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What Drives Foreign Direct Investment Inflow in Indonesia? An Exploration of Province and Sectoral Data

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Abstract

   This study investigates the determinants of FDI inflow in the aggregate and sectors in 33 provinces in Indonesia during the 2010–2018 period. Based on Panel Corrected Standard Errors (PCSE) estimator, this study shows that each sector has specific determinants. Furthermore, we found that seven determinant factors are indispensable in attracting FDI in aggregate in Indonesian provinces: cumulative FDI aggregate, agglomeration neighboring province (GAD), domestic investment, urbanization, human capital (lower secondary school), bank lending, and foreign trade. In addition, we found that human capital (lower secondary school) and unit labor cost are essential variables in luring FDI in the agricultural sector. Whereas for the manufacturing sector, the leading factors in attracting foreign firms are GAD, foreign trade, and industrial estates. Finally, the critical factors for attracting foreign enterprises in the hotel and restaurant sectors are urbanization, human capital (upper secondary school), and GDP per capita.

Keywords: Foreign Direct Investment, Province, Sectoral, Indonesia

1. Introduction

   Foreign direct investment (FDI) plays a prominent role in advancing the global economy, as it can help cushion the capital gap and transfer knowledge and technology to host countries (Balasubramanyam et al. 1996). Recognizing the importance of FDI in host countries, many countries compete to procure FDI. In the literature, most studies on the determinants of FDI inflow are based on Dunning (1998). The author contributed to the literature by outlining FDI motives as market-seeking, resource-seeking, efficiency-seeking, and strategic asset-seeking[1]. However, scholars have recently criticized Dunning (1998) and proposed a new concept known as "Imbalance Theory" (Moon 2016). This theory argues that multinational corporations (MNCs) from developing countries have a superiority to deal with difficult situations when investing in developing countries.

While the determinants of FDI are controversial from a theoretical framework perspective, previous empirical studies have not reached a consensus to exercise the determinants of FDI at the national level. Previous research such as Kumari and Sharma (2017) and Okafor et al. (2017) found that market size is essential for attracting FDI inflows. In contrast, a study from Hintošová et al. (2018) found that market size is a less critical factor. This inconclusiveness potentially arises from the diversity of the local characteristics of regions within a country. For example, China's FDI inflows are mainly in coastal areas (Chan et al. 2014). Hence, taking into consideration the distinct regional characteristics within a country should prove more accurate in explaining the drivers of FDI inflow, compared with studies that focus solely on the national level. Furthermore, due to a lack of sectoral (or disaggregated) data, the analysis of the determinants of FDI inflow in the economic sector is still rarely studied (Kurtović et al. 2020). Thus, research on the determinants of FDI inflow at the regional and sectoral levels will significantly expand the literature on the determinants of FDI inflow.

This paper aims to analyze what factors determine FDI inflow into Indonesia, using data at the provincial and sectoral level, in consideration of local circumstances. Four aspects differentiate this paper from previous studies. First, this study uses a novel dataset of 33 provinces in Indonesia during the 2010–2018 period. Second, this paper does not merely exploit aggregate FDI inflow data. Sectoral FDI inflow data is also explored. Employing such data has the advantage of building a more holistic view of provincial FDI determinants. In addition, exploring data at the provincial and sectoral level may lead to a specific policy for attracting FDI by Indonesian policymakers, who are anxious to promote FDI in certain provinces and economic sectors. Third, this paper builds a set of sub-national determinants of FDI that could prove superior in explaining the determinants of FDI at the provincial level, compared with the national level. In light of this, we propose a set of province-specific variables, such as agglomeration economies (cumulative FDI, agglomeration of neighboring provinces, economic density, domestic investment, and urbanization). Fourth, we use the Panel Corrected Standard Errors (PCSEs) approach to analyze the determinants of FDI inflow into Indonesia, which have particular merit in treating heteroscedasticity and autocorrelation issues in panel data.

The following is the structure of this paper. Section 2 describes the background of FDI inflow into Indonesia. Section 3 will review the literature on the factors that influence FDI inflow. Section 4 discusses the data and econometric methods. Section 5 discusses the estimation results. Section 6 will present concluding remarks.

2. Background of FDI Inflow in Indonesia

Figure 1 depicts the regional distribution of FDI inflow into Indonesia from 2010 to 2018. Overall, FDI inflow is distributed unevenly across provinces. The majority of FDI inflow is to Java (e.g., Jakarta and West Java). However, the expansion of FDI inflow outside of Java appears to be growing faster

Figure 1 FDI Inflows by Provinces in Indonesia
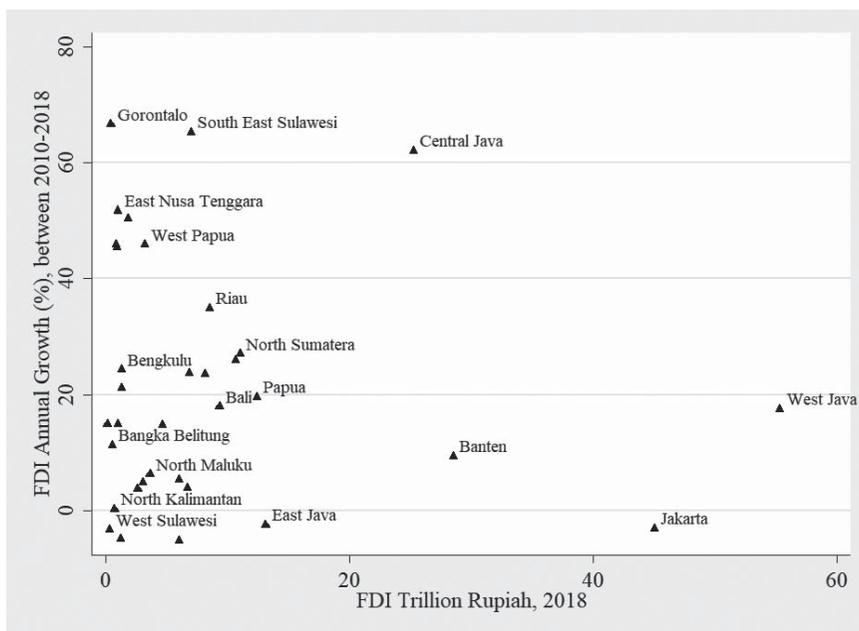
Source: Datasets of BKPM (2021), Author's Calculation.

(e.g., Gorontalo and Southeast Sulawesi). The surge of FDI inflow outside of Java appears to be due to an improvement in infrastructure quality. During president Jokowi's first administration (2014–2019), infrastructure development became a priority policy for building the national economy. Infrastructure development projects, such as airports, ports, electricity supply, and roads are seen as making a significant contribution to regions outside of Java, which have subsequently become a magnet for FDI inflow.

From a sectoral perspective, as stated in the Strategic Plan of the Indonesian Investment Coordinating Board (BKPM) 2020–2024, the manufacturing industry and tourism sectors are strategic priority projects for FDI. Meanwhile, according to Presidential Regulation of Republic Indonesia Number 10, 2021, the agricultural sector is a priority sector for FDI concerning the investment business sector. Therefore, in this study we focus on analyzing the determinants of FDI inflow at the provincial level in the three economic sectors mentioned above.

Furthermore, the datasets from BKPM (2021) demonstrate the amount and the share of FDI inflow in the three sectors over the 2010–2018 period. Overall, the amount of FDI inflow in the three sectors increases. The highest amount is in the manufacturing industry sector (112.6 trillion Rupiah), while the lowest amount can be seen in the hotel and restaurant sector (6.4 trillion Rupiah) over the period given on average. In addition, the manufacturing industry sector has the most significant share (42.0%) compared with the other sectors. Meanwhile, the agricultural sector (6.4%) and the hotel and

restaurant sector (2.4%) followed in second and third place respectively.

From a policy standpoint, the Asian Development Bank (ADB) (2019) reports that several policies were issued during the Jokowi administration since 2015 in order to attract FDI, including cutting overlapping regulations, lowering trade barriers, increasing business establishment facilitation, and facilitating land acquisition. However, the ADB criticized these policy reforms as being too broad, with no specific economic sectors. These critics argue that these reforms should have considered that the constraints in doing business may vary by firm and sector.

3. Literature Review

Most empirical studies have examined FDI determinants at the national level. In contrast, using data at the sub-national level is much less common. Using data at the national level may provide policymakers with misleading information when addressing FDI issues at the sub-national level. There are at least two reasons for elaborating on this topic. First, previous papers using national-level data produced mixed results because the determinants factors used and the country case differed. For example, Shahbaz et al. (2021) discovered that education and transportation infrastructure are critical factors accelerating FDI in France. Using the case of Oman, Ibrahim et al. (2020) discovered that the quality of an institution is critical for attracting FDI, with the institution's quality proxied by property rights, corruption level, fiscal and trade freedom.

Second, using data at the national level falls short of capturing sub-national specific characteristics such as a province's endowment factors, which could attract more foreign enterprises. When sub-national specific characteristics are considered, the picture that emerges from the empirical evidence becomes clearer. For example, Wong et al. (2020) discovered that the main drivers of FDI inflow into China differ for three distinct areas (East China, West China, and Central China).

Although the use of data at the provincial level can explain the province-specific factors for FDI, such factors have been applied using different measurements in previous studies, yielding contradictory results. For example, Hoang and Goujon (2014) used the average annual income per employee in the firm sector in each province as a proxy for labor cost and discovered a positive effect in Vietnamese provinces. Meanwhile, for the same province-level case in Vietnam, Vi Dũng et al. (2018) found a negligible impact on FDI inflows by measuring labor costs with the natural log of the monthly average compensation of firms' workers by province.

Against this backdrop, the existing literature is still far from providing more extensive variables explaining FDI determinants at the provincial level. This study attempts to fill this gap in the literature by exploring the determinants of FDI at the provincial level in Indonesia more comprehensively, and by using a more precise measurement for each variable.

4. Data and Methodology

4.1 Data

This study explores FDI inflow determinants in 33 provinces in Indonesia using data for the 2010–2018 period. Furthermore, this study aims to investigate the determinants of FDI inflow from the sectoral point of view. Three sectors are examined in this study, namely: (i) the agricultural sector (FDI AGR), (ii) the manufacturing industry sector (FDI MAN), and (iii) the hotel and restaurant sector (FDI HR). We collect datasets for FDI from the Indonesian Investment Coordinating Board (BKPM) or the Ministry of Investment. Datasets of explanatory variables are collected from BPS-Statistics Indonesia, except for the variables of the industrial estate, which are collected from the Ministry of Industry. In addition, Table 1 provides information on data definitions and summarizes the statistics of the variables. We also perform an analysis for correlation between FDI determinant variables. However, we do not present the results in this study due to space limitations. The high correlations are seen between cumulative FDI Agg and cumulative FDI MAN, cumulative FDI Agg and ln GAD GDP 33, ln real GDP per square km and ln GAD GDP 33, ln urbanization and ln GAD GDP 33, ln urbanization and ln real GDP per square km.

4.2 Panel Data Analysis

The use of panel data estimation has received much attention from scholars in estimating the critical determinants of FDI inflow. Based on past empirical works and data availability, this study applies the panel data model in analyzing the determinant factors of FDI inflow in Indonesia.

We present the model as follows:

$$Y_{it}^s = \beta_0 + \beta_1 X_{it}^s + Z_{it}' \beta_2 + \beta_3 V_{it\text{-}1} + e_{it} \tag{1}$$

where Y_{it}^s is ln FDI for total, agriculture, manufacturing industry, and hotel and restaurant sectors. X_{it}^s denotes a variable measured at a sectoral level such as cumulative FDI; Z_{it}' is a vector of determinants such as ln GAD GDP 33, ln real GDP per square km, domestic investment, urbanization, upper secondary school, lower secondary school, labor force, bank lending, foreign trade, ln GDP per capita, real GDP growth, growth GDP per capita, ln national road, industrial estate; V_{it-1} includes lagged determinant such as unit labor cost. Furthermore, i denotes the province (i＝1, ...N) and t denotes the time period (t＝1, ...T). Also, e denotes a one-way error component model for the disturbance, containing the unobservable province-specific effect and the remainder disturbance[2].

In the literature, panel data regression is potentially exposed to heteroscedasticity, autocorrelation, and cross-section dependence (Rahman et al. 2019). With those kinds of issues, Beck and Katz (1995) proposed a new estimator for panel data called Panel Corrected Standard Errors (PCSE). In this study,

Table 1 Summary Statistics of Variables

Variable	Definition	Mean	Std. Dev.
Ln FDI Total	Natural log value of realization of foreign direct investment inward in aggregate or all sectors in Rupiah (constant price 2010), the Indonesian currency	28.446	1.878
Ln FDI AGR	Natural log value of realization of foreign direct investment inward in the agricultural sector in Rupiah (constant price 2010)	25.161	2.445
Ln FDI MAN	Natural log value of realization of foreign direct investment inward in the manufacturing industry sector in Rupiah (constant price 2010)	26.706	2.737
Ln FDI HR	Natural log value of realization of foreign direct investment inward in the hotel and restaurant sector in Rupiah (constant price 2010)	23.649	2.765
Ln GDP per Capita	Natural log value of real GDP per capita in Rupiah, constant price 2010	3.018	5.215
Growth GDP per Capita	The growth rate of real GDP per capita (%), constant price 2010	2.885	5.872
Real GDP Growth	The growth rate of real GDP (%), constant price 2010	3.027	7.104
Ln Real GDP per Square Km	The ratio of real GDP/province area km^2 (natural log value), author calculation	3.03	9.288
Unit Labor Cost	The ratio of wage/working population)/(real GDP/working population) (%), author calculation	27.876	1.335
Upper Secondary School	The percentage of working population aged 15 years and over with educational attainment at upper secondary school (%)	9.595	0.747
Lower Secondary School	The percentage of working population aged 15 years and over with educational attainment at lower secondary school (%)	27.601	2.258
Ln National Road	The length of national roads (km^2)/province area km^2, author calculation	8.592	1.842
Foreign Trade	The ratio between trade (foreign exports plus imports) divided by real GDP (%), author calculation	12.417	3.242
Ln Urbanization	The ratio of urban population/province area km^2 (natural log value), author calculation	8.255	1.43
Ln GAD GDP 33	Natural log value of gravity adjusted demand index in each province (the details of GAD formula are in Appendix A), author calculation	47.774	3.879
Industrial Estate	Number of industrial estates, author compilation	25.442	9.131
Ln Domestic Investment	Natural log value of a direct domestic investment in Rupiah (constant price 2010)	36.176	34.117
Cumulative FDI Agg	The ratio of FDI aggregate cumulative of a province/FDI aggregate cumulative total of a province (%), author calculation	2.597	1.133
Cumulative FDI AGR	The ratio of FDI AGR cumulative of a province/FDI AGR cumulative total of a province (%), author calculation	17.201	0.561
Cumulative FDI MAN	The ratio of FDI MAN cumulative of a province/FDI MAN cumulative total of a province (%), author calculation	5.449	4.448
Cumulative FDI HR	The ratio of FDI HR cumulative of a province/FDI HR cumulative total of a province (%), author calculation	3.483	0.691
Share Bank Lending/GDP	The ratio of bank lending to real GDP (%), author calculation	2.401	6.083

Source: Author's Calculation.

we follow the suggestion of Moundigbaye et al. (2018) to apply the PCSE estimator, as this estimator is best for measuring accuracy in hypothesis testing and appropriate for our panel data set (T/N<1.0). In this context, we have T＝9 years and N＝33 provinces. The result of T divided by N is 0.27, which means it meets the requirements (below 1.0).

5. Results and Discussions

5.1 The Estimation Results of Determinant Factors of FDI Inflow by Aggregate at the Provincial Level in Indonesia

Before we ran data using the PCSE panel estimator, we estimated the data using a fixed-effect estimator. However, the results suffered from heteroscedasticity and autocorrelation problems. We do not show these results in order to save space, however the results are available upon request. The main results from the PCSE estimator are presented in Table 2. In this table, we present 14 specifications. Column 1 to 7 shows the baseline specifications (without interaction terms), while column 8 to 14 show our specifications with interaction terms.

In columns 1 to 2, we find that ten variables have statistically significant effects on FDI. The coefficient of cumulative FDI aggregate is positive and statistically significant, implying that agglomeration positively affects FDI. The GAD as an indicator of agglomeration of neighboring provinces also has a positive impact, indicating that the economic characteristics of neighboring provinces also influence decisions by foreign firms to invest in certain locations. Furthermore, GAD captures the effects of economic agglomeration from neighboring provinces. This is different from urbanization which captures the effects of agglomeration from within the province itself. For example, an export-oriented foreign company in the manufacturing sector requires proximity to a port but does not need to set up a factory in a province that has a port. This company can still operate in the province closest to the province that has a port.

Meanwhile, real GDP per square km shows a negative effect. This suggests that the excessive concentration of economic activity in a province can reduce the investment interest of foreign companies. In addition, excessive concentration can incur costs such as air pollution, traffic congestion, and refuse contamination (Henderson 2002). Domestic investment positively increases FDI, meaning that domestic investment can be a good sign for attracting foreign firms. In line with Halvorsen (2012), FDI is also positively affected by urbanization. It reveals that the benefits of urbanization, such as economies of scale, efficiency in production, and service deliveries, will eventually attract more foreign firms (Yin et al. 2014).

Human capital effect on FDI, represented by labor with the educational attainment at upper and lower secondary school, appears to be positive and statistically significant, indicating that FDI favors investing in a province with higher-skilled labor. Surprisingly, the labor force is statistically

Table 2 Estimation Results for Determinants FDI Inflows (Aggregate)

VARIABLES	(1) Ln FDI Total	(2) Ln FDI Total	(3) Ln FDI Total	(4) Ln FDI Total	(5) Ln FDI Total	(6) Ln FDI Total	(7) Ln FDI Total	(8) Ln FDI Total	(9) Ln FDI Total	(10) Ln FDI Total	(11) Ln FDI Total	(12) Ln FDI Total	(13) Ln FDI Total	(14) Ln FDI Total
	Without Interaction Terms							With Interaction Terms						
Cumulative FDI Agg	0.121*** (0.014)	0.134*** (0.015)	0.131*** (0.016)	0.129*** (0.015)	0.129*** (0.015)	0.130*** (0.015)	0.128*** (0.020)	2.519*** (0.296)	2.708*** (0.276)	2.704*** (0.274)	2.694*** (0.278)	2.729*** (0.293)	2.751*** (0.307)	2.818*** (0.312)
Ln GAD GDP 33	2.558*** (0.177)	2.418*** (0.210)	2.365*** (0.184)	2.329*** (0.195)	2.336*** (0.198)	2.189*** (0.206)	2.171*** (0.234)	1.562*** (0.262)	1.641*** (0.267)	1.641*** (0.268)	1.614*** (0.271)	1.586*** (0.271)	1.608*** (0.272)	1.553*** (0.283)
Ln Real GDP per Square Km	-5.353*** (0.653)	-5.858*** (0.761)	-6.318*** (1.068)	-6.243*** (1.087)	-6.237*** (1.082)	-5.818*** (1.039)	-5.701*** (1.211)	-3.059*** (0.792)	-3.311*** (0.808)	-3.369*** (1.078)	-3.300*** (1.073)	-3.256*** (1.075)	-3.319*** (1.037)	-2.938*** (1.091)
Ln Domestic Investment	0.169*** (0.045)	0.100** (0.047)	0.106** (0.046)	0.099** (0.048)	0.098** (0.048)	0.097** (0.049)	0.100* (0.054)	0.137*** (0.042)	0.110** (0.044)	0.111** (0.043)	0.105** (0.042)	0.108** (0.043)	0.108** (0.042)	0.121** (0.049)
Ln Urbanization	0.391** (0.195)	0.627*** (0.228)	0.827** (0.363)	0.829** (0.366)	0.825** (0.365)	0.875** (0.356)	0.842** (0.394)	0.519*** (0.187)	0.511** (0.212)	0.533* (0.324)	0.526 (0.320)	0.525 (0.322)	0.517 (0.327)	0.400 (0.338)
Upper Secondary School	0.075*** (0.027)	0.054** (0.027)	0.033 (0.037)	0.034 (0.036)	0.034 (0.036)	0.046 (0.038)	0.045 (0.038)	-0.084** (0.040)	-0.103** (0.048)	-0.107* (0.056)	-0.106* (0.055)	-0.111** (0.055)	-0.114** (0.055)	-0.121** (0.050)
Lower Secondary School	0.112** (0.048)	0.143*** (0.046)	0.159*** (0.050)	0.154*** (0.049)	0.154*** (0.049)	0.170*** (0.054)	0.173*** (0.056)	0.148*** (0.052)	0.162*** (0.056)	0.163*** (0.058)	0.158*** (0.057)	0.157*** (0.057)	0.154** (0.061)	0.164** (0.064)
Share Labor Force/Population	0.018 (0.016)	0.002 (0.016)	0.002 (0.016)	0.001 (0.016)	0.002 (0.017)	0.002 (0.018)	0.002 (0.018)	-0.044*** (0.016)	-0.059*** (0.016)	-0.059*** (0.017)	-0.059*** (0.017)	-0.064*** (0.018)	-0.065*** (0.018)	-0.065*** (0.018)
Share Bank Lending/GDP	0.037*** (0.007)	0.041*** (0.006)	0.043*** (0.006)	0.040*** (0.007)	0.040*** (0.007)	0.040*** (0.008)	0.041*** (0.010)	0.034*** (0.007)	0.031*** (0.007)	0.031*** (0.007)	0.029*** (0.008)	0.028*** (0.007)	0.028*** (0.008)	0.032*** (0.009)
Foreign Trade	0.016*** (0.001)	0.014*** (0.002)	0.013*** (0.002)	0.012*** (0.002)	0.012*** (0.002)	0.013*** (0.002)	0.012*** (0.003)	0.011*** (0.002)	0.010*** (0.002)	0.010*** (0.002)	0.009*** (0.002)	0.009*** (0.002)	0.009*** (0.002)	0.007** (0.003)
Unit Labor Cost (t-1)		-0.373*** (0.118)	-0.324* (0.168)	-0.360** (0.165)	-0.358** (0.165)	-0.341** (0.170)	-0.339** (0.171)		-0.284** (0.143)	-0.280* (0.170)	-0.318* (0.173)	-0.325* (0.173)	-0.328* (0.174)	-0.325* (0.172)
Ln GDP per Capita			0.387 (0.560)	0.367 (0.556)	0.357 (0.554)	0.214 (0.538)	0.213 (0.535)			0.044 (0.522)	0.041 (0.516)	0.073 (0.523)	0.097 (0.501)	0.121 (0.489)
Real GDP Growth				0.020 (0.016)	0.023 (0.015)	0.021 (0.015)	0.020 (0.016)				0.018 (0.012)	0.012 (0.013)	0.012 (0.013)	0.009 (0.014)
Growth GDP per Capita					-0.009 (0.032)	-0.010 (0.031)	-0.010 (0.031)					0.025 (0.021)	0.025 (0.021)	0.027 (0.022)
Ln National Road						-0.364* (0.205)	-0.370* (0.213)						0.064 (0.172)	0.052 (0.175)

VARIABLES	(1) Ln FDI Total	(2) Ln FDI Total	(3) Ln FDI Total	(4) Ln FDI Total	(5) Ln FDI Total	(6) Ln FDI Total	(7) Ln FDI Total	(8) Ln FDI Total	(9) Ln FDI Total	(10) Ln FDI Total	(11) Ln FDI Total	(12) Ln FDI Total	(13) Ln FDI Total	(14) Ln FDI Total
Industrial Estate							0.005							0.020
							(0.014)							(0.014)
Unit Labor Cost x Upper Secondary School								0.041**	0.049**	0.050**	0.050**	0.052**	0.052**	0.054**
								(0.020)	(0.023)	(0.023)	(0.022)	(0.022)	(0.023)	(0.022)
Unit Labor Cost x Ln Urbanization								−0.094***	−0.082**	−0.082**	−0.080**	−0.081**	−0.082**	−0.084**
								(0.031)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.038)
Ln Domestic Investment x Cumulative FDI Agg								−0.066***	−0.076***	−0.076***	−0.076***	−0.077***	−0.077***	−0.080***
								(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.011)
Cumulative FDI Agg x Ln Urbanization								−0.035***	−0.025**	−0.025**	−0.025**	−0.025**	−0.025**	−0.024**
								(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Constant	−228.810	−307.699	−298.706	−300.560	−305.738	−365.903*	−361.990*	−188.734	−247.674	−246.067	−246.749	−230.405	−219.261	−199.263
	(174.250)	(197.039)	(205.805)	(202.307)	(204.626)	(205.178)	(205.251)	(177.754)	(192.237)	(199.439)	(196.203)	(198.982)	(192.674)	(191.565)
Observations	290	259	259	259	259	259	259	290	259	259	259	259	259	259
R-squared	0.775	0.777	0.778	0.780	0.780	0.782	0.782	0.826	0.826	0.826	0.827	0.828	0.828	0.829
Number of provinces	33	33	33	33	33	33	33	33	33	33	33	33	33	33
Island Region-Specific Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors in parentheses, *** p < 0.01, ** p < 0.05, * p < 0.1
Source: Author's Estimation.

insignificant, meaning that FDI is more attracted to labor quality than quantity. One possible reason is that market-seeking FDI may hire skilled labor to serve the domestic market that demands more high technology products (Vi Dũng et al. 2018).

In columns 3 to 7, we control for GDP per capita, real GDP growth, GDP growth per capita, national road, and industrial estate. Unexpectedly, the results for additional control variables provide insignificant results, except for national roads, which is statistically significant yet negative. A possible interpretation is that foreign firms consider other factors that are more important than market size. The negative effect of national roads suggests that the inadequate availability of national roads may make foreign companies less willing to invest. Meanwhile, the insignificant effect of the industrial estate implies that the Indonesian government in designing this industrial estate policy is devoted to FDI in a particular sector such as the manufacturing industry.

In columns 8 to 14, we assess how unit labor costs contribute to FDI inflow depending on human capital. Here we added the interaction term between unit labor cost and upper secondary school. The result of interaction is statistically significant and positive, suggesting that an increase in wages coupled with an increase in the quality of human capital will lead to an increase in FDI inflow. Furthermore, educated workers are preferred by foreign enterprises, since such workers are more likely to have higher productivity.

We also added interaction terms between unit labor cost and urbanization in order to examine whether or not higher wages and higher urbanization can lure an inflow of FDI. The interaction result exerts a negative and statistically significant impact on FDI, indicating that higher labor costs in a province experiencing increased urbanization will lessen FDI inflow.

In addition, we also interact domestic investment and cumulative FDI Agg, and cumulative FDI Agg and urbanization. First, the interaction between domestic investment and cumulative FDI Agg is statistically significant and negative. This finding indicates that the more concentrated domestic and foreign companies are in a province, will lead to increasingly fierce competition. Further, it can reduce foreign companies' investment interest. Second, the interaction between cumulative FDI Agg and urbanization also appears to be statistically significant and negative. This means that foreign companies are not interested in investing in a province with a higher pool of FDI and higher level of urbanization. One possible explanation for this is that FDI is likely to prefer investing in a province whose increasing urbanization does not generate negative externalities such as congestion, air pollution, or a higher cost of living, making labor wages no longer cheap.

5.2 The Estimation Results of Determinant Factors of FDI Inflow by Agricultural Sector at Provincial Level in Indonesia

Table 3 presents the estimation results for determinants of FDI inflow in the agricultural sector. What stands out in this table is the difference between the determinants of FDI in aggregate and FDI

Table 3 Estimation Results for Determinants FDI Inflows (Agricultural Sector)

VARIABLES	(1) Ln FDI AGR	(2) Ln FDI AGR	(3) Ln FDI AGR	(4) Ln FDI AGR	(5) Ln FDI AGR	(6) Ln FDI AGR	(7) Ln FDI AGR
Cumulative FDI AGR	1.061*	0.726	0.705	0.741	0.732	0.806	0.867
	(0.596)	(0.634)	(0.640)	(0.654)	(0.652)	(0.704)	(0.661)
Ln GAD GDP 33	0.966***	1.471***	1.284***	1.428***	1.454***	1.919***	2.112***
	(0.240)	(0.295)	(0.264)	(0.303)	(0.342)	(0.412)	(0.415)
Ln Real GDP per Square Km	− 1.450*	− 2.796***	− 4.098***	− 4.380***	− 4.442***	− 5.847***	− 6.612***
	(0.742)	(0.732)	(0.960)	(0.990)	(1.083)	(1.525)	(1.494)
Ln Domestic Investment	0.064	− 0.005	0.011	0.012	0.010	0.011	0.000
	(0.102)	(0.122)	(0.123)	(0.121)	(0.121)	(0.113)	(0.122)
Ln Urbanization	− 0.460***	− 0.374	0.234	0.264	0.272	0.192	0.397
	(0.156)	(0.257)	(0.387)	(0.364)	(0.359)	(0.488)	(0.588)
Upper Secondary School	0.205**	0.155	0.042	0.055	0.070	0.012	0.021
	(0.097)	(0.122)	(0.139)	(0.145)	(0.167)	(0.165)	(0.163)
Lower Secondary School	0.194*	0.090	0.136	0.133	0.139	0.090	0.069
	(0.115)	(0.113)	(0.123)	(0.120)	(0.119)	(0.133)	(0.127)
Share Labor Force/Population	0.036	0.052**	0.050*	0.053*	0.066	0.072	0.071
	(0.025)	(0.026)	(0.026)	(0.028)	(0.044)	(0.048)	(0.049)
Share Bank Lending/GDP	0.031	0.054**	0.059**	0.064**	0.065**	0.065**	0.060*
	(0.030)	(0.026)	(0.027)	(0.028)	(0.029)	(0.029)	(0.032)
Foreign Trade	− 0.001	− 0.004	− 0.007**	− 0.006*	− 0.006	− 0.006*	− 0.002
	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Unit Labor Cost (t−1)		− 0.562**	− 0.430	− 0.355	− 0.337	− 0.363	− 0.353
		(0.265)	(0.293)	(0.299)	(0.308)	(0.295)	(0.298)
Ln GDP per Capita			1.389**	1.346**	1.273*	1.728**	1.752**
			(0.586)	(0.592)	(0.695)	(0.799)	(0.814)
Real GDP Growth				− 0.043	− 0.027***	− 0.019**	− 0.014
				(0.035)	(0.010)	(0.008)	(0.013)
Growth GDP per Capita					− 0.060	− 0.066	− 0.071
					(0.108)	(0.108)	(0.107)
Ln National Road						1.037*	1.096*
						(0.564)	(0.559)
Industrial Estate							− 0.027
							(0.022)
Unit Labor Cost x Upper Secondary School	− 0.139***	− 0.124***	− 0.108***	− 0.110***	− 0.117**	− 0.109**	− 0.114**
	(0.032)	(0.041)	(0.041)	(0.042)	(0.051)	(0.052)	(0.052)
Unit Labor Cost x Ln Urbanization	0.192***	0.210***	0.198***	0.198***	0.205***	0.194***	0.202***
	(0.044)	(0.054)	(0.055)	(0.054)	(0.060)	(0.062)	(0.062)
Ln Domestic Investment x Cumulative FDI AGR	− 0.068***	− 0.054**	− 0.054**	− 0.053**	− 0.053**	− 0.056**	− 0.055**
	(0.022)	(0.025)	(0.024)	(0.024)	(0.023)	(0.024)	(0.024)
Cumulative FDI AGR x Ln Urbanization	0.169***	0.152***	0.153***	0.144***	0.144***	0.148***	0.137***
	(0.026)	(0.026)	(0.027)	(0.028)	(0.030)	(0.028)	(0.029)
Constant	− 194.880	60.478	91.725	85.437	33.090	187.128	182.154
	(137.858)	(135.517)	(164.455)	(165.141)	(194.370)	(181.075)	(179.142)
Observations	257	233	233	233	233	233	233
R-squared	0.636	0.664	0.667	0.671	0.672	0.679	0.680
Number of provinces	33	33	33	33	33	33	33
Island Region-Specific Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Source: Author's Estimation.

in the agricultural sector. In column 1, cumulative FDI in the agricultural sector (AGR), GAD, human capital (both measured by upper and lower secondary schools) is positive, statistically significant and influences FDI in the agricultural sector. Meanwhile, the significant effect and negative are real GDP per square km and urbanization. The remaining variables such as domestic investment, labor force, bank lending, and foreign trade are statistically insignificant.

An interesting fact to be emphasized by this finding is that urbanization affects negatively, where this effect is different from the effect on FDI in aggregate. These results indicate that an increase in urbanization in a province will reduce FDI in the agricultural sector. This result is plausible because FDI in that sector is usually located in rural areas or remote areas. Furthermore, urbanization can positively make an impact when it has interacted with unit labor cost and cumulative FDI in the agricultural sector. The explanation may be that FDI in agriculture may be attracted by urbanization as long as urbanization generates positive externalities such as higher demand for consuming agricultural products in urban areas.

Another interesting finding is that the effect of upper secondary school is positive, and its coefficient is higher than that of lower secondary school. However, the interaction between unit labor cost and upper secondary school shows a negative result. The explanation for this result is that FDI in agriculture is likely to place its investment under the following two conditions: first, when low-skilled labor is abundant; second, when labor is highly skilled but low-paid.

In column 2, the labor force effect becomes statistically significant and positive. This finding indicates that labor availability is the main attraction for FDI in the agricultural sector, considering that the abundance of labor can indicate the opportunity to recruit cheap labor. Furthermore, this is also reinforced by the negative effect of unit labor costs. Bank lending is statistically significant and positive, meaning that FDI in agriculture is attracted by higher financial development since foreign firms can harness bank lending to expand their business and fill the liquidity need in the short term.

In column 3, the impact of GDP per capita is statistically significant and positive. This finding suggests that FDI in the agricultural sector has a market-seeking motive, where domestic market access becomes very important for this type of FDI because the domestic market will be the primary purpose for marketing agricultural products. Furthermore, the market size represented by real GDP growth is not significant. However, this variable is statistically significant and negative in the results of columns 5 and 6. This means that the size of domestic consumers is less attractive in luring FDI in this sector than the quality of domestic consumers. On the other hand, the impact of growth GDP per capita is statistically insignificant.

In column 6, national roads statistically significantly affect FDI in the agricultural sector. This finding reveals that road infrastructure is essential in attracting FDI in this sector as roads can facilitate the delivery of agricultural products. In column 7, industrial estate is statistically insignificant. This indicates that FDI in the agricultural sector is not related to industrial estates, as this location-based

investment policy is designed for the industrial manufacturing sector.

5.3 The Estimation Results of Determinant Factors of FDI Inflow in the Manufacturing Industry Sector at the Provincial Level in Indonesia

Table 4 displays the estimation results for determinants of FDI inflows in the manufacturing industry sector. In column 1, this study finds that cumulative FDI in the manufacturing industry sector (MAN), GAD, bank lending, and foreign trade is statistically significant and positive. Real GDP per square km is the only variable that is statistically significant and has a negative impact. Interestingly, the coefficient of GAD is higher than the estimate for aggregate nor agriculture, and hotel and restaurant sectors. This shows that FDI in the manufacturing industry sector mainly takes advantage of economic agglomeration in the concern of supporting its business activities. In addition, foreign companies can benefit from the surrounding support industries, such as supplying bolts and nuts.

Another interesting finding from this investigation is that foreign trade has a positive impact, and when compared, the coefficient is higher than the estimate for aggregate FDI. This fact in particular explains that FDI in the manufacturing sector is attracted by higher openness to trade. The argument in support of this result is that Indonesia has participated in global supply chains, and the manufacturing sector is indeed the most significant contributor to non-oil and gas exports abroad[3].

In column 2, we also find that unit labor cost affects are statistically significant and negative, suggesting that cheap labor is preferable for foreign enterprises in the manufacturing sector. This result can also be attributed to the Indonesian government policy that mainly attracts FDI in the

Table 4 Estimation Results for Determinants FDI Inflow (Manufacturing Sector)

VARIABLES	(1) Ln FDI MAN	(2) Ln FDI MAN	(3) Ln FDI MAN	(4) Ln FDI MAN	(5) Ln FDI MAN	(6) Ln FDI MAN	(7) Ln FDI MAN
Cumulative FDI MAN	2.746***	2.524***	2.530***	2.577***	2.572***	2.946***	3.187***
	(0.588)	(0.633)	(0.624)	(0.632)	(0.630)	(0.618)	(0.547)
Ln GAD GDP 33	2.938***	3.056***	2.936***	2.951***	2.962***	3.404***	3.148***
	(0.347)	(0.338)	(0.431)	(0.442)	(0.450)	(0.410)	(0.434)
Ln Real GDP per Square Km	− 5.798***	− 6.159***	− 7.124***	− 7.135***	− 7.155***	− 8.545***	− 7.460***
	(1.342)	(1.286)	(2.200)	(2.204)	(2.205)	(2.316)	(2.633)
Ln Domestic Investment	− 0.037	− 0.023	− 0.013	− 0.008	− 0.010	− 0.014	0.033
	(0.090)	(0.098)	(0.095)	(0.095)	(0.095)	(0.093)	(0.108)
Ln Urbanization	0.827	0.711	1.154	1.155	1.158	1.113	0.828
	(0.572)	(0.632)	(1.072)	(1.078)	(1.084)	(1.086)	(1.165)
Upper Secondary School	− 0.001	0.049	− 0.022	− 0.023	− 0.019	− 0.081	− 0.107
	(0.093)	(0.117)	(0.115)	(0.116)	(0.119)	(0.116)	(0.105)
Lower Secondary School	0.046	0.056	0.087	0.090	0.090	0.035	0.080
	(0.102)	(0.117)	(0.140)	(0.142)	(0.142)	(0.142)	(0.148)
Share Labor Force/Population	0.029	0.010	0.008	0.010	0.014	0.020	0.013
	(0.030)	(0.027)	(0.027)	(0.027)	(0.031)	(0.028)	(0.026)

VARIABLES	(1) Ln FDI MAN	(2) Ln FDI MAN	(3) Ln FDI MAN	(4) Ln FDI MAN	(5) Ln FDI MAN	(6) Ln FDI MAN	(7) Ln FDI MAN
Share Bank Lending/GDP	0.069***	0.082***	0.085***	0.087***	0.087***	0.084***	0.097***
	(0.017)	(0.019)	(0.020)	(0.021)	(0.021)	(0.021)	(0.020)
Foreign Trade	0.017***	0.016***	0.015***	0.015***	0.015***	0.013***	0.005
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Unit Labor Cost (t—1)		− 0.554*	− 0.470*	− 0.431*	− 0.425*	− 0.456*	− 0.485**
		(0.286)	(0.272)	(0.256)	(0.254)	(0.257)	(0.241)
Ln GDP per Capita			0.927	0.928	0.908	1.422	1.515
			(1.320)	(1.330)	(1.362)	(1.313)	(1.298)
Real GDP Growth				− 0.017	− 0.013	− 0.011	− 0.019
				(0.028)	(0.021)	(0.022)	(0.026)
Growth GDP per Capita					− 0.018	− 0.017	− 0.016
					(0.088)	(0.085)	(0.089)
Ln National Road						1.100***	1.046***
						(0.343)	(0.331)
Industrial Estate							0.074***
							(0.028)
Unit Labor Cost x Upper SecondarySchool	− 0.011	− 0.029	− 0.021	− 0.021	− 0.023	− 0.014	− 0.010
	(0.045)	(0.057)	(0.048)	(0.048)	(0.049)	(0.049)	(0.047)
Unit Labor Cost x Ln Urbanization	0.003	0.089	0.085	0.083	0.085	0.071	0.075
	(0.058)	(0.081)	(0.077)	(0.078)	(0.078)	(0.078)	(0.075)
Ln Domestic Investment x Cumulative FDI MAN	− 0.040***	− 0.029*	− 0.028*	− 0.030**	− 0.030**	− 0.043***	− 0.048***
	(0.015)	(0.015)	(0.014)	(0.015)	(0.014)	(0.015)	(0.014)
Cumulative FDI MAN x Ln Urbanization	− 0.129***	− 0.138***	− 0.142***	− 0.141***	− 0.142***	− 0.139***	− 0.150***
	(0.028)	(0.032)	(0.034)	(0.034)	(0.035)	(0.033)	(0.030)
Constant	− 1,035.821***	− 1,179.477***	− 1,159.459***	− 1,158.712***	− 1,173.661***	− 1,004.126***	− 947.284***
	(330.525)	(386.483)	(373.748)	(374.610)	(371.261)	(367.295)	(345.650)
Observations	279	253	253	253	253	253	253
R-squared	0.705	0.710	0.712	0.712	0.712	0.719	0.725
Number of provinces	33	33	33	33	33	33	33
Island Region-Specific Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors in parentheses, *** p < 0.01, ** p < 0.05, * p < 0.1
Source: Author's Estimation.

manufacturing sector in order to provide employment. Foreign firms that are typically labor-intensive are attracted.

Our analysis in columns 6 and 7 shows that national roads and industrial estates are statistically significant and positive. These results indicate that infrastructure roads are attractive for FDI in this sector. Industrial estates effectively attract FDI in the manufacturing sector, since this place-based location policy aims to draw foreign firms to the manufacturing sector.

5.4 The Estimation Results of Determinant Factors of FDI Inflow by Hotel and Restaurant Sector at the Provincial Level in Indonesia

Table 5 shows the estimated results for the determinants of FDI inflow into the hotel and restaurant sector. Our findings for determinant factors in this sector differ from those in the aggregate, agriculture, and manufacturing industry. What is most interesting from our investigation in column 1 is that urbanization has a positive and statistically significant impact, not found in the agricultural or manufacturing sectors. This finding confirms that FDI in hotels and restaurants is increasing in provinces that are becoming more urbanized.

Human capital has a positive and statistically significant impact only on upper secondary school, with no statistically significant impact on lower secondary school. Higher human capital quality is preferable for FDI in this sector because hotels should provide services that meet customer expectations and use a skilled labor force to upgrade the service offered (Assaf et al. 2015). However, we find a negative and statistically significant interaction between unit labor cost and upper secondary school. This finding could be interpreted as indicating that higher labor wages associated with higher education can limit FDI in the hotel and restaurant sector. Also, foreign trade has a statistically significant negative impact. This negative effect suggests that foreign firms in this sector prefer not to serve foreign markets. This finding supports columns 3 and 4, which indicate that GDP per capita and real GDP growth make a positive impact.

In column 6, we find that the national road is statistically significant and positive, which is consistent with the findings of Ramasamy and Yeung (2010). This means that road infrastructure is critical to attracting FDI in the services sector, such as hotels and restaurants, because the availability of infrastructure can efficiently stimulate FDI operation. Surprisingly, the industrial estate in column 7 has a positive and statistically significant correlation. One possible explanation for this is that foreign firms in this sector intend to serve customers through business activities.

5.5 Robustness Checks

We do not report the results of the robustness tests in this session to save space. The results, however, are available on request. We performed a robustness test with the GMM System estimator, which helps address endogeneity issues in the model, such as the causality relationship between FDI and wages and FDI and GDP. Our robustness test results show that the determinants of FDI are generally robust for several variables, including cumulative FDI, GAD, real GDP per square km, lower secondary school, and foreign trade.

Table 5 Estimation Results for Determinants FDI Inflow (Hotel and Restaurant Sector)

VARIABLES	(1) Ln FDI HR	(2) Ln FDI HR	(3) Ln FDI HR	(4) Ln FDI HR	(5) Ln FDI HR	(6) Ln FDI HR	(7) Ln FDI HR
Cumulative FDI HR	0.375***	0.307**	0.308**	0.298***	0.280**	0.126	0.174
	(0.132)	(0.119)	(0.123)	(0.114)	(0.125)	(0.116)	(0.107)
Ln GAD GDP 33	−0.588	−0.654	−0.829	−0.919	−0.832	−0.168	−0.409
	(0.687)	(0.834)	(0.935)	(0.877)	(0.844)	(0.906)	(0.907)
Ln Real GDP per Square Km	−2.266	−1.604	−4.092***	−3.148**	−3.205**	−6.087***	−3.531***
	(1.592)	(1.348)	(1.190)	(1.284)	(1.322)	(1.199)	(1.044)
Ln Domestic Investment	0.060	−0.013	0.009	−0.033	−0.047	−0.069	−0.049
	(0.108)	(0.113)	(0.119)	(0.121)	(0.120)	(0.117)	(0.113)
Ln Urbanization	1.531***	1.073**	2.066***	1.803***	1.781***	2.011***	1.209
	(0.462)	(0.440)	(0.709)	(0.609)	(0.631)	(0.627)	(0.744)
Upper Secondary School	0.443***	0.501***	0.375**	0.391**	0.410**	0.320**	0.286*
	(0.160)	(0.159)	(0.185)	(0.169)	(0.165)	(0.161)	(0.150)
Lower Secondary School	−0.050	−0.016	0.045	0.030	0.032	−0.011	0.053
	(0.120)	(0.137)	(0.144)	(0.132)	(0.135)	(0.123)	(0.127)
Share Labor Force/Population	−0.044	−0.057	−0.059	−0.062	−0.048	−0.034	−0.029
	(0.047)	(0.051)	(0.052)	(0.053)	(0.064)	(0.059)	(0.059)
Share Bank Lending/GDP	0.033	0.037	0.047	0.042	0.043	0.042	0.064*
	(0.031)	(0.039)	(0.033)	(0.033)	(0.032)	(0.032)	(0.037)
Foreign Trade	−0.007*	−0.009**	−0.011**	−0.013***	−0.012***	−0.012***	−0.021***
	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.003)
Unit Labor Cost (t−1)		−0.421	−0.217	−0.439*	−0.434	−0.554**	−0.660**
		(0.256)	(0.293)	(0.259)	(0.275)	(0.279)	(0.278)
Ln GDP per Capita			1.993**	1.602**	1.459**	2.304***	1.963***
			(0.882)	(0.807)	(0.738)	(0.622)	(0.758)
Real GDP Growth				0.070***	0.088***	0.093***	0.085***
				(0.019)	(0.016)	(0.022)	(0.028)
Growth GDP per Capita					−0.057	−0.061	−0.052
					(0.061)	(0.059)	(0.061)
Ln National Road						1.225***	1.188***
						(0.313)	(0.279)
Industrial Estate							0.076***
							(0.018)
Unit Labor Cost x Upper Secondary School	−0.203***	−0.229***	−0.212***	−0.208***	−0.214***	−0.195***	−0.166***
	(0.059)	(0.054)	(0.057)	(0.054)	(0.056)	(0.056)	(0.055)
Unit Labor Cost x Ln Urbanization	0.174***	0.258***	0.244***	0.247***	0.253***	0.235***	0.201***
	(0.065)	(0.068)	(0.073)	(0.065)	(0.067)	(0.073)	(0.074)
Ln Domestic Investment x Cumulative FDI HR	0.010*	0.013**	0.012**	0.014**	0.014***	0.012**	0.010**
	(0.006)	(0.006)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
Cumulative FDI HR x Ln Urbanization	−0.053***	−0.054***	−0.052***	−0.056***	−0.055***	−0.037***	−0.039***
	(0.010)	(0.013)	(0.013)	(0.014)	(0.014)	(0.009)	(0.009)
Constant	−17.320	−113.219	−71.570	−97.495	−137.316	−35.272	53.704
	(284.764)	(331.926)	(309.973)	(315.835)	(343.165)	(324.639)	(299.039)
Observations	208	190	190	190	190	190	190
R-squared	0.637	0.626	0.630	0.637	0.639	0.646	0.653
Number of provinces	32	32	32	32	32	32	32
Island Region-Specific Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors in parentheses, *** p < 0.01, ** p < 0.05, * p < 0.1
Source: Author's Estimation.

6. Concluding Remarks

This paper has described the critical factors that drive FDI inflow using a unique dataset for FDI inflow in Indonesia's provincial and economic sectors. The empirical results of our analysis provide essential findings that the determinants of FDI inflow at the provincial level in Indonesia vary at the aggregate level and across economic sectors.

We discovered that cumulative FDI aggregate, agglomeration neighboring province (GAD), domestic investment, urbanization, human capital (lower secondary school), bank lending, and foreign trade are essential determinants for attracting aggregate FDI in Indonesia. Furthermore, the analysis results confirmed that human capital (lower secondary school) and unit labor cost are substantial in attracting FDI in agriculture. GAD, foreign trade, and industrial estate are critical factors attracting foreign firms to the manufacturing sector. Eventually, urbanization, human capital (upper secondary school), and GDP per capita become critical factors attracting foreign firms in the hotel and restaurant sectors.

In light of this research, the Indonesian government may consider these factors when promoting FDI in a specific province or sector. Our findings corroborate ADB's (2019) findings, which criticized the Indonesian government for establishing an incentive program to encourage FDI without distinguishing between economic sectors as the target. Hence, if the government wants to attract FDI while promoting economic growth, it is necessary to improve the quality of human capital.

We are aware of the limitations of this study. Due to a lack of data, this study may suffer from omitted variables in explaining province-specific characteristics such as institutional quality and provincial economic policy, which could better explain our study's investigation into determinants of FDI inflow.

Notes

1 Dunning argues that market-seeking motives possess the goal of exploiting a new market. In addition, resource-seeking is motivated by winning possession of supply sources and minimizing costs. Meanwhile, efficiency-seeking is to pursue the diverse factor endowments, cultures, institutions arrangements, demand pattern, economic policy, and market structures by selecting a particular location to serve various markets. Strategic asset-seeking intends to override global competitiveness by purchasing competitive power in an unknown market.

2 In the literature, error of panel data regression can be divided into two types. First, a_i denotes an unobservable variable that varies from one province (entity) to the others but does not change over time (time-invariant), which is commonly called "fixed effect". Second, u_it denotes an unobservable variable that varies from one province to another and changes over time (time-variant). Both errors are referred to as the error component model.

3 In the report "Analysis of Export Commodities 2012–2019" published by BPS-Statistics Indonesia (2020), accessed from https://www.bps.go.id/on June 22, 2021, the contribution of the manufacturing sector to non-oil and gas exports nationally in 2019 was 81.71%, making the manufacturing sector the most significant contributor to non-oil and gas exports.

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Appendix A Agglomeration Economies (GAD)

The gravity adjusted demand (GAD) index (Fukao in Someya (1997)):

- $GAD_j = \sum_{i=1}^{n} \frac{GDP_i}{dist_{ij}^2} + \frac{GDP_j}{r_j}$

- GAD_j indicates the gravity adjusted demand for economy j (E.g., Jakarta).

- GDP_i denotes GDP of neighboring of 33 provinces i (E.g., Banten, Jawa Barat, Lampung, etc.).

- GDP_j is the GDP of host province j (Jakarta).

- r_j is the radius of province j (Jakarta) provided that the economy j (Jakarta) took the round shape.

- r_j is obtained by calculating the total area of the province j (Jakarta) divided by 3.14 (π), then the results are transformed into square roots ($\sqrt{\ }$).