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Determinants of Premature Deindustrialization and Uneven Manufacturing Industry in Indonesia

Benny Imantria[1]✉

[1]Faculty of Economics and Business, Diponegoro University, Semarang, Indonesia

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Abstract

Indonesia is currently undergoing an economic transformation to become a developed country, but premature deindustrialization and uneven manufacturing industry between western and eastern Indonesia may hinder economic development. This study aims to identify determinants of Indonesia's declining manufacturing industry output, which has led to premature deindustrialization and uneven manufacturing industry. Data sample used is a panel dataset of 34 provinces during the period 2015-2023 which was analyzed using panel data regression and spatial autoregressive combined (SAC). The novelty of this study lies in production function perspective and spatial regression. This study finds that foreign direct investment, domestic investment, labor, and trade openness have a significant positive effect on manufacturing industry output, while average years of schooling and minimum wage have no significant effect on manufacturing industry output in Indonesia. In addition, there is no significant spillover effect from neighboring provinces that determines manufacturing industry output in Indonesia during the observation period. Policymakers are expected to increase value and investment projects, employment opportunities, formal education quality, capital goods imports, and final goods exports. In addition, minimum wage needs to be adjusted according to regional conditions and provide employment affirmation to local labor.

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✉correspondence address:
Faculty of Economics and Business, Diponegoro University, Semarang
Jln. Hayam Wuruk No.5, Semarang, Indonesia
E-mail: bennyimantria@students.undip.ac.id

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INTRODUCTION

The gradual change in the economic structure occurs from an economy based on agriculture, manufacturing, and services industry. Manufacturing industry, as a secondary sector, plays an important role in accelerating economic growth and driving structural transformation towards developed countries. However, some developing countries may risk failing to become developed countries if they experience premature deindustrialization, characterized by declined manufacturing industry output share and employment share (R & M, 2022). In addition, disparities in manufacturing industry performance between regions can increase poverty and hinder economic development in the long-run (van Leeuwen & Földvári, 2016).

According to the Kaldorian analysis, manufacturing industry plays an important role as an engine of growth to drive economic development in developing countries (Dasgupta & Singh, 2007). Manufacturing industry has a relatively higher value added and employment than other industries (Verico, 2021). Developing countries should have a dominant manufacturing industry share of Gross Domestic Product (GDP) to accelerate its economic development. Meanwhile, premature deindustrialization and uneven manufacturing industry can pose serious challenges that hinder economic transformation.

Deindustrialization tends to occur in developed countries. Capital flows will shift from advanced markets to emerging markets, resulting in the relocation of manufacturing industries from developed to developing countries. Deindustrialization in developed countries is determined by factors such as interest rates, exchange rates, financial integration, and Dutch disease/ increased exports of primary goods (Araujo et al., 2021), negative contributions from prices, domestic demand, and substitution of imports by domestic production (Liboreiro et al., 2021), as well as trade deficits, high concentration of labor in manufacturing industry, low labor productivity, unemployment, large population, and financial crises (Vu et al., 2021).

However, premature deindustrialization can also occur in developing countries when their per capita income is lower than that of advanced countries during their industrialization period (Dasgupta & Singh, 2007). de Oliveira & da Fonseca Nicolay (2022) found that premature deindustrialization in developing countries occurs due to low innovation capacity in terms of technology and education, leading to a lack of competitiveness in the global market. Deindustrialization in developing countries will increase poverty and slow economic growth, reducing the demand for low-skilled labor and causing job losses in the manufacturing industry (Liu & An, 2023).

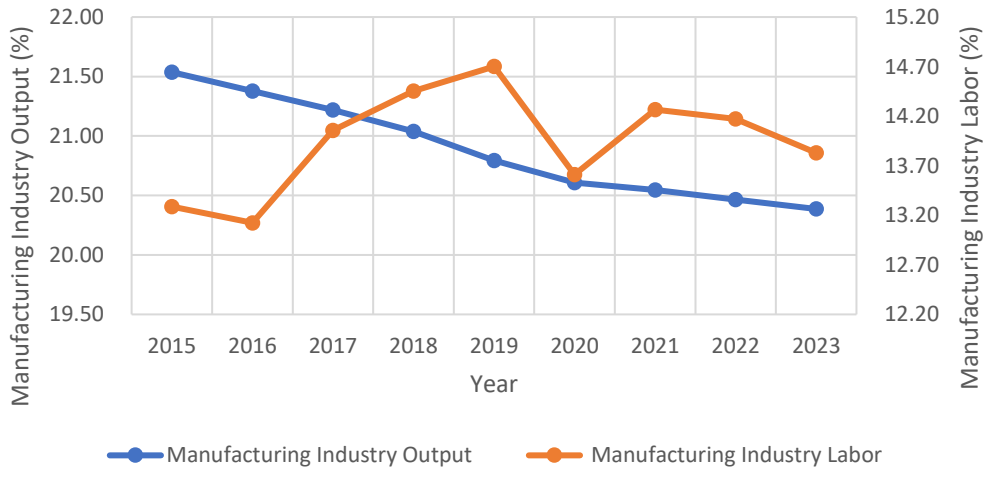
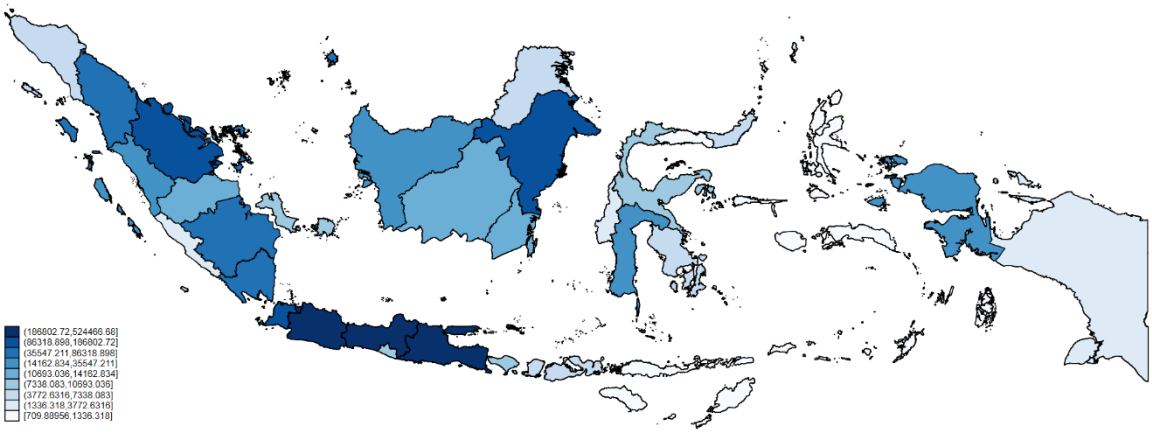


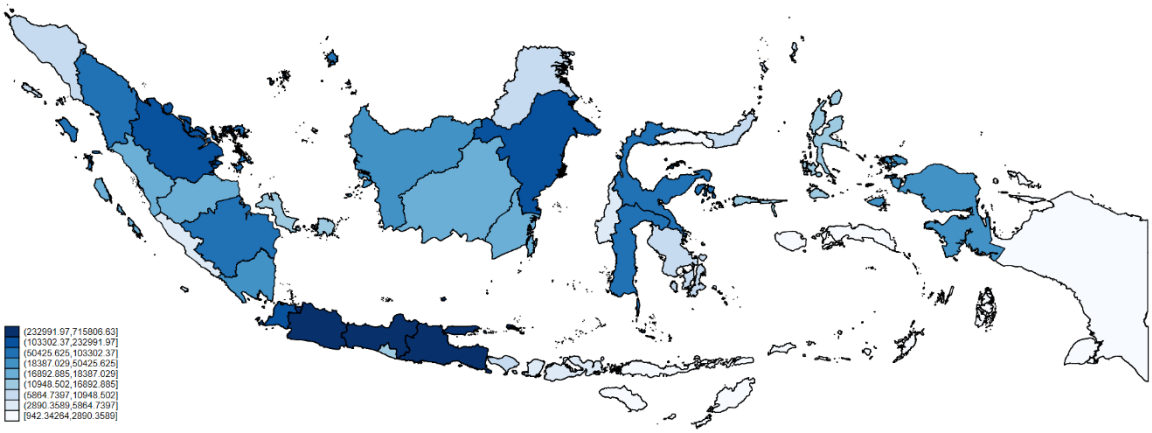
Figure 1. Share of Manufacturing Industry's Output and Labor in Indonesia
Source: Statistics Indonesia (2024)

Based on Figure 1, share of manufacturing industry output in GDP has been consistently declining from 2015 to 2023. Although manufacturing industry output still contributes the largest share to GDP, decreasing trend of its contribution indicates a decline in productivity, which could hinder economic growth in Indonesia. Meanwhile, declining share of manufacturing labor in total employment since 2021 also indicates economic instability in Indonesia, which requires labor

efficiency. Declining in both output and labor share of manufacturing industry show that Indonesia has experienced premature deindustrialization.



(a) Indonesian Manufacturing Industry Output in 2015



(b) Indonesian Manufacturing Industry Output in 2023

Figure 2. Manufacturing Industry Output at Province Level in Indonesia
Source: Data Processed (2024)

Based on Figure 2, there is a disparity in manufacturing industry output between western and eastern Indonesia. Western Indonesia, consisting of provinces in Sumatra and Java, contributes significantly to 88.54% of Indonesian manufacturing industry output during the period 2015-2023. It indicates a large inequality in Indonesian manufacturing industry performance, with the country's economy heavily dependent on western Indonesian manufacturing industry. In fact, all provinces in Java Island contribute the most to Indonesia's GDP from manufacturing industry, which is 70.18% during the observation period. In addition, some provinces have experienced significant changes in manufacturing industry output during the period 2015-2023. West Sumatra, Lampung, Bali, West Nusa Tenggara, and Papua have experienced large declined manufacturing industry output, while South Sulawesi, Central Sulawesi, and North Maluku have experienced large increased manufacturing industry output.

Premature deindustrialization and uneven manufacturing industry in Indonesia are mainly caused by declined output productivity (Andriyani & Irawan, 2018; Islami & Hastiadi, 2020). Solow (1956) with neoclassical theory of economic growth states that output is determined by physical capital, labor, and knowledge. Investment in physical capital must exceed depreciation to achieve economic growth in the long-run. Skilled labor increases output, while knowledge encourages the use of more advanced physical capital and more efficient production techniques to generate greater output. In addition, trade openness and minimum wage also play an important role in increasing output. Importing capital goods can increase productivity through R&D spillovers effect (Mo et al., 2021), and exporting final goods increases productivity and competitiveness in the global market (Sahoo et al., 2022). Meanwhile, increased minimum wage will increase variable costs, which may reduce output without labor adjusted (Ni & Kurita, 2020).

Several studies have found that manufacturing industry performance in Indonesia has been declining and uneven. Andriyani & Irawan (2018) found that deindustrialization in Indonesia has occurred since the 1997 financial crisis, resulting in declined share of labor and value added by the manufacturing industry. Grabowski & Self (2020) found that manufacturing industry expansion in Indonesia is hampered by increased staple food prices, which leads to higher wages and decreased labor intensity of the manufacturing industry. Islami & Hastiadi (2020) found that deindustrialization in Indonesia is caused by declined share of manufacturing industry value added in GDP, manufacturing industry productivity, and trade, thus slowing economic growth. Verico (2021) found that manufacturing industry in Indonesia has grown below the economic growth after 1997 financial crisis and continues to experience a decline in its contribution to GDP. Meanwhile, manufacturing industry in Indonesia is dominated by small-scale manufacturing industry.

In addition, several previous studies in other countries have also found that premature deindustrialization can occur in developing countries. Tsukada (2023) found that low trade openness and export-oriented foreign direct investment increase the risk of premature deindustrialization in Vietnam. Busse et al. (2024) found that trade liberalization would lead to premature deindustrialization by reducing manufacturing industry employment in developing countries, particularly in sub-Saharan Africa and Latin America. Labor productivity need to be improved in order to increase competitiveness in global trade. Cengiz & Manga (2024) found that deindustrialization generally occurs in developed countries, but many developing countries experience deindustrialization before they become developed countries. Economic globalization in the form of European Union (EU) can be used to promote manufacturing industry by increasing employment opportunities and value added in western Balkan. Falleiro & Fonseca (2024) found that premature deindustrialization in Brazil occurred due to declined labor productivity. Meanwhile, Ibourk & Elouaourti (2024) found that premature deindustrialization in Morocco occurred in a process of structural change in which labor released from agriculture industry could not be fully absorbed by manufacturing industry. The government needs to improve human capital, institutional quality, and export-oriented trade from manufacturing industry.

Indonesia is currently undergoing a structural transformation to become a developed country, supported by its demographic bonus. However, manufacturing industry performance shows a decline in its contribution to GDP and decreased share of labor. Manufacturing industry development is also uneven between western and eastern Indonesia. In addition, studies on declined manufacturing industry performance in Indonesia remain limited. Therefore, determinants of premature deindustrialization and uneven manufacturing industry in Indonesia need to be identified.

The government needs to formulate precise policies based on the identified determinants in order to improve manufacturing industry performance in Indonesia. This study is important to be conducted because a thriving manufacturing industry can add significant value relative to other industries, as well as absorb large numbers of jobs by using low-skilled labor. High economic growth rates will support the successful transformation of Indonesia's economy into a developed country. The government has set a target for manufacturing industry's contribution to GDP at 28% and aims to be among top five countries in terms of per capita income, according to the vision of Indonesia Emas 2045 (Ministry of National Development Planning, 2024).

This study differs from previous studies in that it uses a production function perspective, augmented with control variables, to identify determinants of manufacturing industry output in Indonesia. In addition, spatial regression is used to understand spillover effects from surrounding areas. This study aims to identify determinants of premature deindustrialization and uneven manufacturing industry in Indonesia. This study can contribute to literature by providing empirical evidence on determinants of manufacturing industry output that lead to premature deindustrialization and uneven manufacturing industry in Indonesia as a developing country Indonesia which is currently undergoing an economic transformation from agriculture to manufacturing industry. Furthermore, policymakers are encouraged to consider the important role of capital investment, labor, education, trade openness, and minimum wage to manufacturing industry performance in Indonesia.

This study has several alternative hypotheses, which can be explained as follows.

H1: Foreign direct investment has a significant positive effect on manufacturing industry output.
H2: Domestic investment has a significant positive effect on manufacturing industry output.
H3: Labor has a significant positive effect on manufacturing industry output.

H4: Average years of schooling has a significant positive effect on manufacturing industry output.
H5: Trade openness has a significant positive effect on manufacturing industry output.
H6: Minimum wage has a negative positive effect on manufacturing industry output.

METHOD

This study was conducted by quantitative approach utilizing secondary data from official government institution, namely Statistics Indonesia. Data sample consists of a panel dataset with 306 observations from 34 provinces during the period 2015-2023. Detailed information on data variable can be found in table 1.

Table 1. Data Variables

Variables	Descriptions	Units	Sources
Manufacturing Industry Output (Manufacturing)	Manufacturing industry output at constant prices	Billion (IDR)	Statistics Indonesia
Foreign Direct Investment (FDI)	Direct investment inflow from non-resident investors	Million (USD)	Statistics Indonesia
Domestic Investment (DI)	Direct investment inflow from resident investors	Billion (IDR)	Statistics Indonesia
Labor (Labor)	Number of people in the labor force who are working in manufacturing industry	Thousand (People)	Statistics Indonesia
Average Years of Schooling (School)	Number of average years spent in formal education by people aged 25 and over	Year	Statistics Indonesia
Trade Openness (Trade)	Total value interprovincial and intercountry exports and imports at constant prices	Billion (IDR)	Statistics Indonesia
Minimum Wage (Wage)	Minimum wage earned by labor in their main job at province level	Million (IDR)	Statistics Indonesia

Source: Data Processed (2024)

Data sample used is an aggregated panel dataset at province level because some districts did not have investment projects in certain years. Therefore, data sample at province level are used to have a balanced panel dataset. Data sample also covers the period 2015-2023 to capture declined share of manufacturing industry output and labor in Indonesia, as well as secondary data availability due to North Kalimantan province split-off in 2012. Data sample from North Kalimantan is not aggregated with East Kalimantan because data sample is already available, while Southwest Papua, South Papua, Central Papua, and Papua Pegunungan experienced split-off in 2022, resulting in aggregation of data sample to their original provinces due to data variable unavailability during the observation period.

This study uses panel data regression to identify determinants of premature deindustrialization and uneven manufacturing industry in Indonesia, as shown in equation 1. In addition, spatial regression is used to identify direct and indirect effects, as shown in equation 2. All data variables are transformed into natural logarithm form to simplify further analysis. The model equations for panel data regression and spatial regression can be written as follows.

$$\ln Manufacturing_{it}=\alpha_0+\beta_1 \ln FDI_{it}+\beta_2 \ln DI_{it}+\beta_3 \ln Labor_{it}+\beta_4 \ln School_{it}+\beta_5 \ln Trade_{it}+\beta_6 \ln Wage_{it}+\varepsilon_{it} \quad (1)$$

where, α_0: intercept; $\beta_{1,2,3,4,5,6}$: coefficient; i: province; t: year; ε: error term.

$$y=\rho Wy+X\beta+\mu, \quad \mu=\lambda W\mu+\varepsilon \tag{2}$$

where, y: dependent variable vector; ρ: spatial autoregressive coefficient; W: spatial weight matrix; X: independent variable vector; β: coefficient vector; μ: error term vector; λ: spatial error autoregressive coefficient; ε: uncorrelated error vector and homoscedasticity.

Panel data regression can be conducted using Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM), based on model selection test result using Chow test, Lagrange multiplier test, and Hausman test. Meanwhile, panel data regression must also satisfy Gauss-Markov assumption, which means that model estimation should be a best linear unbiased estimator, as determined by normality test, multicollinearity test, heteroskedasticity test, and autocorrelation test (Gujarati & Porter, 2009).

In addition, spatial regression in this study was conducted using Spatial Autoregressive Combined (SAC) model and queen contiguity, which takes into account spatial effects for both dependent variable and error term from neighboring provinces (Anselin, 1988). Spatial regression begins by testing the spatial dependence of data sample using Pesaran test, Friedman test, and Frees test (De Hoyos & Sarafidis, 2006).

RESULT AND DISCUSSION

Detailed information about data sample for dependent and independent variables during observation period can be displayed in descriptive statistics, as shown in Table 2. Descriptive statistics are displayed to provide basic information about the variables in the dataset and to provide a brief explanation of possible relationships between variables.

Table 2. Descriptive Statistics

Variables	Obs.	Mean	Std. Dev	Min	Max
Manufacturing Industry Output	306	75,119.42	138,899.60	709.88	715,806.60
Foreign Direct Investment	306	988.49	1,438.52	2.00	8,283.70
Domestic Investment	306	11,303.92	16,326.44	0.10	95,202.10
Labor	306	521.81	1,027.26	10.35	4,612.38
Average Years of Schooling	306	8.49	0.97	5.99	11.45
Trade Openness	306	308,635.00	457,359.80	141,85.88	2,583,435.00
Minimum Wage	306	2.37	0.64	0.91	4.90

Source: Data Processed (2024)

Based on Table 2, manufacturing industry output has a high standard deviation, indicating a large gap between manufacturing industry output in western and eastern Indonesia. Manufacturing industry output in western Indonesia is 7.72 times higher than that in eastern Indonesia. This condition can be briefly observed from several production factors as independent variables which show a wide disparity in western and eastern Indonesia during the observation period.

Table 3. Panel Data Regression Model

Selection Tests	P-values	Decisions
Chow Test	0.0000	Fixed Effect Model
Lagrange Multiplier Test	0.0000	Random Effect Model
Hausman Test	0.0000	Fixed Effect Model

Source: Data Processed (2024)

Based on Table 3, this study uses panel data regression with a Fixed Effect Model (FEM). Fixed effect model takes into account independent variables heterogeneity across provinces and remains constant for each province during the observation period. Fixed effect model also assumes a constant influence of error term (Ekananda, 2019).

Normality test conducted using skewness kurtosis test resulted in a significant p-value, leading to rejection of H_0. It indicates that residual are not normally distributed. This condition occurs due to significant disparity between western and eastern Indonesia. Nevertheless, the non-normal data distribution does not need to be adjusted when using a large data sample because F-stat and t-stat values are obtained based on assumption that residual follows a normal data distribution (Gujarati & Porter, 2009).

Multicollinearity can be tested by using correlation matrix to identify partial correlations among independent variables. The results of pairwise correlations among independent variables show that correlation matrix has values below 0.75, indicating that there is no multicollinearity.

Heteroscedasticity test conducted using the Wald test shows a significant p-value, leading to the rejection of H_0 and residual are heteroscedastic. Meanwhile, autocorrelation test conducted using the Wooldridge test also shows a significant p-value, leading to the rejection of H_0 and indicating the presence of serial correlation. Estimation results with heteroscedasticity and autocorrelation remain unbiased and consistent, but they are not efficient because variance is not minimized, resulting in smaller and insignificant F-stat and t-stat values. Heteroscedasticity and autocorrelation can be addressed by using robust standard errors (Gujarati & Porter, 2009).

Furthermore, spatial analysis is also conducted to identify spillover effect using Spatial Autoregressive Combined (SAC) model. Spatial dependency using Pesaran test and Frees test indicate spatial dependence, but the result from Friedman test show no spatial dependence.

Table 4. Panel Data Regression and Spatial Regression Model Results

Independent Variables	Dependent Variables: lnManufacturing			
	FEM	SAC		
		Direct Effect	Indirect Effect	Total Effect
lnFDI	0.0369* (0.058)	0.0389*** (0.001)	0.0026 (0.276)	0.0416*** (0.001)
lnDI	0.0300* (0.084)	0.0312*** (0.001)	0.0021 (0.295)	0.0334*** (0.002)
lnLabor	0.3185*** (0.001)	0.3153*** (0.000)	0.0216 (0.253)	0.3369*** (0.000)
lnSchool	0.2380 (0.816)	0.3960 (0.521)	0.0272 (0.555)	0.4232 (0.519)
lnTrade	0.3707** (0.015)	0.3661*** (0.000)	0.0251 (0.242)	0.3912*** (0.000)
lnWage	0.0165 (0.903)	-0.0560 (0.657)	-0.0038 (0.694)	-0.0599 (0.658)
Observation	306		306	
Prob>F	0.0000		0.0000	
R-squared	0.6953			
Pseudo R-squared			0.7950	

Note: significance * p<0.10; ** p<0.05; *** p<0.01

Source: Data Processed (2024)

Based on P>|t| values, foreign direct investment, domestic investment, labor, and trade openness have a significant positive effect on manufacturing industry output, while average years of

schooling and minimum wage have no significant effect on manufacturing industry output in Indonesia.

Based on Prob>F values, foreign direct investment, domestic investment, labor, average years of schooling, trade openness, and minimum wage simultaneously have a significant effect on manufacturing industry output in Indonesia. Based on R-squared and Pseudo R-squared values, dependent variable during observation period is affected by independent variables by 69.53% and 79.50% respectively, while remaining portion is determined by error term or other independent variables not included in model estimation.

Based on Table 4, panel data regression and spatial regression have the same estimation results with slightly different coefficient values. It is useful as a robustness check that can be used for further analysis. In this study, SAC model estimation results are used to discuss determinants of manufacturing industry output because it can identify spillover effect. Independent variables effect originating from the same province on dependent variable of particular province can be explained by direct effect, while independent variables effect from surrounding provinces on dependent variable of particular province can be explained by indirect effects, also known as spillover effect. However, spillover effect in Table 4 has non-significant p-values, indicating that manufacturing industry output in each province is not determined by independent variables of neighboring provinces during the observation period.

Foreign direct investment has a significant positive effect on manufacturing industry output. An increase in foreign direct investment by 1% will increase manufacturing industry output by 0.0389%, ceteris paribus. Foreign direct investment, especially labor-intensive investment, will increase employment opportunities and thus raise per capita income. Increased per capita income will increase purchasing power and demand for goods, thereby increasing output demand and encouraging manufacturing industry to produce more goods. In addition, multinational companies often uses advanced technology in production processes, resulting in more efficient production in larger quantities.

This finding is consistent with study conducted by L. Sugiharti et al. (2022), who found that foreign direct investment will increase productivity and technical efficiency in Indonesian manufacturing industry. However, local firms with low technology and unskilled labor will face challenges in technology adoption. Orlic et al. (2018) found that foreign direct investment from multinational firms would provide productivity spillovers in the form of knowledge to local manufacturing firms, thereby improving human capital in Czech Republic, Estonia, Hungary, Slovakia, and Slovenia. The spillover effect depends on absorptive capacity of local firms. Li et al. (2024) also found that foreign direct investment in China has a spillover effect through technology transfer and supply chain to local firms. However, Wako (2021) found that foreign direct investment in natural resources would lead to deindustrialization in sub-Saharan Africa due to low institutional quality, resulting in reduced demand for domestic labor and increased income inequality.

Domestic investment has a significant positive effect on manufacturing industry output. An increase in domestic investment by 1% will increase manufacturing industry output by 0.0312%, ceteris paribus. Domestic investment creates more employment opportunities because local firms have limited capital and use less technology in production processes, thus employing lower-skilled workers. In addition, multinational companies also crowd in local firms through knowledge and technology transfer, thereby boosting domestic investment.

This finding is consistent with study conducted by Djulius et al. (2019), who found that domestic investment drives manufacturing industry performance in Indonesia. Chen et al. (2018) also found that local firms can adopt technology introduced by multinational firms, making domestic investment crucial for technological progress in China. Similarly, Shah et al. (2020) found that foreign direct investment in manufacturing industry crowds out domestic investment in Pakistan as the government encourages increased public and private domestic investment, thereby increasing absorptive capacity. Sinha & Shastri (2023) found that financial development in India promotes domestic investment in the short and long-run. Dinga et al. (2024) found that domestic investment can promote economic development in sub-Saharan Africa because governments support local firms through incentive policies and protection, which increases productivity and competitiveness. However, domestic investment may decline as a result of increased foreign direct investment if local firms lack the capacity to absorb technology effectively, making it difficult to compete with multinational firms, as found in studies by Choi (2018) on South Korea and Ibhagui & Olawole (2019) on OPEC countries.

Labor has a significant positive effect on manufacturing industry output. An increase in labor by 1% will increase manufacturing industry output by 0.3153%, ceteris paribus. Labor will increase per capita income, thereby increasing purchasing power and promoting manufacturing industry output. Household consumption contributes 55.39% to GDP during the period 2015-2023, playing an important role in Indonesia's economic growth (Statistics Indonesia, 2024). Meanwhile, high skilled labor will further boost productivity and sustainable economic growth.

This finding is consistent with study conducted by Amri (2022), who found that labor has a significant positive effect on manufacturing industry in Indonesia in both short and long-run. Cylus & Al Tayara (2021) found that an aging labor in 180 countries reduces productivity and economic growth, but that this productivity loss can be prevented through health support. Amornkitvikai et al. (2023) also found that old-age population has a positive effect on economic growth, while youth-age population has a negative effect on economic growth in Asia. Old-age population can become skilled labor due to their work experience, while youth-age population has less skills and work experience. Meanwhile, Yu et al. (2024) found that labor productivity can promote more efficient use of resources, thereby promoting sustainable green economic growth in Asia, Europe, and South America. Zhao et al. (2024) also found that industrial robots can increase labor productivity in China, while also having diminishing marginal effects and a larger coefficient in low-density robot industries.

Average years of schooling have no significant effect on manufacturing industry output.This condition is likely due to declining education quality in Indonesia, as evidenced by declining PISA scores in 2015, 2018, and 2022 (Organization for Economic Development and Cooperation, 2024). Reading scores decreased from 397, 371 to 359. Mathematics scores decreased from 386, 379, to 366. Meanwhile, science scores decreased from 403, 396, to 383In addition, there is a disparity in school enrollment between western and eastern Indonesia. Declining education quality leads to increased low-skilled labor, which reduces productivity and value added. People with low levels of formal education will also struggle to find well-paying jobs. As a result, labor in Indonesia is dominantly employed in the informal sector, accounting for 58.18% over the period 2015-2023 (Statistics Indonesia, 2024).

Maneejuk & Yamaka (2021) found that higher education or tertiary education has a greater positive effect and plays an important role in sustainable economic growth in Indonesia. R. R. Sugiharti et al. (2021) also found that average years of schooling can drive economic growth in Indonesia. However, labor productivity in Indonesia is more affected by work experience rather than years of formal education. Asadullah & Zafar Ullah (2018) found that Vocational Education and Training (VET) can promote economic growth in OECD countries. Dao (2018) found that per capita education expenditure increases per capita GDP growth in 78 developing countries. Omar (2019) found that higher enrollment in tertiary education will promote economic growth in Middle East and North Africa. Meanwhile, Agasisti & Bertoletti (2022) found that increasing the number of universities will improve higher education quality, thereby promoting economic growth in Europe through high-quality research and specialization in Science, Technology, Engineering, and Mathematics (STEM).

Trade openness has a significant positive effect on manufacturing industry output. An increase in trade openness by 1% will increase manufacturing industry output by 0.3661%, ceteris paribus. The government needs to support manufacturing industry to compete in global market, thereby promoting growth of manufacturing industry output through trade openness policies, including exports and imports. Meanwhile, local firms also need to improve their technology absorption capacity to benefit from global value chain. Import activities can increase productivity through technology absorption, while export activities can expand markets and increase demand, thereby promoting output growth.

This finding is consistent with study conducted by Patunru (2023), who found that increasing trade openness and integration into global value chains will boost economic growth in Indonesia. Banday et al. (2021) also found that trade openness can promote both short and long-run economic growth in BRICS countries due to advanced technology possession, which increases productivity and competitiveness in the global market. Mo et al. (2021) found that importing capital goods can increase productivity through R&D spillovers, thereby stimulating economic growth in China. Sahoo et al. (2022) found that export activities increase productivity and competitiveness in manufacturing industry in India, supported by R&D and technology transfer. Studies conducted by Bajo-Rubio & Ramos-Herrera (2024) on Europe and Nam & Ryu (2024) on ASEAN also found that increased trade

openness leads to economic growth. However, Rahman et al. (2020) found that trade openness has a significant negative effect on economic growth in South Asia because domestic production capacity cannot compete with other countries. The government needs to increase domestic production and exports, as well as increase imports of capital and intermediate goods rather than consumer goods.

Minimum wage have no significant effect on manufacturing industry output. Ideally, increased minimum wage should increase variable costs for firms, thereby encouraging labor reduction to adjust production costs. In other hand, increased minimum wage should also benefit household purchasing power and boost manufacturing industry output. However, declined labor share in manufacturing industry will increase labor share in other industries. This condition indicates that increased minimum wage in manufacturing industry will not directly stimulate household purchasing power. In addition, increased imports of consumer goods with lower price may increase competition and potentially reduce manufacturing industry output.

Ni & Kurita (2020) found that increased minimum wage in Indonesia would reduce firms' productivity by reducing labor to lower production costs. Kim et al. (2023) found that increased minimum wage in South Korea would reduce hours worked, especially for young and less-skilled labor, prompting the government to prepare unemployment insurance policies to mitigate wage increase impact. Li et al. (2023) found that increased minimum wage would reduce new firms in China, especially for firms with lower wages and low-skilled labor. Meanwhile, Ma et al. (2024) also found that increased minimum wage would encourage job seekers to migrate to other cities in China that offer higher minimum wage.

CONCLUSSION AND RECOMMENDATION

This study aims to identify determinants of manufacturing industry output which lead to premature deindustrialization and uneven manufacturing industry in Indonesia. The novelty of this study lies in production function perspective and spatial regression. Data sample used consists of secondary data from Statistics Indonesia with 306 observations from 34 provinces during the period 2015-2023, which was analyzed using panel data regression with fixed effect model and spatial autoregressive combined model. This study found that foreign direct investment, domestic investment, labor, and trade openness have significant positive effects on manufacturing industry output, while average years of schooling and minimum wage have no significant effects on manufacturing industry output in Indonesia. Foreign direct investment, domestic investment, labor, average years of schooling, and trade openness from surrounding areas have a positive but insignificant effect, while minimum wage from surrounding areas has a negative but insignificant effect on manufacturing industry output in a region.

Appropriate policies need to be put in place by the government to strengthen determinants that drive manufacturing industry and address issues related to determinants that have not yet had an impact but have had positive effects in other countries. This study findings are expected to serve as considerations for policymakers to increase investment, employment opportunities, formal education, and adjustments in trade openness through capital goods imports and final goods exports. Meanwhile, minimum wage should be adjusted according to regional economic conditions, education and training should be linked and matched with manufacturing industry needs, and affirmative recruitment pathways should be established for local labor. The government's policy to increase manufacturing industry output must be implemented in a balanced manner between western and eastern Indonesia in order to achieve equitable economic development.

This study has limitations as it only identifies determinants of manufacturing industry output from a production perspective. Data sample used does not fully represent regional conditions in Indonesia as it still relies on province level dataset. Therefore, further study is needed to identify determinants of manufacturing industry from a distribution and consumption perspective in more specific areas, such as district level, as well as western and eastern Indonesia. The short and long-run effects of these determinants also need to be identified.

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