.2014.04.008

Ghazali, A. (2010). Analyzing the Relationship between Foreign Direct Investment Domestic Investment and Economic Growth for Pakistan. *International Research Journal of Finance and Economics*, 47, 123–131.

Gregory, A. W., & Hansen, B. E. (1996). Practitioners Corner: Tests for Cointegration in Models with Regime and Trend Shifts. *Oxford Bulletin of Economics and Statistics*, 58, 555–560. https://doi.org/10.1111/j.1468-0084.1996.mp58003008.x

Huang, Y. (2003). One Country, Two Systems: Foreign-invested Enterprises and Domestic Firms in China. *China Economic Review*, 14, 404–416. https://doi.org/10.1016/j.chieco.2003.09.011

Jain, V., Gopalaswamy, A. K., & Acharya, D. (2014). Dynamic Linkages between Foreign Direct Investment and domestic Investment: Evidence from Emerging Market Economies. *International Journal of Economics and Business Research*, 8, 1. https://doi.org/10.1504/IJEBR.2014.063938

Jude, C. (2019). Does FDI Crowd Out Domestic Investment in Transition Countries? *Economics of Transition and Institutional Change*, 27, 163–200. https://doi.org/10.1111/ecot.12184

Kaur, G. (2019). Inflation and Fiscal Deficit in India: An ARDL Approach. *Global Business Review*, 097215091982816. https://doi.org/10.1177/0972150919828169

Kripfganz, S., & Schneider, D. C. (2018). ARDL : Estimating Autoregressive Distributed Lag and Equilibrium Correction Models. *London Stata Conference September 7, 2018*.

Lindblad, J. T. (2015). Foreign Direct Investment in Indonesia: Fifty Years of Discourse. *Bulletin of Indonesian Economic Studies*, 51, 217–237. https://doi.org/10.1080/00074918.2015.1061913

Lütkepohl, H. (2005). *New Introduction to Multiple Time Series Analysis*. Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-540-27752-1

Mileva, E. (2008). The Impact of Capital Flows on Domestic Investment in Transition Economies. In *ECB Working Paper* (871 / February 2008; Issue 871).

Misun, J., & Tomsik, V. (2002). Does Foreign Direct Investment Crowd In or Crowd Out Domestic Investment? *Eastern European Economics*, 40, 38–56. http://www.jstor.com/stable/4380291

Morrissey, O., & Udomkerdmongkol, M. (2012). Governance, Private Investment and Foreign Direct Investment in Developing Countries. *World Development*, 40, 437–445. https://doi.org/10.1016/j.worlddev.2011.07.004

Narayan, P. K. (2005). Saving and Investment Nexus for China: Evidence from Cointegration Tests. *Applied Economics*, 37, 1979–1990. https://doi.org/10.1080/00036840500278103

Narayan, P. K., & Smyth, R. (2005). Electricity Consumption, Employment and Real Income in Australia Evidence from Multivariate Granger Causality Tests. *Energy Policy*, 33, 1109–1116. https://doi.org/10.1016/j.enpol.2003.11.010

Ndikumana, L., & Verick, S. (2008). The Linkages Between FDI and Domestic Investment: Unravelling the Developmental Impact of Foreign Investment in Sub-Saharan Africa. *Development Policy Review*, 26, 713–726. https://doi.org/10.1111/j.1467-7679.2008.00430.x

Nguyen, H. T., Luu, H. N., & Do, N. H. (2020). The Dynamic Relationship between Greenfield Investments, Cross-border M&As, Domestic Investment and Economic Growth in Vietnam. *Economic Change and Restructuring*. https://doi.org/10.1007/s10644-020-09292-7

Pesaran, M. H., & Shin, Y. (1997). An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis. *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium.*, *March 3-5*, *1995*, 1–31.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics*, 16, 289–326. https://doi.org/10.1002/jae.616

Sbia, R., Shahbaz, M., & Hamdi, H. (2014). A Contribution of Foreign Direct Investment, Clean Energy, Trade Openness, Carbon Emissions and Economic Growth to Energy Demand in UAE. *Economic Modelling*, 36, 191–197. https://doi.org/10.1016/j.econmod.2013.09.047

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, 70, 65. https://doi.org/10.2307/1884513

Tang, S., Selvanathan, E. A., & Selvanathan, S. (2008). Foreign Direct Investment, Domestic Investment and Economic Growth in China: A Time Series Analysis. *World Economy*, 31, 1292–1309. https://doi.org/10.1111/j.1467-9701.2008.01129.x

Thomsen, S. (1999). Southeast Asia : The Role of Foreign Direct Investment Policies in Development. In *OECD Working Papers on International Investment*. https://doi.org/http://dx.doi.org/10.1787/431857742281

Wang, M. (2010). Foreign Direct Investment and Domestic Investment in the Host Country: Evidence from Panel Study. *Applied Economics*, 42, 3711–3721. https://doi.org/10.1080/00036840802314580