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## Calorie Consumption and Indonesia's Household Expenditure: Is There a Paradox?

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### Abstract

*During 2011-2014, anecdotal evidence suggested a paradox in Indonesia concerning calorie intake that had fallen, despite increased per capita expenditure and household size. This study will rigorously analyze calorie intake by applying several analytical methods, mainly repeated cross-section methods using an instrumental variable. The study used national scale data from the National Socio-Economic Survey (Susenas) in March 2011-2014. This study finds a meaningful relationship between calorie intake and per capita expenditure and household size in Indonesia in the 2011-2014 period. Besides, calorie needs and the "Subsidized Rice for the Poor" or the Raskin program are positively correlated with calorie intake. The research also suggests that the government needs to maintain household food assistance programs, ensure the stability of staple food prices, and apply economies of scale in calculating the poverty line.*

### Keywords:

calorie intake, household expenditure, household size, calorie needs, repeated cross-section method.

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## Introduction

Calorie intake (CI) is a more direct measure of basic needs satisfaction and is widely used to calculate absolute poverty lines. The poverty line in Indonesia is calculated by using the Cost of Basic Needs (CBN) and Food Energy Intake (FEI) methods (Ravallion & Bidani, 1994). The minimum calorie needs vary by country. In Indonesia, 2,100 kilocalories per capita per day (Kcal/capita/day) are applied based on the Recommended Daily Dietary Allowance (RDA) consensus through the 1978 National Workshop on Food and Nutrition (Ravallion & Bidani, 1994). In India, poverty is measured by a direct method using minimum calorie adequacy of 2,400 Kcal/capita /day in rural areas and a minimum of 2,100 Kcal/capita/day in urban areas (Dev, 2005). In comparison, the Philippines applies minimum calorie adequacy of 2,000 Kcal/capita/day (Balisacan & Fuwa, 2004).

Several studies have found a strong relationship between welfare levels and food consumption (Attanasio et al., 2013; Ravallion, 2015). These empirical findings align with Engel's Law, which proved a positive relationship between per capita income and food consumption, even though it tends to be inelastic. Several recent studies have, however, documented the "riddle" or paradox in food consumption. In the case of India (Deaton & Drèze, 2009), China (Du et al., 2002), and Britain during the Industrial Revolution (Clark et al., 1995), the population experienced rapid growth and rapid revenue growth. However, structural transformation in the form of calorie consumption was stagnant.

Deaton & Drèze (2009) showed that despite real expenditure growing, CI declined because households spend less on food and less on staple foods, at a certain level of expenditure, with cheaper sources of calories. This is in line with the results of empirical investigations in India that found that country has experienced a paradox over the past four decades, namely, monthly per capita real expenditure increasing over time, but the average number of calories consumed per capita falling (Basu & Basole, 2013).

Figure 1. Engel Calorie Curve Based on Intake Per Capita HE in Indonesia

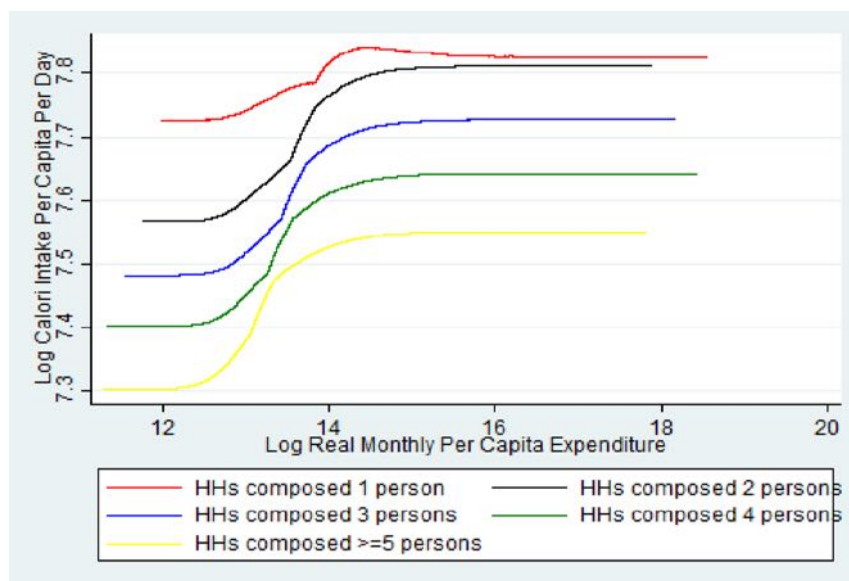


Source: Statistics Indonesia, taken from various sources.

In a different context, Deaton & Paxson (1998) reported that households with more household members have a smaller CI per capita than a household with a similar per capita expenditure. This implies that households with more household members have poor nutrition. The above phenomenon contradicts the classic model (Barten, 1964) that states that households with more household members will have better nutrition as they consume more food per capita and benefit from economies of scale. Besides that, social capital is truly endogenous to household welfare (Adepoju & Oni, 2012).

In Indonesia's case, during 2011-2014, cross-section data shows that CI per capita per day tends to increase in line with increased income (proxied by average household expenditure/HE). The Engel calorie curve (Figure 1) shows a preliminary indication of the inconsistency of CI and household income in Indonesia, however, with CI levels remaining relatively flat regardless of the per capita expenditure after a certain point.

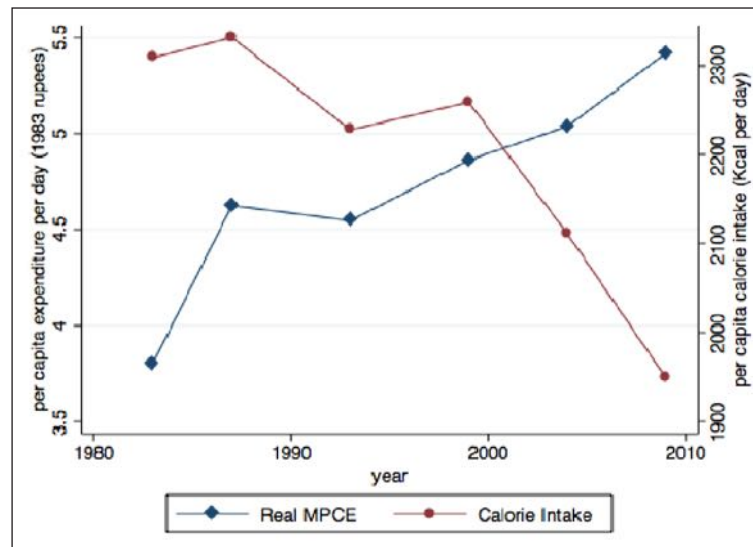
**Figure 2. Engel Calorie Curve Based on Intake Per capita Household Expenditure Per capita and Household Size in Indonesia (2011-2014)**



Source: Statistics Indonesia, taken from various sources

In Indonesia in 2011-2014, CI tended to decline, from 1,952 Kcal/capita/day in 2011 to 1,859 Kcal/capita/day in 2014. Depending upon the HE, it showed that an increase in household size (HS) tended to decrease CI per capita and vice versa (Figure 2). Empirical studies in several countries such as India (Figure 3), China, and the United Kingdom show that an increase in income results in a decrease in CI, and an increase in household size reduces household CI. However, a literature review has found no research on this puzzle using Indonesia datasets.

Figure 3: Monthly Real Per Capita Expenditure (in rupee 1983) and Estimated Average CI (Kcal per day) in Rural India.



Source: Basu and Basole (2013)

This paper aims to explain that the decrease in CI is closely related to the measurement of the poverty rate, especially in Indonesia, where the food poverty line is used as an indicator with minimum calorie needs set at 2,100 Kcal/capita/day. During 2012–2014, Indonesia's poverty targets were not met, so to address this issue and fulfill the minimum CI needs in low-income groups, and the government continued a program of subsidized rice for the poor (*Raskin*).

On the whole, this study examines four main issues of interest: first, the relationship and effect of household expenditure per capita on the level of CI per capita; second, the relationship and effect of household size on CI per capita; third, the relationship and effect of calorie need based on physical activity level on CI per capita; and fourth, the effectiveness of the *Raskin* program on CI per capita.

## Method

Empirical studies relating to variables in both areas of the puzzles are still very limited in developing countries. The use of cross-section data varies in each of the previous studies. Li (2011) used data exceeding 100,000 households in India from several time periods (1983, 1987–1988, 1993–1994, 1999–2000, and 2004–2005), while Basu and Basole (2013) used panel data consisting of 74 regions in the “state regions” which are rural areas in India from six periods, namely 1983–1984, 1987–1988, 1993–1994, 1999–2000, 2004–2005, and 2009–2010. Salois et al. (2010) explored the relationship between CI and other nutrients as a function of income using data from 171 countries (including Indonesia) in two time periods (1990–1992 and 2003–2005); Subramanian & Deaton (1996) estimated the elasticity of CI and HE by using households in rural areas of Maharashtra in India in 1983. Skoufias (2003) examined the relationship between

changes in income and calorie availability in Indonesia using household data from Susenas between 1996 and 1999 with a sample of around 60,000 households per year. Skoufias et al. (2009) used sample data of 7,553 households in 240 poor rural areas from eight Mexican states in the survey period between October 2003 and April 2004, while Skoufias et al. (2012) estimated the elasticity of income and calories from staple foods of grain before and after the 1997-1998 crisis in Indonesia using cross-section data; while the 1996 and 1999 Susenas survey used a sample of 60,678 and 62,217 households respectively.

Previous studies in several countries, including Indonesia, mostly used cross-section data or time-series data because it was challenging to obtain panel data with the same observation unit over the period. This study will use a fixed effect repeated cross-sections method using instrument variable estimation (Deaton, 1985; Moffitt, 1993; Verbeek, 2008; Skoufias et al., 2012) microdata level (household) as a unit of analysis. Theoretical model refers to Eli & Li (2015) that was further developed by Basu & Basole (2013).

The primary data source used to combine intake data and core data is the National Socio-Economic Survey (*Susenas*). The intake data is used to calculate CI per capita and expenditure per capita. The core data is used to describe individual/household characteristics. Both of these data sets are combined into a yearly household cross-section data structure. The observation period is from March 2011 to March 2014, where the observation unit is a household. This data period is due to the initial paradox of decreasing calorie consumption while household expenditure tends to increase. Data selection was based on the need for data to prove indications of the hypothesized CI paradox.

The main empirical model with the four main variables is specified through interaction with the time dimension (years) to measure the marginal effect on the 2011 base reference, referring to Skoufias et al. (2012). Interaction with the years is also treated equally towards the control variables and fixed effects. This study uses a fixed effect repeated cross-sections model that can be expressed as follows:

$$\log(\text{Cal\_Int})_{jti} = \beta_0 + \sum_{k=1}^4 \mathbf{X}_{jtk} \cdot \beta_k + \sum_{k=1}^4 (\mathbf{X}\theta)_{jtk} \cdot \beta_{kt} + \sum_{m=1}^7 \mathbf{Z}_{jtim} \cdot \beta_m + \sum_{m=1}^7 (\mathbf{Z}\theta)_{jtim} \cdot \beta_{mt} + \alpha_j + \theta_t + (\alpha\theta)_{jt} + v_{jti} \quad (1)$$

To make the above empirical model clear with the four main variables in equation (1) above, the empirical model can be written as:

$$\begin{aligned} \log(\text{Cal\_Int})_{jti} = & \beta_0 + \beta_1(\log(\text{Riil}_{PCE}))_{jti} + \beta_2(\log(\text{Riil}_{PCE})x(D_{2012}))_{jti} + \\ & \beta_3(\log(\text{Riil}_{PCE})x(D_{2013}))_{jti} + \beta_4(\log(\text{Riil}_{PCE})x(D_{2014}))_{jti} + \\ & \beta_5(\log(\text{HHsize}))_{jti} + \beta_6(\log(\text{HHsize})x(D_{2012}))_{jti} + \\ & \beta_7(\log(\text{HHsize})x(D_{2013}))_{jti} + \beta_8(\log(\text{HHsize})x(D_{2014}))_{jti} + \\ & \beta_9(\log(\text{Cal\_Req}))_{jti} + \beta_{10}(\log(\text{Cal\_Req})x(D_{2012}))_{jti} + \\ & \beta_{11}(\log(\text{Cal\_Req})x(D_{2013}))_{jti} + \beta_{12}(\log(\text{Cal\_Req})x(D_{2014}))_{jti} + \\ & \beta_{13}(\log(\text{D}_{Raskin}))_{jti} + \beta_{14}(\log(\text{D}_{Raskin})x(D_{2012}))_{jti} + \\ & \beta_{15}(\log(\text{D}_{Raskin})x(D_{2013}))_{jti} + \beta_{16}(\log(\text{D}_{Raskin})x(D_{2014}))_{jti} + \\ & \sum_{m=1}^7 \mathbf{Z}_{jtim} \cdot \beta_m + \sum_{m=1}^7 (\mathbf{Z}\theta)_{jtim} \cdot \beta_{mt} + \alpha_j + \theta_t + (\alpha\theta)_{jt} + v_{jti} \end{aligned} \quad (2)$$

Where:

$j$  = 1, 2, ..., 65 (urban/rural provinces as cross-sections)

$t$  = 1, 2, ..., T (time period index in the year as repeated)

$i$  = 1, 2, ..., n (the number of households)

$m$  = 1, 2, ..., 7 (the number of control variables)

$Cal\_Int$  = average household CI per capita per day

$Riil\_PCE$  = average monthly real expenditure per capita (proxy per capita income monthly real)

$HHsize$  = household size

$Cal\_Req$  = estimated average calorie needs of household

$D_{Tahun}$  = *dummy* certain (year) time

$D_{Raskin}$  = *dummy* variable for household recipients of subsidized rice for the poor or non-recipient

$Z_{jti}$  = matrix of all control variables.

$(Z\theta)_{jti}$  = interaction of control variables and time

$\delta_j$  = *fixed effect*, urban / rural province.

$\theta_t$  = *fixed effect*, time

$(\alpha\theta)_{jt}$  = *fixed effect*, interaction of urban / rural provinces and time

$v_{jti}$  = *error term*.

The instrument variable technique is a standard reference for overcoming endogenous problems or inconsistencies in OLS estimation. The challenge is to find the instrument variable, which correlates with the explanatory variable but does not correlate with the error term component. Regression with instrument variables will produce consistent estimates (Deaton, 1997; Wooldridge, 2016). Some studies use Instrumental Variable (IV) in correcting the endogenous effects of social capital on poverty (Adepoju & Oni, 2012; Aker, 2007; Glaeser & DiPasquale, 1998; Grootaert, 1999; Grootaert & Narayan, 2004; Kirori et al., 2011). The study showed an endogenous problem that made it difficult to estimate the magnitude and direction of influence (Adepoju and Oni, 2012; Aker, 2007; Hassan and Birungi, 2011; Kirori et al., 2011; Tenzin et al., 2013). In cases where there is an endogenous problem, estimation using the Ordinary Least Square (OLS) method will be biased and inconsistent even though the number of samples is increased (Juanda, 2009). Dummy variables as instrument variables are often used (Angrist & Krueger, 2001), the instrument variable in this study used a dummy variable for a female partner who does not work. The consideration is that calorie consumption expenditure in households is primarily determined by women's decision making as a spouse of the head of the household and the pattern of purchasing and processing food needs in the household.

## Results and Discussion

### Overview of CI and HE

The preliminary description of the trends in aggregate data for CI and average HE in Indonesia during 2011-2014 indicates a food consumption puzzle. This puzzle is evident from a decrease in CI per capita per day despite an increase in real monthly expenditure per capita (correlation coefficient -0.71). Other facts powerfully demonstrate a variation in the puzzle between urban and rural areas where the phenomenon is present in urban areas (correlation coefficient -0.74) but rare in rural areas (correlation coefficient 0.99). The variation between urban and rural areas is probably due to different consumption patterns and the primary calorie sources for each area. An increase in intertemporal food and non-food consumption and higher between-years growth in urban areas than rural areas are other possible factors. Similar shifts in Engel's calorie curve occur in demand for calories and food observed by comparing urban or rural areas (wealthier areas versus lower areas). CI per capita decreased in urban and rural areas, but the decline in rural areas was higher.

Changes in the source of household calories are suspected of being the results of a move from grains and root vegetables (GRV) to other sources of calories, especially oils and fats and food and beverages (FB). Both urban and rural areas experienced calorie shifting. However, this phenomenon delineates the differences in consumption patterns between urban and rural populations. The shift in household CI sources is essential since it is related to improving nutritional status (through nutritional adequacy rates, where calories are a component in the calculation) and public welfare.

Observations *within-year* indicate that an increase in income will reduce CI for the GRV group. However, *between-year* observations reveal that when fixed income is constant, CI tends to decrease. This is implied by the shift in Engel's calorie curve that moves to the bottom. This means that the higher the income, the more the CI decreases for the GRV group. This phenomenon demonstrates a similar pattern to the relationship between HE and total consumption of per capita calories.

When conducting a *within-year* observation of the other three food groups (eggs, fish, milk, and meat (EFMM); vegetables, nuts, and fruits (VNF); and FB), this study found that an increase in income essentially results in increasing CI per capita. Meanwhile, a *between-years* observation on the other three food groups specifies that the higher the income, the lower the CI from each other's food groups. This condition can also be shown by the shift of Engel's calorie curve that is likely to move downwards between years. The indication of a decrease in the amount of CI in Indonesia also seemed to exist for HE's deciles.

### Overview of CI and Household Size

Economic theory predicts that households' economic scale often improves household economic welfare by increasing per capita consumption of personal goods. Larger households must manage higher per capita consumption of personal goods such as food. Household size is one of the determinants of household CI patterns.

Household size is one of the determinants of the household CI pattern. The average household size during 2011-2014 was stagnant at around 4.6 people while the CI per capita tended to shrink, except in 2014 when there was an increase. The decrease in CI per capita in line with the increase in household size between 2011-2014 occurs *within the year* and *between years* and in rural and urban areas.

### Result of Fixed Effect Repeated Cross-Sections Method

The empirical model using a *fixed effect repeated cross-sections method* in this study aims to examine the relationship between daily CI per capita and some key variables of interest such as (i) real per capita HE; (ii) daily calorie needs per capita; (iii) household size; and (iv) the subsidized rice received. The best empirical model uses the instrument variables (IV) method to eliminate the endogeneity problem resulting in a *robust* and consistent estimator. The instrument variables used are strongly correlated with real household expenditure per capita and are eminently proved by the test results (Table 1).

### Relationship between CI and HE

The *fixed effect repeated cross-sections* (IV) method for the Indonesia data in 2011 reveals an increase in CI per capita and an increase in per capita expenditure, which is statistically significant using a *within-year* comparison. This result is consistent with Basu & Basole (2013) findings, but the value of elasticity is more excellent at 0.556 compared to 0.309 with a significance level of 1 percent (Table 1). The estimation of the *marginal effect* coefficient of CI and per capita household expenditure on the *between-years* observation is negative and significantly different in 2012 and 2014. Empirically, there tends to be a paradox concerning the increasing expenditure per capita, resulting in CI per capita decline.

Aguiar & Hurst (2005) shows that there is a decline in food expenditure, neither the quantity nor the quality of food intake with retirement status. However, unemployed household experience a decline in consumption commensurate to the impact of job displacement on permanent income.

### Relationship Between CI and Household Size

The results of the *fixed-effect repeated cross-sections* (IV) method for Indonesia in the observation of the *baseline* year shows that an increase in household size by 1 percent will result in a decrease in CI per capita by 0.108 percent. The between-year observation results show that the increase in household size by 1 percent in 2014 led to a decrease in CI per capita in 2011 of 0.053 percent (Table 1). These findings are statistically significant, and it shows that an increasing household size will lead to a decline in CI per capita, even though it was only significantly different in 2014 from 2011 and noted as unfavorable. Pelto et al. (1991) shows that large household size will rise up the risk factor for malnutrition in developing countries, especially for infants and young children.

**Table 1. Results of Log Estimation (CI Expenditure Per capita per day) Using *Fixed Effect Repeated Cross-Sections* Method (OLS and IV)**

| Variable                                         | OLS      |       | IV        |         |
|--------------------------------------------------|----------|-------|-----------|---------|
|                                                  | Coef.    | S.E.  | Coef.     | S.E.    |
| Log(real per capita HE)                          | .250***  | 0.003 | 0.556***  | 0.080   |
| <i>Marginal effect</i>                           |          |       |           |         |
| Log(real per capita HE)*D2012                    | .010**   | 0.005 | -0.171*   | 0.095   |
| Log(real per capita HE)*D2013                    | 0.016*** | 0.005 | -0.067    | 0.101   |
| Log(real per capita HE)*D2014                    | 0.025*** | 0.005 | -0.208**  | 0.088   |
| Log(calorie needs)                               | .374***  | 0.014 | 0.285***  | 0.028   |
| <i>Marginal effect</i>                           |          |       |           |         |
| Log(calorie needs)*D2012                         | 0.076*** | 0.020 | -0.023    | 0.035   |
| Log(calorie needs)*D2013                         | 0.004    | 0.019 | 0.014     | 0.037   |
| Log(calorie needs)*D2014                         | 0.023    | 0.019 | 0.034     | 0.033   |
| Log(household size/HS)                           | 0.171*** | 0.004 | -0.108*** | 0.017   |
| <i>Marginal effect</i>                           |          |       |           |         |
| Log(HS)*D2012                                    | .003     | 0.005 | -0.022    | 0.023   |
| Log(HS)*D2013                                    | 0.011**  | 0.005 | -0.007    | 0.024   |
| Log(HS)*D2014                                    | 0.022*** | 0.005 | -0.053*** | 0.020   |
| Raskin Program                                   | .033***  | 0.003 | 0.109***  | 0.020   |
| <i>Marginal effect</i>                           |          |       |           |         |
| Raskin Program*D2012                             | 0.002    | 0.004 | -0.043*   | 0.025   |
| Raskin Program *D2013                            | 0.001    | 0.004 | -0.010    | 0.026   |
| Raskin Program *D2014                            | .002     | 0.004 | -0.041*   | 0.023   |
| Observations                                     | 284,963  |       | 284,963   |         |
| R-squared                                        | 0.369    |       | 0.230     |         |
| Control Variable                                 | Yes      |       | Yes       |         |
| Raskin Program                                   | Yes      |       | Yes       |         |
| Dummy Province, Regency/Village                  | Yes      |       | Yes       |         |
| Dummy Year                                       | Yes      |       | Yes       |         |
| (Dummy Province, Regency/Village)*(Dummy Year)   | Yes      |       | Yes       |         |
| Endogeneity:Wu-Hausman: F-stat. [p-value]        |          |       | 27.96     | [0.000] |
| Endogeneity:Durbin score: chi-sq. test [p-value] |          |       | 119.9     | [0.000] |
| Excluded instrument test, F-stat.                |          |       | 139.6     |         |

### Relationship Between CI and Calorie Needs

The *fixed effect repeated cross-sections* (IV) method for Indonesia in 2011 (*baseline*) shows a positive relationship between calorie needs per capita and CI per capita at a 1 percent significant level. The increase in per capita calorie needs is following an increase in CI per capita (Table 1). The *marginal effect* coefficient estimates are CI per capita, and calorie needs per capita on the *between-years* observation are negative and did not

show significant changes throughout the period observed. There is, therefore, insufficient evidence to show that an increase in calorie needs per capita will reduce CI per capita.

### Relationship between CI and Subsidized Rice

Using the *fixed-effect repeated cross-sections* (IV) method, this study finds that the *Raskin* program positively correlates with the CI per capita and is still essential. Compared to the Kochar (2005) shows that CI elasticity and the *Raskin* program were almost equal at 0.11 to 0.08. The *between-years* observation also showed that the CI per capita of the subsidized-rice recipient households in 2012 and 2014 are significantly different from the baseline and are negative (Table 1). The empirical evidence shows that the *Raskin* program will increase CI per capita and tend to result in a decrease in CI per capita between years.

### Conclusion

This research for Indonesia concludes that, empirically, there tends to be a paradox that an increasing expenditure per capita results in calorie intake per capita declining. This research is statistically significant and shows that an increase in household size will lead to a fall in calorie intake. There is insufficient evidence to show that an increase in calorie needs per capita will reduce calorie intake per capita. Thirdly, this research shows that the *Raskin* program has led to increased calorie intake per capita.

Based on the results of this research and the conclusion above, this study recommends several policy adjustments are government must define particular distributors/stalls/shops/supermarkets that serve and help the non-cash food assistance cardholder to receive their benefit, education on the importance of fulfilling proper and balanced calorie consumption mainly to overcome underweight/obesity and wasting and stunting conditions, the government needs to improve and ensure the stability of the price of staple food at the consumer level-especially for the fulfillment of the fundamental rights of the community, and BPS needs to consider the use of economies of scale in calculating the poverty line to fix the apparent overestimation of the poverty line that calculated using the current BPS method.

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### Disclaimer

Any errors of fact or omissions in this document are the sole responsibility of the authors.

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## Do Remittances Matter for Poverty Reduction in ASEAN?

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### Abstract

*This study examined the influence of remittances and macro-economic variables on poverty in ASEAN-4 countries (i.e., Indonesia, Malaysia, Thailand, and the Philippines) over the 1991 to 2019 period using a panel Autoregressive Distributed Lag (ARDL) model. The study documented that remittance and unemployment have a significant effect on poverty reduction in the long run. Meanwhile, economic growth and the Gini coefficient were found to have an insignificant influence on poverty reduction. The speed of adjustment due to shocks in the short term is restored within eight months into the long-run equilibrium. Our results emphasize that poverty in ASEAN-4 must be addressed with pragmatic macroeconomic policies, especially policies that affect the poor's income. Besides, with the real contribution of remittances, the strengthening of international cooperation related to migrant workers is also essential to alleviate poverty.*

### Keywords:

poverty, remittances, macroeconomic variables, ASEAN, Panel ARDL.

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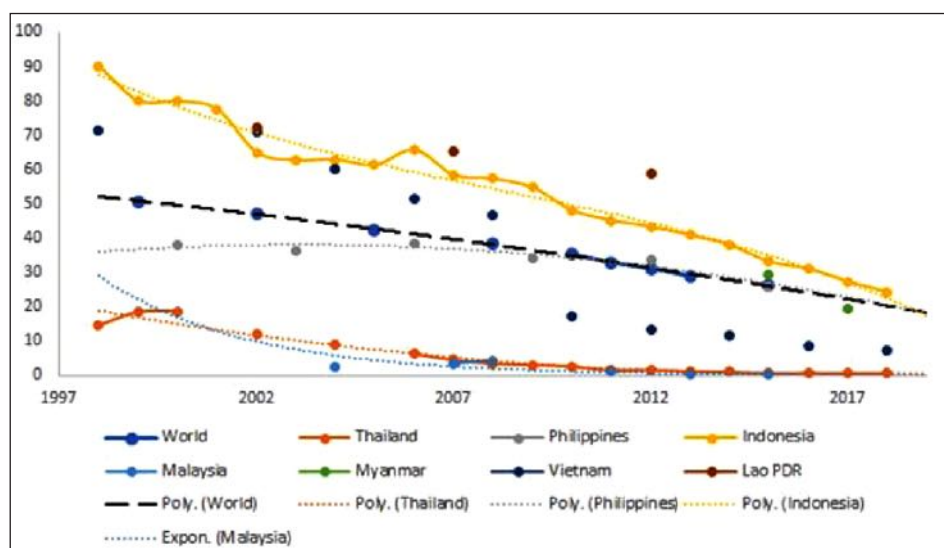
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## Introduction

Governments have made poverty alleviation efforts at various levels in every country, including countries in the Association of Southeast Asia Nations (ASEAN). World Bank (2020) reported that poverty reduction efforts, especially in the last decade in East Asian and the Pacific regions, had shown significant success, resulting in the release of millions of people from poverty. This progress reflects the involvement of the government as well as non-governmental organizations working in this field. Besides, favourable economic conditions have also revitalized the market and provided employment opportunities for most of the population.

In ASEAN's context, the poverty rates generally follow the downward trend of the world poverty rate, as shown in Figure 1. Poverty in some ASEAN countries has been relatively low, such as in Malaysia and Thailand. In Singapore and Brunei Darussalam, the number of poor has been very minimal. Meanwhile, Indonesia and Vietnam are the two countries that have experienced a relatively higher poverty rate. However, these countries have experienced a relatively significant reduction in poverty in the last two decades. According to the World Bank (2018), Vietnam's success in reducing poverty is contributed by an increasing income from highland agriculture, where the farmers are encouraged to grow more profitable industrial crops. Meanwhile, Indonesia has adopted a macro-economic approach by maintaining strong economic growth to reduce poverty. However, the rate of poverty reduction in the country has not been as fast as in Vietnam.

Figure 1. ASEAN's Poverty Headcount Ratio at \$3,20 a Day (2011 PPP)



The generally relatively good foundation of peace between ASEAN countries is a pillar in improving welfare and poverty alleviation. Most ASEAN member countries are highly trade-oriented. This vital trade orientation has translated into an increasing market share of ASEAN globally, both in exports and imports over the past few decades (Karim & Majid, 2010; Intal & Chen, 2017). Each ASEAN country's internal policies

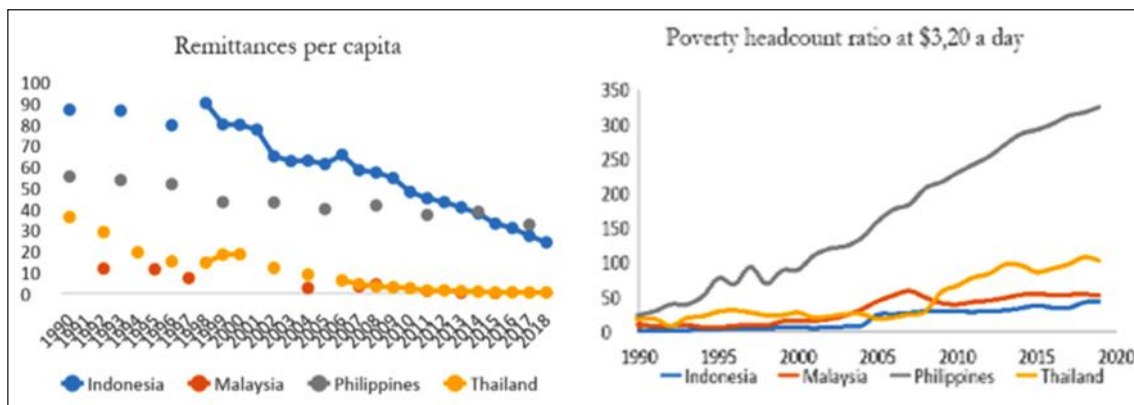
have also driven poverty alleviation efforts, such as higher public spending allocations for education, increased access to health care, and infrastructure expansion. Singapore and Malaysia have maintained their traditional emphasis on household savings and deposit funds, while Indonesia and the Philippines have adopted various poverty reduction policies, despite limited funding. Although its impact is still debated, Thailand has conducted a relatively comprehensive policy, while Vietnam has increased its spending on social protection and essential services for poverty reduction (Cook & Pincus, 2014).

As mentioned above, all the factors have been considered to improve people's living standards in the regions. Still, a variable has been (relatively) ignored in poverty alleviation efforts, namely international remittances or remittances. This thinking begins from the high population, and low availability of job opportunities at the lower-middle-class level is estimated to be a push factor for job searches out of their areas or out of their home countries. Such movements are commonly referred to as "Migrant Workers." Martin and Zürcher (2008) opined that a pull factor of the population to migrate includes recruiting labor and families' unification.

Remittances from migrant workers can improve the welfare of the lowest segment of the population as it allows recipients to increase their consumption. The literature on remittances shows that this monetary transfer from migrants to their relatives at home leads to higher consumption levels, better education, and greater access to health care (Amuedo & Pozo, 2004). Remittances also affect job market participation and entrepreneurial decisions and change recipient households' behavior and opportunities (Acosta et al., 2009).

As for the case of ASEAN countries, it also seems that remittances negatively related to poverty rates, as shown in Figure 2. Remittances in ASEAN-4 (i.e., Indonesia, Malaysia, Philippines, and Thailand) have moved inversely to the poverty headcount ratio. Over more than 30 years, the per capita remittances in the Philippines and Thailand have increased quite sharply. On the other hand, the poverty rate in ASEAN countries has decreased significantly with Indonesia and Thailand's immense contribution.

Figure 2. Evolution of Remittances and Poverty in ASEAN (1991-2018)



The above phenomenon raises various allegations about the impact of remittances on poverty, although most of the study results suggest poverty alleviation's adverse influence. For example, a study conducted by Adams & Cuecuecha (2013) in Ghana produced three findings. First, compared to what they would spend without a remittance receipt, households receiving remittances spend less on food margins. Second, households receiving remittances spend more on margins for three investment items: education, housing, and health. Third, receipt of remittances dramatically reduces the likelihood of household poverty. These findings support the growing presumption that remittances can reduce poverty and increase investment in developing countries.

It cannot be denied that remittance income increases purchasing power and helps improve the economic resilience of recipient households. Research conducted by Airola (2007) in Mexico showed that the share of food in total consumption was significantly lower, while spending on durable goods, including health and housing, was considerably higher among households receiving remittances. This indicates that remittance flows helped increase purchasing power and basic needs, especially for non-food consumption. Rising income from remittances has also proven to provide a stronger safety net and reduce food insecurity (Lacroix, 2011).

Another study developed by Wagle & Devkota (2018) in Nepal's case using random-effects regressions documented strong evidence of the increasing economic well-being effects of foreign remittances, primarily when originating from countries other than India. This analysis's findings are generally consistent with results from existing studies for Nepal, such as those conducted by Lokshin et al. (2010), which found that a fifth of Nepal's poverty reductions between 1995 and 2004 were attributed higher migrant workers and remittances. In Southeast Asia, Osaki (2003) researched the effect of remittances on household welfare in Thailand using survey data conducted by the National Migration Survey of Thailand (NMS) in 1992. The results confirmed that remittances have a relationship with socioeconomic and demographic factors in Thailand. According to him, international migration is one of the right ways for low-income households to overcome household income shortage. Similarly, in Indonesia's case, Nahar & Arshad (2017) found that the increase in remittances led to a reduction in poverty by 2.56%. Meanwhile, inflation and exchange rate variables each have positive and negative effects on poverty.

A broader perspective on remittances-poverty nexus was developed by Vacaflores (2017). His research examined the effectiveness of international remittances in reducing poverty and inequality in Latin America. Using a dynamic panel regression model for 18 Latin American countries in the period 2000-2013, the study showed that increased remittances had a statistically negative and significant impact on poverty and inequality in the region. In particular, remittances seem to have a more substantial effect in countries that receive large remittances where more extensive parts of their population are working abroad. Regional differences also affect the impact of remittances on people's welfare, but financial developments have a limited effect on remittances' effectiveness on poverty and inequality. Imai et al. (2014) examined remittance, growth, and poverty relationships in

twenty-four Asia-Pacific countries. Using an approach to static panel data and two-stage least squares (2SLS) panel, they confirmed that remittance flows had benefited economic growth in the Asia-Pacific region. The analysis also shows that volatility in capital flows, such as remittances and foreign direct investment is harmful to economic growth. Thus, although remittances contribute to the economy's performance, they are also a source of output shocks. Finally, remittances contribute to poverty reduction, primarily through its direct effects. Migration and remittances have the potential to be supporting broader development efforts.

Using a broader sample with the classification of developing countries and dynamic panel estimators, Masron & Subramaniam (2018) investigated the implications of remittances on poverty in 44 developing countries from 2006 to 2014. Their findings provide strong evidence that poverty rates tend to be lower in countries with higher remittance flows. Remittances have a statistically significant impact on poverty, which means that remittances are a significant determinant of poverty on the panel of emerging economies. These results support the fact that remittances improve the recipients of a household's well-being by increasing their income and consumption at the micro-level. These findings are also supported by Nahar & Arshad (2017), Banga & Sahu (2010), and Chaudhry & Imran (2013), which found that remittance flows are more helpful to reduce poverty in a developing country.

If we trace previous studies on remittances and poverty, there is little analysis of remittances and poverty in the ASEAN region. Most of the researches was conducted in Latin America and Africa. Studies focusing on the ASEAN region still refer to the general discussion of developing or global countries. For example, Azam et al. (2016) examined the impact of remittances along with several other macroeconomic variables (i.e., foreign assistance, debt, human capital, inflation, and income) on poverty alleviation in 39 countries, including lower, middle, and high middle-income countries in the period 1990-2014. The results of Azam et al. (2016) were quite different from most of the above-reviewed previous studies. Using the Fully-Modified OLS (FMOLS) panel method revealed an increase in income (GDP per capita) led to a significant poverty reduction.

Meanwhile, foreign remittances positively impacted poverty alleviation and were statistically significant only for upper-middle-income countries. The impacts of aid and debt on poverty were found to be positive. This indicates that both factors contribute positively to the expansion of poverty. These results show no concrete evidence that foreign aid has effectively reduced poverty.

Thus, it is interesting to examine the time effects of these two variables. Although the existing literature shows that the international remittances contribute to reducing poverty, its impact on the recipient's household cannot directly be interpreted as improving overall well-being. When most people who migrate are from the upper-middle class, the effects of remittances on poverty will be significantly influenced by time because there is a distance in the money turnover from remittances to reaching the poorest segments of the region. This shows that the findings rely heavily on how

it spreads throughout a country's economy. However, when these remittances flow to the population's poorest segments, it should directly affect the recipient's standard of living and reduce poverty.

Considering poverty as a multi-complex social issue and many variables that influence it in the process; therefore, our study considers a series of macroeconomic variables that strongly affect poverty as the control variables. For example, Mulok et al. (2012) explored how economic growth affects poverty in Malaysia. Using real GDP as a proxy for economic growth, they found that the GDP significantly influenced poverty reduction even at the 1 percent level. These results are one of the references in the selection of GDP as a control variable in our study in addition to several other studies related to GDP and growth (Sabir & Tahir, 2012; Sasmal & Sasmal, 2015; Dewi et al., 2018; Majid et al., 2019; Nansadiqa et al., 2019).

Another economic variable that affects poverty, in addition to economic growth, is income inequality. Hassan et al. (2015) found a positive and significant relationship between income inequality and poverty levels both in the long- and short-term. In micro perspectives, Cheema & Sial (2012) determined the long-term relationship between poverty, income inequality, and growth using data sets of income and household expenditure surveys between 1992/93 and 2007/08 in Pakistan. They found that growth and income inequality significantly affected poverty. The increase in GDP in developing countries leads to high-income disparities in the early stages of a country's economic development (Cheema & Sial, 2012). Although the increase in GDP lowers poverty, the level of inequality remains constant. On the other hand, the inequality represented by this Gini coefficient has a positive and significant effect on the poverty level.

Human capital in the form of educational achievement and health status also affects the number of poor people. Higher levels of education from households have been shown to reduce poverty (Rahman, 2013). In terms of health, heads of well-health and primed households also enjoy higher economic well-being (Weaver, 2012), while those with health problems increase the chances of living in poverty (Henly et al., 2005). Unemployed or inactive households increase the likelihood of poverty or lower economic well-being (Rupasingha & Goetz, 2007). Households with higher unemployment rates are also more likely to be low (Mukherjee & Benson, 2003). Following these studies' findings, our study also considers one of the human capital elements as the research control variable, namely the unemployment rate.

The differences in the results of previous studies and similar limited studies conducted in the ASEAN region have motivated our research to empirically examine the influence of remittances on poverty reduction in ASEAN. Besides, previous studies mostly relied more on the micro-panel schemes in econometrics where the length of the period is smaller than the number of individuals observed. Thus, this study aims to fill these gaps in the existing literature on remittances-poverty nexus in ASEAN using more robust macro panel schemes by considering both long- and short-term influences. Our study also utilizes a more comprehensive data set than the previous studies (Lokshin et

al., 2010; Azam et al., 2016; Vacaflares, 2017; Masron & Subramaniam, 2018) that covers the period from 1991 to 2019.

Our study's findings are hoped to shed some light for the policymakers in ASEAN countries in designing macro-economic policy to utilize remittances for poverty reduction optimally. Our results are also expected to enrich the existing literature on remittances-poverty nexus from developing countries of ASEAN.

## Methods

This study used the Autoregressive Distribution Lag (ARDL) panel approach to explore the role of time and relationships between remittance and poverty. The dependent variable used in this study is the poverty level. In contrast, the variable remittances from migrants (remittances) and other macroeconomic variables, namely GDP per capita growth, unemployment rates, and Gini coefficient, are included as the independent variables. The ASEAN-4 countries investigated in this study comprise Indonesia, the Philippines, Thailand, and Malaysia.

The general form of the ARDL model tested in this study is based on Pesaran et al. (2001), as follows:

$$Y_t = \alpha_0 + \alpha_i t + \sum_{i=1}^p \theta_i Y_{t-i} + \beta' X_t + \sum_{i=1}^{q-1} \beta^{*'} \Delta X_{t-i} + u_t \quad (1)$$

Since our study uses panel data, thus the Equations (1) could be re-written, as follows:

$$Y_{j,t} = \alpha_0 + \alpha_i t + \sum_{i=1}^p \theta_{1i} Y_{j,t-i} + \beta' X_{i,t} + \sum_{i=1}^{q-1} \beta^{*'} \Delta X_{j,t-i} + u_{j,t} \quad (2)$$

Substituting our investigated variables into Equation (2), the following panel ARDL model can be re-written:

$$\begin{aligned} \Delta POV_{j,t} = & \alpha_0 + \sum_{i=1}^n \alpha_{1i} \Delta POV_{j,t-i} + \sum_{i=1}^n \alpha_{2i} \Delta REM_{j,t-i} + \sum_{i=1}^n \alpha_{3i} \Delta GDP_{j,t-i} \\ & + \sum_{i=1}^n \alpha_{4i} \Delta UNP_{j,t-i} + \sum_{i=1}^n \alpha_{5i} \Delta GINI_{j,t-i} + \beta_{11} POV_{j,t-1} + \beta_{21} REM_{j,t-1} \\ & + \beta_{31} GDP_{j,t-1} + \beta_{41} UNP_{j,t-1} + \beta_{51} GINI_{j,t-1} + u_{j,t} \end{aligned} \quad (3)$$

Where *POV* is a poverty level, *REM* is remittances, *GDP* is per capita income growth, *UNP* is the unemployment rate, *GINI* is Gini coefficient,  $\alpha_i$  is a short-term estimated coefficient,  $\beta_i$  is a long-term estimated coefficient,  $u$  is the error term,  $j$  is the country  $j$ , and  $t$  is the period  $t$ .

The poverty rate is measured in the form of a poverty headcount ratio at USD3.20 a day. The percentage of remittances measures remittance to per capita GDP. GDP variables are represented by GDP growth per capita, unemployment is the percentage of unemployed to the total labor forces, and Gini is the index of Gini to represent the income disparity level. All data was obtained from the publication

of the World Bank and World Development Indicators (2020). In estimating the remittances-poverty nexus, the study follows the standard procedures of estimation. It starts by testing the data stationarity using Levin, Lin and Chu (LLC) and Phillips-Perron (PP) tests, followed by panel cointegration test of Kao (1999) and panel ARDL model estimation.

## Result and Discussion

This paper uses the ARDL model in panel form to test the effect of remittances and macroeconomic variables on the poverty level. In the first part, the findings of stationary and cointegration of panel data are provided and discussed. Meanwhile, in the second part, the ARDL panel model's estimates are provided and discussed in the long-run. Finally, the short-term ARDL model estimates, along with the correction term error value, are highlighted.

**Table 1. The panel of Unit Root Tests Results**

| Variables             | Level & First Diff. | Intercept / Trend | Prob.                     |                      | Decision |
|-----------------------|---------------------|-------------------|---------------------------|----------------------|----------|
|                       |                     |                   | Levin, Lin, and Chu (LLC) | Phillips-Perron (PP) |          |
| Poverty               | Level               | Intercept         | 0.4919                    | 0.1732               | I(1)     |
|                       |                     | Interc. & trend   | 0.3104                    | 0.7307               |          |
|                       | First diff.         | Intercept         | 0.0060                    | 0.0001               |          |
|                       |                     | Interc. & trend   | 0.0350                    | 0.0004               |          |
| Remittance (Log)      | Level               | Intercept         | 0.0010                    | 0.0091               | I(0)     |
|                       |                     | Interc. & trend   | 0.7111                    | 0.5084               |          |
|                       | First diff.         | Intercept         | 0.0513                    | 0.0000               |          |
|                       |                     | Interc. & trend   | 0.4456                    | 0.0000               |          |
| GDP Per Capita Growth | Level               | Intercept         | 0.0000                    | 0.0000               | I(0)     |
|                       |                     | Interc. & trend   | 0.0004                    | 0.0000               |          |
|                       | First diff.         | Intercept         | 0.0000                    | 0.0000               |          |
|                       |                     | Interc. & trend   | 0.0000                    | 0.0000               |          |
| Unemployment          | Level               | Intercept         | 0.4767                    | 0.2546               | I(1)     |
|                       |                     | Interc. & trend   | 0.3731                    | 0.7278               |          |
|                       | First diff.         | Intercept         | 0.0000                    | 0.0000               |          |
|                       |                     | Interc. & trend   | 0.0000                    | 0.0000               |          |
| Gini                  | Level               | Intercept         | 0.9828                    | 0.9939               | I(1)     |
|                       |                     | Interc. & trend   | 0.5075                    | 0.7137               |          |
|                       | First diff.         | Intercept         | 0.0000                    | 0.0000               |          |
|                       |                     | Interc. & trend   | 0.0000                    | 0.0000               |          |

The findings of stationary tests based on Levin, Lin, and Chu (LLC) and Phillips-Perron (PP) Fisher Chi-Square are reported in Table 1. As observed from Table 1, the variables of poverty, unemployment, and Gini index are found to be stationary at the first difference. Meanwhile, remittances and GDP growth per capita are stationary at the level. The panel of unit root test results showed a mixture of I(0) and I(1) where it confirmed the suitability of the use of the ARDL panel model for the case of our study.

Cointegration tests benefit from analyzing variables that are estimated to have a stable relationship in the long run. In this study, the Kao (1999) test that comprises both Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) is used to test the panel data cointegration. The cointegration test output gives rise to residuals obtained by regressing free variables to the OLS bound variables. The results of the panel cointegration test are reported in Table 2.

**Table 2. Kao (1999)'s Cointegration Test**

| ADF                      | t-statistic | Prob.   |
|--------------------------|-------------|---------|
|                          | -2.00479    | 0.0225* |
| <b>Residual variance</b> | 5.99338     |         |
| <b>HAC variance</b>      | 7.70367     |         |

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 2 describes panel cointegration testing results for the ASEAN countries over the period from 1991 to 2019. The test results showed a significant probability value at a level of 5%. In other words, it can be concluded that there is a possible correlation of cointegration between remittances and other macro variables with poverty in ASEAN in the long term. These findings show the tendency of the variables to move toward the same direction in the future. Thus, to predict a variable's movements in the model, one can rely on the other variables' movements' trends.

ARDL panel results are estimated from the best model, where lag selection on ARDL models (2, 2, 2, 2, 2) is conducted using the Akaike Information Criteria (AIC) lag criteria by limiting the length of all variables for two years. Table 3 presents the long-term relationship between remittances (REM) and other macro variables (GDP, UNP, & GINI) with poverty (POV) as predicted by the alleged pooled mean group (PMG). ARDL panel models are estimated with intercepts and trends. The estimated result of PMG in Table 3 shows that remittances negatively affect poverty with a coefficient of -10.45. This indicates that a 1 percent increase in remittances will reduce poverty by 10.45 percent in the long run. On the other hand, GDP has no effect on poverty in the long run. These long-term remittance results seem to corroborate previous researchers' findings in which remittances contributed significantly to the reduction in poverty (Imai et al., 2014; Vacaflores, 2017; and Nahar & Arshad, 2017).

Table 3. Long Run Results

| Variables | Coefficient | Std. error | t-statistic | Prob.     |
|-----------|-------------|------------|-------------|-----------|
| LREM      | -10.45219   | 2.70517    | -3.86378    | 0.0003*** |
| GDP       | -0.55566    | 0.33598    | -1.65383    | 0.1028    |
| UNP       | 9.01219     | 2.87236    | 3.13756     | 0.0025*** |
| GINI      | -0.38416    | 0.42120    | -0.91206    | 0.3650    |

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The unemployment variable was found to positively affect long-term poverty, with an estimated coefficient of 9.01. Thus, a 1 percent drop in unemployment would lower the poverty rate by 9.01 percent and vice versa. However, income inequality has did not affect poverty in ASEAN countries. These empirical findings corroborate previous research conducted by Siyan et al. (2016), where unemployment proved to be significant in causing poverty. On the other hand, the finding that income inequality did not affect poverty seems to reject the results of research conducted by Hassan et al. (2015), which documented a significant positive link between income inequality and poverty in Pakistan.

An increase in economic growth supposedly benefits almost all citizens in a country and, in turn, reduces poverty. If economic growth increases its citizen's income in equal proportions, then the income distribution would not change. Our finding showed weak evidence of the positive effect of economic growth on poverty reduction in the long-run at the 10 percent (10.28 percent) level of significance. This implies that the direction of macroeconomic policies that encourage economic growth in the ASEAN-4 region is already heading towards poverty reduction but at the weakest level. The fact that so many of the world's poor people now live in middle-income countries (which, by definition, have experienced moderate economic growth) suggests that economic growth alone is not sufficient to reduce poverty (Mulok et al., 2012). If economic growth is pro-poor, why is there still a global poverty problem, particularly in developing countries, such as ASEAN?

About the insignificant effect of income inequality on poverty in the long run, perhaps, it is worth considering some arguments stating that inequality does not need to get all the attention to distract from the real problem (Peterson, 2017). Brückner & Lederman (2015) believed that inequality would only be related to economic growth because the rich save more than middle-lower income groups by generating more investment resources. Thus, it makes sense when our study showed an insignificant effect of inequality on poverty because most incomes are controlled by a small fraction of people who only increase savings. On the other hand, economic activity generated from savings would also increase the poor's income, but with a small proportion. This explains the existence of a weird relationship between inequality and poverty.

Furthermore, the other two variables, namely remittances and unemployment, are documented to significantly affect the poverty rate. The implications are clear that

both variables affect as they directly impact the incomes of poor people. The transfers of remittances by the migrant workers to their original home country had directly increased the income and even their family savings. As for unemployment, the expansion of employment directly absorbs the labor force and further reduces the number of unemployed. In this study, a decline in unemployment has been proven to help reduce poverty. This means that jobs increase the amount of income from the poor and increase household savings (Munir et al., 2011; Gani, 2016).

From another point of view, remittances are a consequence of domestic labor's oversupply, further encouraging workers to migrate. Therefore, a pragmatic approach is needed where macroeconomic strategies, such as industrialization policy and job creation, must also be supported by access for the poor and those vulnerable to poverty. Social security is also one of the policies that must be strengthened because significant price changes will encourage vulnerable people to fall below the poverty line.

**Table 4. Short Run Results**

| Variable    | Coefficient | Std. error | t-statistic | Prob.    |
|-------------|-------------|------------|-------------|----------|
| COINTEQ01   | -0.08363    | 0.04543    | -1.84076    | 0.0700*  |
| D(POV(-1))  | 0.42606     | 0.16876    | 2.52457     | 0.0139** |
| D(LREM)     | -0.78136    | 1.24769    | -0.62624    | 0.5333   |
| D(LREM(-1)) | 7.36971     | 4.47149    | 1.64816     | 0.1039   |
| D(GDP)      | -0.09896    | 0.14373    | -0.68849    | 0.4935   |
| D(GDP(-1))  | -0.00208    | 0.03712    | -0.05602    | 0.9555   |
| D(UNP)      | 0.03394     | 0.10990    | 0.30884     | 0.7584   |
| D(UNP(-1))  | -0.02168    | 0.61414    | -0.03530    | 0.9719   |
| D(GINI)     | 0.03782     | 0.39173    | 0.09655     | 0.9234   |
| D(GINI(-1)) | -0.01314    | 0.12828    | -0.10244    | 0.9187   |
| C           | 1.55087     | 2.43779    | 0.63618     | 0.5268   |

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

After analyzing the long-term relationship between remittances and other macroeconomic variables to poverty, this section discusses the results of these variables' short-term studies. As reported in Table 4, PMG results showed a significant and negative error correction term (ECT) of -0.0836. The ECT coefficient's negative value means that the model's variables move in a convergent way to restore stable conditions in case of short-term shocks. Speed of adjustment of ECT coefficient of -0.0836 shows that the adjustment has taken up to about eight months to recover from the short-term shock. The exciting thing about these findings is that none of the existing

independent variables affected poverty in the short-term. This fact implies that, in general, low households in ASEAN are classified as having resilience in the short-term. This conjecture is based on the poverty conditions in the region dominated by rural poverty (World Bank, 2020).

Our findings of the significant effect of remittances on poverty in the long-run are disharmony with most previous results (Vacaflores, 2017; Nahar & Arshad, 2017; and Chaudhry & Imran, 2013). However, on the other hand, the findings that remittances did not affect poverty in the short-term corroborate Musakwa & Odhiambo (2019). They found that when poverty is measured by household consumption expenditure, remittances had no impact on poverty in Botswana. The remittances also do not affect the long-run when poverty in question is measured by household spending (Musakwa & Odhiambo, 2019). A previous study by Azam et al. (2016) classified the impact of remittances globally based on GDP per capita. It documented that foreign remittances have a positive impact on poverty alleviation only for upper-middle-income countries. As three of the four ASEAN countries sampled in our study are upper-middle-income countries (i.e., Malaysia, Indonesia, and Thailand), it is plausible for the remittances to have only a significant effect long-run.

**Table 5. Cross-Section Short-Run ECT Coefficients**

| Variables   | The Philippines |           | Thailand    |           | Indonesia   |           | Malaysia    |           |
|-------------|-----------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|
|             | Coefficient     | Prob.     | Coefficient | Prob.     | Coefficient | Prob.     | Coefficient | Prob.     |
| COINTEQ01   | -0.1900         | 0.0005*** | -0.0036     | 0.0536*   | -0.0126     | 0.0001*** | -0.1283     | 0.0001*** |
| D(POV(-1))  | 0.7124          | 0.0005*** | 0.5107      | 0.0001*** | -0.0626     | 0.0534*   | 0.5437      | 0.0003*** |
| D(LREM)     | 0.8670          | 0.9078    | 1.8178      | 0.5744    | -2.5989     | 0.8765    | -3.2113     | 0.1681    |
| D(LREM(-1)) | 2.8781          | 0.6110    | 0.9483      | 0.6096    | 20.5390     | 0.3240    | 5.1134      | 0.0844*   |
| D(GDP)      | 0.1014          | 0.0002*** | -0.0534     | 0.0002*** | -0.5181     | 0.0000*** | 0.0742      | 0.0000*** |
| D(GDP(-1))  | 0.0125          | 0.0362**  | -0.0628     | 0.0002*** | 0.0970      | 0.0020*** | -0.0551     | 0.0000*** |
| D(UNP)      | 0.2903          | 0.7321    | -0.0341     | 0.8551    | 0.1083      | 0.9323    | -0.2288     | 0.4176    |
| D(UNP(-1))  | -0.4603         | 0.5000    | 1.5717      | 0.0010*** | 0.1519      | 0.9120    | -1.3501     | 0.0256**  |
| D(GINI)     | 0.4919          | 0.0060*** | 0.4654      | 0.0015*** | -1.1323     | 0.0010*** | 0.3263      | 0.0008*** |
| D(GINI(-1)) | -0.2657         | 0.0371**  | 0.1359      | 0.0477**  | 0.2689      | 0.0461**  | -0.1917     | 0.0054*** |
| C           | 8.4225          | 0.7833    | -0.0929     | 0.9276    | -3.0287     | 0.0624*   | 0.9026      | 0.8692    |

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

A comprehensive understanding of the speed of adjustment and fluctuations in the short-term could be viewed from Table 5 when we sort out the coefficients of ECT from each country. Table 5 shows that Thailand and Indonesia are countries that have experienced relatively fast adjustment speeds. The short-term imbalance of

remittances and other macroeconomic variables in Thailand and Indonesia in the previous year was adjusted in a somewhat shorter period. Meanwhile, the coefficients of ECT for Malaysia and the Philippines tend to be slow at 0.1283 and 0.1900, respectively. This means that the short-term shocks in Malaysia and the Philippines in the previous year could not be adjusted in the ongoing year but somewhat adjusted for the coming year. The overall ECT coefficient on short-term ARDL panel results (Table 5) shows that adjusted speeds are generally relatively fast in response to short-term imbalances.

Short-term fluctuations of independent variables indicate that autoregressive variables (lag poverty) both overall and in each country significantly affect poverty levels. Our findings are in line with Vacaflores (2017), who stated that poverty is a persistent variable that could not be changed within a shorter period. This further confirms that the poverty alleviation program would take a more extended period to be effective. The macro-economic policies for poverty reduction might be ineffective in a short period. Still, in the longer-period, they would reduce the poverty rate in the ASEAN region. Thus, a macro-economic policy harmonization among the ASEAN countries to combat poverty should be evaluated and enhanced from time to time, as its effectiveness takes a more extended period.

Besides, Table 5 shows that remittance receipts have an insignificant effect on poverty in the short-term. This is demonstrated by all insignificant p-values, except for lag 1 of the short-term remittance (DLREM(-1)) for Malaysia's case. The estimated short-term coefficient of DLREM(-1) for Malaysia has shown no adverse effects following the existing macroeconomic theories. Unemployment is also found to be insignificant in the short-term, except for the coefficient lag (-1) for the cases of Thailand and Malaysia. These findings are in line with macroeconomic theories that state, although the market-clearing model assumes that all wages and prices are flexible, in the real world, some wages and prices are rigid (Mankiw, 2013). In the labor market, a person who works, if dismissed, would be given a guarantee in the form of severance (or other terms) so that in the short-term, those who lose their jobs can still survive. Finally, the dominance of rural poverty in ASEAN reinforces this finding because most rural communities can maintain their primary consumption by relying on natural economic resources.

Finally, the cross-section results for GDP per capita growth and income inequality were very different from the findings of short-term (overall) and long-term estimates. These two macroeconomic variables have significant short-term fluctuations in each country. This means that macroeconomic policies carried out in the ASEAN-4 have been generally temporary. Cook and Pincus (2014) stated that the growing awareness of the need to strengthen social protection in ASEAN coincides with a global reassessment of social assistance's role in reducing poverty. The reversal of prevailing assumptions about the disincentive effects of direct transfer policy and government agencies' capacity to provide direct financial assistance without leaks and political manipulation further obscures the conceptual differences between social security and poverty alleviation programs. This

condition makes the effect of macroeconomic policy on poverty alleviation is ineffective in the long term.

## **Conclusion**

This study empirically examined the short and long-run effects of remittances on poverty reduction in ASEAN-4 (i.e., Indonesia, Malaysia, Philippines, and Thailand) over the period from 1991 to 2019. Using the panel ARDL model, the study found that GDP growth per capita and income inequality have no significant effect on poverty. Meanwhile, the study documented the significance of remittances and unemployment in connection with poverty. This implies that unemployment is one of the significant economic determinants contributing to poverty in the ASEAN region. From another point of view, remittances are a consequence of domestic labor's oversupply, further encouraging workers to migrate. Remittances sent directly by migrant workers to their families in their home countries in the long-term have improved the welfare of low households in this ASEAN region.

Meanwhile, in the short-term, poverty lagging values become the only variables that significantly affect the contemporaneous poverty in the ASEAN-4 countries. However, fluctuations of macroeconomic variable shocks in the short-term were adjusted to the long-run equilibrium within the next eight months. This fact implies that, in general, low households in ASEAN are classified as having resilience in the short-term because the majority of poor people in the region are dominated by rural poverty. Those poor people generally have the resilience to the bare necessities available by nature.

Our findings provide some policy implications, especially the policies that can affect the incomes of the poor. One of the things that can be done is policies that can create conducive working conditions and eliminate barriers to low participation in the growth process by increasing employment access and investing in necessary infrastructure and social protection. Given the significant remittance income contribution to reducing poverty, strengthening international employment cooperation can be an excellent alternative policy to be implemented. Prevention of illegal labor delivery practices, improvement of workers' skills and capacity, and guaranteeing the safety of migrant workers are priorities in pushing this alternative policy. On the other hand, because remittance recipient households in the ASEAN region are suspected to be the poor and those who are likely to be needy and depend mainly on natural resources for their livelihoods, environmental conservation policies should be integrated into the poverty alleviation program.

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## Do Growth Spillovers Matter?

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**Abstract**

*Although the Yogyakarta Special Region and Central Java are two independent provinces with different regulations, these economies were integrated as a unity that interacts with each other, so this study examined whether the growth spillovers between regencies/cities occurred in these provinces. The data included economic growth, education, working-age population, and asphalted road published by the Central Bureau of Statistics for 2001-2018. This study used a regression analysis based on the Dynamic Ordinary Least Square (DOLS) model. The results showed that there were growth spillovers. The economic growth of a regency/city was positively influenced by economic growth in its surrounding regions. A particular regency/city obtained benefit from economic growth occurred in its surrounding. Meanwhile, an increase in the working-age population and the asphalted road positively affects economic growth. However, the increase in education did not affect economic growth. Therefore, the local government needs to improve connectivity between regions by building road networks and enhancing intergovernmental cooperation.*

**Keywords:**

growth, spillovers, connectivity.

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## Introduction

Economic growth is a reliable indicator of regional development. It shows an increase in the long-term capacity of the economy to provide various goods and services. The local government is always aiming at a specific economic growth rate to increase people's welfare. An increase in output can be achieved by using new technology or using more input. New technology enables enterprises to use the best technologies to increase productivity and reduce costs (Çaliskan, 2015). The replacing technology is done by dismantling old machines and installing new ones.

Companies will consider the benefits and costs of replacing technology. The benefits of the new technology include faster production processes and lower production costs. Meanwhile, the cost of replacing technology includes the cost of dismantling old machines and installing new ones. The company will use new machinery if it is considered economically feasible. It means that the new technology may not be accepted if it does not provide significant additional benefits, while the user must bear some costs. Besides, it takes a long time to find a new technology. Therefore, in the short term, companies tend to increase their output by using more inputs. The company must minimize the production cost to sustain its competitiveness. Most of the production cost is the purchase of raw materials (Niewiadomski & Pawlak, 2016), so the firm always searches for lower-priced inputs, including input supplied from other regions. The input movement from other regions needs excellent transportation facilities. Improved road facilities increase transportation efficiency and solve high-cost distribution problems.

Improved transport infrastructure also promotes economic integration between regions (Yu, 2017). Economic integration allowed the interaction of economic actors between regions. The economic integration between regions will take place quickly if this region's economy and its surroundings complement each other. The integration of some neighboring regions is a first step toward creating an enormous market for trade and investment. Economic integration is believed to stimulate efficiency, productivity, and competitiveness (Ehigiamusoe & Hooi, 2018) through increased interaction between economic agents. The investors and workers from the surrounding area could be involved in the production process. As a result, they receive a fringe benefit in the form of capital rent and wages. Capital rents and wages are components of the Gross Regional Domestic Product (GRDP). Therefore, an increase in capital rents and wages promotes a rise in the GRDP that leads to economic growth.

Furthermore, economic activities tend to be concentrated in specific regions. Economically, this area is a single entity, but, occasionally, administratively, it covers several regencies/cities with different regulations from one another. Efficiency considerations make it necessary for companies to choose the right place. There are three interrelationship elements in the choice of venue: the interaction between economies of scale, transport cost, and customer demand. Considering economies of scale make businesses concentrate their production process in a specific location to serve the entire market. Some economic

sectors such as accommodation, food establishment, construction are mostly located in the sub-urban area (Dubé et al., 2016). Companies tend to build their plants in these areas to minimize transportation costs.

Generally, significant local demand comes from locations around central business districts. People tend to live in these areas due to amenities such as good transportation, excellent telecommunication facilities, and shorten the distance to the business center. The population density in suburban areas is higher than in rural areas. An area around the central business district becomes an exciting county. Some firms prefer to build their plant in this area, with some workers come from the central business district and surrounding areas. Some worker from various regions meets in industrial centers that promote social interaction between workers. The social interaction between educated workers in the central business district and the surrounding areas promotes knowledge spillover.

Educated workers share their experience, knowledge, and skills. Knowledge transfer is likely to occur over relatively short distances, through face-to-face contact with clients or suppliers, or within the local labor market (de Nicola et al., 2019). The economies around the central business districts received positive externalities from human capital working in this venue. Therefore, human capital affects not only particular regions but also the surrounding regions.

Knowledge spillovers promote innovation (Aghion & Jaravel, 2015), resulting in high productivity (Hall, 2011). A spillover effect of knowledge accumulation will be smooth if there is a spatial closeness between regions. Spatial proximity determines how well knowledge spread between workers to facilitate innovation and growth. It overcomes barriers to social interactions such as long-distance and language constraints. Spatial proximity allows workers to move quickly due to low transport costs and linguistic similarity. Spatial closeness encourages interaction between economic actors to allow knowledge to spread across economic sectors.

Furthermore, knowledge spillovers provide additional knowledge to companies. Then, the firms combine it with the knowledge they already have. Spillovers occur in all economic sectors such as agriculture, manufacturing industry, and services. Knowledge spillovers have an impact on increased labor productivity in areas around the business center. Many of the staff who work in the business center come from this place and its surroundings. Social interaction enables skilled workers to share their knowledge, experience, and skills with other workers. Better knowledge of the production process allows workers to work more quickly and efficiently. Social interaction among co-workers can lead to productivity spillover (Cornelissen, 2016) to increase output at fixed inputs to increase labor productivity.

Productivity spillovers promote an increase in output in the region around the growth center. The economic growth occurred in a specific area also stimulates economic growth in the surrounding areas. This process is referred to as growth spillovers. Growth spillover is related to the gap between regions. The magnitude of

the growth spillover decreases with the increasing distance between the two regions (Veneri & Ruiz, 2015).

Spatial closeness allows local demand to play a crucial role in the economic growth of its neighbor. Input-output links contribute to inter-regional spillover, and these effects cannot be ignored. Moreover, the influence of one province on the other may be positive or negative. On the one side, it can expand the market and promote information transfer to its neighbors (positive spillover effects). On the other hand, by improving its competitiveness in the commodity and labor markets (adverse shadow effects), it could empty its neighbors' economic activity. One region's positive influence on its neighbor occurred if their characteristics complement each other. If there is a complement characteristic between provinces, a wealthy province's rapid growth could drag its poor neighbors through capital and technology transfer. The rapid growth of a prosperous province can also push its neighbors by demanding input. High demand for inputs may generate opportunities for suppliers to exploit economies of scale (de Nicola et al., 2019).

Economic growth encourages an improvement in people's well-being. People's welfare promotes a rise in market demand. Initially, the demand for goods and services was served by businesses in the local area. However, if these demands continue to grow, the local firms cannot fulfill these needs. Therefore, these needs are supplied by the firm from other regions. This mechanism will continue as long as the input price from surrounding regions is lower than that in the specific region. Also, variations in characteristics between regions mean that the region has a comparative advantage in producing several goods but has a comparative disadvantage in producing other goods. A region depends on the products supplied from its neighbors, and vice versa. Urban areas, for example, do not have significant agricultural land, although the demand for an agricultural product is relatively great due to their large population. Therefore, urban people's needs for agricultural products rely on supplies from the nearest rural areas.

Moreover, an increase in income in a specific region enhances the increase in demand for tourism products in other regions, in particular tourist destinations. Tourist trips stimulate economic growth in several tourist destinations. The economy of tourist destinations such as Yogyakarta is growing along with the increase in tourist arrivals. Tourist visits to Yogyakarta encourage the development of the trade, hotel, and restaurant sectors. Therefore, the Yogyakarta economy benefits from the economic growth that occurred in its surroundings.

Conversely, some regions will compete with each other if they have similar characteristics. This competition makes a region's economic growth is accompanied by a deterioration of the neighboring area. It means that this growth does not have a positive impact on its surrounding. Economic growth in a specific region does not impact its surroundings unless it involves economic agents from the surrounding area. This problem arose due to the absence of an input-output relationship between

regions, so the production process in a specific region does not require input from the surrounding area. Moreover, the homogeneous product also makes some regions compete with each other. The similarity of output and input creates a lack of exchange between regions. Therefore, the spatial closeness between regions is not always a positive effect.

Several studies revealed positive growth spillovers (Samake & Yang, 2014; Benos et al., 2015; Seif et al., 2017; Amidi & Majidi, 2020). However, the other research exhibited negative growth spillovers (Arora & Vamvakidis, 2013; Laksono et al., 2018; Amidi et al., 2020). More, Samake & Yang (2014) exhibited that the Low-Income Countries (LICs) received positive growth spillover from Brazil, Russia, India, China, and South Africa (BRICS) through an increase in trade volume, a rise in Foreign Direct Investment (FDI) and technology transfer. Benos et al. (2015) exhibited that spillovers are essential for European regional growth. The regions surrounded by dynamic entities are likely to grow faster than otherwise. Meanwhile, Seif et al. (2017) showed a positive spatial growth spillover between the Middle East and North of Africa (MENA countries). Moreover, Amidi & Majidi (2020) revealed that a country's economic growth was positively affected by its neighbor and trade partners' performance.

Conversely, Arora & Vamvakidis (2013) revealed that China's net export growth contribution is harmful to several large countries in other parts of the world. China's exports of goods to other countries negatively affect those countries' net exports. Laksono et al. (2018) showed the negative growth spillovers among regencies/cities in East Java. Developing a regency/city has been detrimental to developing other regencies/cities in East Java due to an absence of synergistic and mutual reinforcing among this province's regencies/cities. More, Amidi et al. (2020) exhibited negative spillover growth in some Asian countries. An increasing growth rate of the labor force in one country leads to decreased economic growth in other countries.

Several studies revealed growth spillovers with the research object at the regional level, which includes several countries. Also, one study examined growth spillover among regencies/cities in one province with similar regulations. Unlike the several previous studies, this study examines the possibility of growth spillover between regencies/cities in two economically integrated provinces. Although the Yogyakarta Special Region and Central Java are two independent provinces with different regulations, economically, these provinces are a single entity. This linkage is occurred due to the complementarity between the regencies/cities in these provinces. The interaction between regencies and cities in these provinces includes various activities, such as population migration, investment, and trade between regions. This economic integration is facilitated by some roads linking several cities and intergovernmental cooperation. Thus, the economic growth in these regions is the inseparable outcome of the interaction between regions. Whatever occurred in Yogyakarta Special Region had an impact on Central Java, and vice versa. The economic interaction between a specific region and its surroundings makes the region's economic growth affected by its economic factor and surroundings. Therefore, this research investigates whether *the growth spillovers between regencies/cities occurred in these provinces*.

## Methods

This research used data published by the Central Bureau of Statistics (BPS). This data includes economic growth, education, working-age population, an asphalted road. The study area's scope is all regencies and cities in Yogyakarta Special Region and Central Java for 2001-2018. The selection of the starting point of the research in 2001 when the regional autonomy takes place. Meanwhile, the final point was selected in 2018 because BPS data is the latest data. In this study, economic growth is measured as the percentage rate of increase in the real gross regional domestic product (GRDP). Education is measured by mean years of schooling. The percentage of the population aged 15-64 years reflects the working-age population—moreover, the percentage of the asphalted road as a measure of the asphalted road. Due to the limited data of asphalted roads, the study uses an interpolation technique to estimate the data for specific years.

This study covers the economic growth in all regencies and cities in Yogyakarta Special Region and Central Java for 2001-2018, so it is panel data. Panel data has advantages over time series and cross-section data. Panel data provides more information, variability, degree of freedom and reduces collinearity between variables. Also, panel data is powerful to observe the dynamics of adjustment. Furthermore, the study is performed based on the following spatial regression model.

$$GROW_{ij} = \alpha_i \sum_{j=1}^N w_{ij} GROW_{ij} + \beta_1 EDUC_{ij} + \beta_2 WORK_{ij} + \beta_3 ROAD_{ij} + \delta_i + e_i$$

Respectively, GROW is economic growth;  $w_{ij}$  is a spatial weighting matrix based on spatial proximity between a specific regency/city and its surroundings, EDUC is education, WORK is the working-age population, and ROAD is asphalted road. The proximity relationship between locations in the autoregressive model is expressed in the spatial weighting matrix  $w$ , with the elements  $w_{ij}$  indicating the  $i$ -th and  $j$ -location relationships' size. The spillover effect of economic growth can be observed based on the sign of the  $w_{ij}$  coefficient. If  $w_{ij}$  is positive, a specific region grows in line with growth in the surrounding region. Thus, a specific region receives spillovers from economic growth occurred in its surrounding. Moreover, the weighting matrix used is Rook contiguity with the location's provisions adjacent to the location of concern given a weighting of 1, while other locations are given a weight of 0.

Before further analysis is carried out, it must be evaluated whether a set of variables in the model are cointegrated. If cointegration occurred, there is a long-run relationship between the economic variables as desired in economic theory. This study uses the Kao method to test whether a set variable is cointegrated in the model. Moreover, this study used the Dynamic Ordinary Least Square (DOLS) method to estimate the regression model. The DOLS method is superior to the OLS method (Arize et al., 2015).

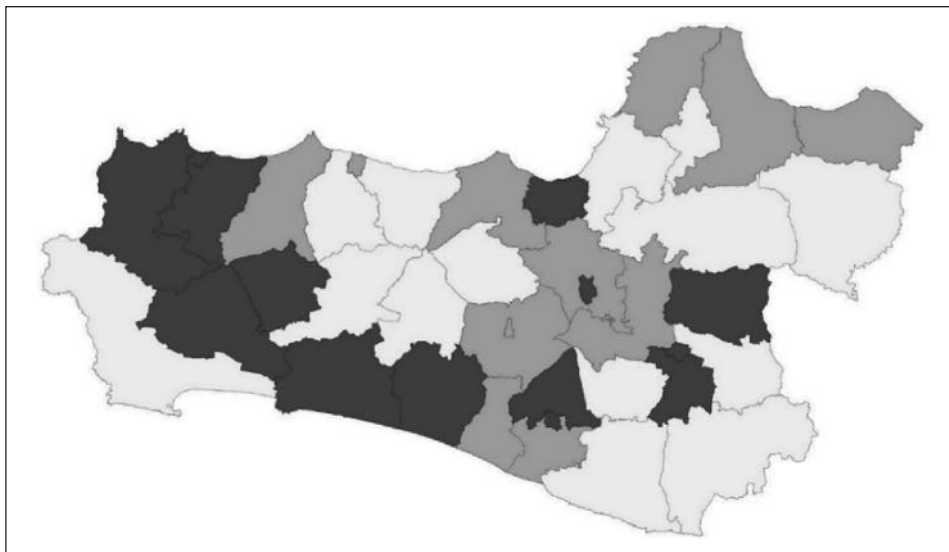
## Results and Discussion

### Results

Economic growth occurred in the Yogyakarta Special Region and Central Java varies between regions. Some regencies/cities have high economic growth, but many regencies/cities have low economic growth. This condition is due to each regency/city's different characteristics, such as human capital, labor productivity, and infrastructure. The rate of economic growth depends on education, working-age population, and infrastructure. Regions with higher education levels, higher working-age population, and excellent infrastructure are experiencing higher economic growth and vice versa.

High economic growth occurred in the regencies of Brebes, Banyumas, Tegal, Purbalingga, Kebumen, Purworejo, Sleman, Sukoharjo, Sragen, Yogyakarta City, Solo City, Tegal City, Salatiga City, and Semarang City. Meanwhile, some regions with moderate economic growth include the regencies of Kulonprogo, Bantul, Magelang, Boyolali, Semarang, Kendal, Rembang, Pati, Jepara, Pekalongan City, and Magelang City. The low economic growth occurred in the Cilacap, Banjarnegara, Pekalongan, Pemalang, Wonosobo, Temanggung, Klaten, Gungkidul, Wonogiri, Karanganyar, Grobogan, Blora, Kudus and Demak Regencies (Figure 1).

Figure 1. The Rate of Economic Growth by Regency/Municipality in Yogyakarta Special Region and Central Java



Moreover, this study uses descriptive statistics as a way to describe data specifications (Table 1). The highest economic growth rate was 10.840 percent, while the lowest growth rate was 5.032 percent. The highest economic growth of 10.840 percent occurred in Kulonprogo Regency in 2018 and Yogyakarta International Airport's development. The high value of this airport is the main driver behind the rapid growth of the Kulonprogo Regency. Conversely, the Banjarnegara Regency's lowest economic growth of 0.070 percent occurred in 2001. Meanwhile, the highest level of education of 11.440 years occurred

in Yogyakarta City. It is reasonable due to the predicate of Yogyakarta as a student city. Conversely, the lowest education level in the Brebes Regency of 4.840 in 2004 occurred due to the low per capita income in this regency.

**Table 1. Descriptive Statistic**

|                    | Growth | Education | Working-Age Population | Asphalted Road |
|--------------------|--------|-----------|------------------------|----------------|
| Mean               | 4.852  | 7.583     | 66.962                 | 51.272         |
| Median             | 5.032  | 7.260     | 66.776                 | 49.625         |
| Maximum            | 10.840 | 11.440    | 79.935                 | 99.160         |
| Minimum            | 0.070  | 4.840     | 58.726                 | 10.650         |
| Standard Deviation | 1.314  | 1.408     | 3.130                  | 18.344         |

Meanwhile, the area with the highest working-age population was Sleman Regency, with 79.9935 percent in 2018. The region with the smallest working-age population was Pemalang Regency, with 58.726 percent in 2001. Sleman Regency is the young people's destination who wants to continue their studies. Meanwhile, the Pemalang Regency is a lagging region, so many of its residents go to the other region to seek a job. Moreover, the highest percentage of the asphalted road of 99.160 occurred in Yogyakarta Municipality in 2018. Yogyakarta City has excellent road infrastructure due to its role as the business center in Yogyakarta Special Region. The lowest percentage of the asphalted road of 10.650 occurred in Grobogan Regency in 2001 due to the limited local budget, although this regency has a wide area.

Furthermore, the result of the Kao Cointegration test showed a t-statistic value of -3,229 and statistically significant. It means that there is a long-run relationship between economic variables as desired in economic theory. In a set of variables, there are several linear combinations of these variables, which are stationary. Thus there is a causal relationship in one direction among the variables in the model.

Moreover, both DOLS analysis based on pool and weighted estimation shows similar results. The regression coefficient for both models have the same apparent magnitude, and all have positive signs. The regression coefficient of growth spillovers, working-age population, and asphalted roads are significant in both models. However, the regression coefficient of education is not significant either in the DOLS pool or the DOLS weighted estimation. The coefficients of determination ( $R^2$ ) produced by these two models are the same apparent magnitude. In the pool DOLS estimation model, the amount of 46.9 percent of growth variation can be explained by variations in explanatory variables. Meanwhile, in the DOLS weighted estimation model, variations in all explanatory variables explain 46.5 percent growth variation (Table 2).

Table 2. The Estimation Result

| Number         | Variable               | DOLS<br>(Pooled Estimation) | DOLS<br>(Weighted Estimation) |
|----------------|------------------------|-----------------------------|-------------------------------|
| 1              | W_Growth               | 0.323*<br>(0.056)           | 0.364*<br>(0.009)             |
| 2              | Education              | 0.096<br>(0.052)            | 0.032<br>(0.026)              |
| 3              | Working-Age Population | 0.042*<br>(0.005)           | 0.049*<br>(0.003)             |
| 4              | Asphalted Road         | 0.017*<br>(0.003)           | 0.015*<br>(0.001)             |
| R <sup>2</sup> |                        | 0.469                       | 0.465                         |
| Observation    |                        | 600                         | 600                           |

Note\* significant at ( $\alpha=5\%$ )  
Numbers in parentheses are Standard Errors  
Dependent variable: Growth

## Discussion

The coefficient of growth spillovers is positive and significant. It means that a specific region obtains a positive growth spillover from its surrounding regions. For example, Cilacap Regency is bordered by Brebes, Banyumas, and Kebumen Regencies. Thus, the economic growth of the Cilacap Regency, besides being influenced by this regency's resources, is also positively influenced by the economic growth of Brebes, Banyumas, and Kebumen Regencies. The W\_GROW coefficient is 0.323 (pool estimation DOLS) and 0.364 (weighted estimation DOLS). It means that the influence of economic growth in Brebes, Banyumas, and Kebumen Regencies on the economic growth of the Cilacap Regency was 0.108 percent (pool estimation DOLS) and 0.121 percent (weighted estimation DOLS).

Increased GRDP of a regency involves inputs from this regency and inputs from its surrounding region. Inter-regional linkages occur due to the complementarity effect as a consequence of various characteristics of each region. These differences promote the emergence of supply and demand from each region that complement each other. Some inputs used in the Cilacap Regency come from Cilacap itself and the surrounding regions. Similarly, the output of Cilacap is partially consumed by the residents of Cilacap itself, while the rest is taken out to meet the demand from the nearby region. Differences in factor endowment give Cilacap Regency has a comparative advantage over specific products and sell it to other regions. Simultaneously, Cilacap Regency has a comparative disadvantage in other products and purchases them from nearby areas.

The linkage of Cilacap, Banyumas, and Kebumen is supported by local governments' agreement in Ex Bayumas Residency. Some local government in these regions have agreed to form an institution which coordinates some economic activity such as trade, investment,

and labor. This cooperation is a tool to fulfill the local market demand. Economic agents in these regions cooperate to increase their capacity by sharing information, technology, and other activity for raising economies of scale. If economic agents in a specific regency cannot meet their input demand, they request cooperation with their neighbor regency to supply raw material, labor, and capital. This cooperation creates employment for residents in neighboring regions.

Meanwhile, Cilacap and Brebes' economic linkage is encouraged by developing large and medium manufacturing industries in Cilacap. These industries need input, especially labor input. Due to the requirement of expertise and skill, the labor need cannot be fulfilled only by Cilacap residents. The residents from neighboring regions, including Brebes, also fulfill this labor need. Some commuters from Brebes promote industrial activities in Cilacap, and they get fringe benefits from this activity.

Besides, a firm always tries to minimize costs by seeking cheap inputs from its region or its surrounding regions. The cost minimization strategy promotes companies in the Brebes, Banyumas, and Kebumen regencies to purchase Cilacap Regency input. Input owners in the Cilacap Regency get the fringe benefit for their contributions to their neighboring regions' production process. This compensation includes wages, rents, and interest, which form the GRDP based on the expenditure approach. More, income is used to fulfill the needs, and this process is represented in increased consumption—an increase in consumption drive-up the GRDP. Therefore, the Cilacap Regency has received spillovers of economic growth that occurred in its neighboring areas. Conversely, economic growth occurred in Cilacap need some input that comes from this regency and its surrounding. It means that input owners in the Brebes, Banyumas, and Kebumen also get compensation for their contribution to the production activity. These neighboring regions also get benefit from growth spillovers that occurred in Cilacap Regency.

Moreover, the economic growth that occurred in Cilacap Regency promotes a rise in income. An increase in income supports a rise in consumption for primary, secondary, and tertiary products. In line with the comparative advantage principle, a part of the primary needs is supplied from the surrounding regions. This process continues as long as the product price in some neighboring regencies is lower than that in Cilacap Regency. Therefore, economic growth occurred in Cilacap promotes an increase in demand for primary products of its surrounding regions. The increase in demand drives up production, leading to economic growth in the surrounding regions. Conversely, the rise in income occurred in Brebes, Banyumas, and Kebumen promotes an increase in demand for primary products of Cilacap Regency.

Likewise, for the secondary product's needs, such as industrial manufacturing products, a region relies on other regions' output. It means that companies from other regions supply the need for industrial products in a specific region. This situation is a result of the unequal distribution of the industrial sector. Different regional characteristics promote some industries tend to build their plants in suburban areas and serve people's

needs from their location. The increase in demand for a secondary product in a particular area promotes a rise in output in other regions. Therefore, economic growth that occurred in a specific region supports a rise in value-added in other regions.

After primary and secondary needs were fulfilled, the high-income people allocated their income to meet tertiary needs such as tourism. The rich people from Cilacap visited their surrounding areas, such as Banyumas, Kebumen, and Brebes Regencies. A rise in the number of travelers from Cilacap encouraged a rise in consumption in many tourism destinations. They needed food and drink, accommodation, and other needs that promote the emergence of economic activities such as trade, hotels, and restaurants. The economic activity caused an increase in added value, so it encouraged economic growth. Therefore, the area around Cilacap received positive spillover from the economic growth that occurred in Cilacap Regency. The higher the economic growth, the greater the spillover effect received by a specific region. This study's result was consistent with Ho et al. (2013) that grew from one country has a positive spillover effect to its trading partners. This finding was in line with Ahmad & Hall (2017) evidence that growth improvement in a country generated positive spillover effects on neighbors' economic growth. This result also supported Ahmad (2019) that economic globalization was a significant driver of growth, and when it was spatially modeled, economic globalization had a positive effect on its neighbors. Nevertheless, this results from the contrary to Laksono et al. (2018) that developing a regency/city has detrimental to developing other East Java regions.

Furthermore, the increase in education did not affect economic growth due to the low mean years of schooling. The mean years of schooling in Yogyakarta Special Region and Central Java is only 7.58 years or the equivalent of grade 2 junior high school. It means that mostly the labor force has not graduated from junior high school. Their skills did not meet the requirements to enter the formal sector. Their knowledge did not make enough to take training for operating high-tech machine. Due to inadequate knowledge, the employers and government faced adversity with giving training.

As a consequence of inadequate skill, they were forced to enter the informal sector. Unlike the formal sector, the informal sector is labor-intensive with low capital intensity. Capital intensity determines labor productivity: The higher capital intensity, the higher labor productivity, and vice versa. The low capital intensity in the informal sector leads to low labor productivity and low value-added. A very low value-added did not have a significant effect on economic growth.

There is a link between the education level and the quality of human resources. Qualified human resources indicate a community of expertise (Taty et al., 2017) and then referred to as human capital. Human capital is an element that organizes other resources to generate added value (Blaga & Jozsef, 2014). Human capital is a crucial factor in economic development. Human capital becomes an essential element in achieving sustainable economic development. The quality of human capital is an essential factor

in technical mastery. Technology mastery demonstrates a country's progress rate and determines its efficiency to increase economic output. Higher human capital allows a faster rate of economic growth.

Recently, the production process tends to a capital intensive method. Considering profit make employers prefer capital intensive than labor-intensive method. The capital intensive method was formulated in the usage of new machines with high technology. However, not all workers could operate the high tech machine. This machine just only could be operated by skilled labor.

Worker expertise was associated with the quality of human resources. Worker's capability such as knowledge, intelligence, ideas, and skills determines the production process's efficiency. Human resources tend to have cumulative and long-term effects compared to physical capital. The relationship between capital and skilled labor is the key to realize economic growth. Economic growth is no longer based on natural resources but depends on human capital. Some countries with sufficient human capital have achieved a high standard of living for their citizens, although they did not have adequate natural resources.

Conversely, some countries rich in natural resources, but lack human capital, persist at a low standard of living. Countries with inadequate human capital continue to experience underdevelopment. Without adequate human capital, natural resources and physical capital become insignificant to increase output. Human capital allows a better manufacturing process to maximize productivity through innovation. Skilled labor works faster to obtains a better result. The skilled worker promotes a rise in the manufacturing process's efficiency, so a rise in output can be realized with fixed input. Therefore, human capital determines the rate of economic growth.

The rate of economic growth is positively associated with advanced education. Advanced education positively affects the quality of human resources. The quality of human resources can be improved in various ways, including education. Education increases knowledge, productivity, and creativity. Educational progress directly contributes to the development of human resources quality. Lagging education has a severe impact on the lagging human resources quality. Local governments need to improve the quality of human resources to create a competitive region. Regional development policies that do not emphasize enhancing human resources quality will make them stay underdeveloped. The local governments must enhance human resources quality in all sectors through personal investment as the central pillar of development. Countries that emphasize enhancing human capital will thrive even though they do not have adequate natural resources. Emphasis on human resources is a foundation for labor productivity improvement. Many production factors, such as land, labor, and physical capital, can experience declining returns, but science and technology can produce innovations to support economic growth. Increased education also promotes technological progress through innovation.

Investment in education is considered to affect an increase in resources to promote

growth positively. Education shape and enhance one's knowledge so that one can work faster. Higher education leads to higher labor productivity. Since the education quality determines the quality of human resources, the central government has provided the broadest possible access to completing the 9-year compulsory education program. Education is required to promote the sustainability of economic growth. Education broadens people's knowledge and increases the rationality of thought. Higher knowledge promotes the development of reforms in engineering, economics, and other aspects of life.

One measure of education investment was the mean years of schooling. Low mean years of schooling indicated low education investment. At low education, such as junior high school, changes in the study's length did not significantly impact graduate quality. It means that the study period's extension for the junior school period did not impact economic growth. This result supported Hanif & Arshed (2016) that extending primary enrolment would only generate risks for the economy. Their education stills not enough to obtain better jobs. However, this finding was contrary to Pauw et al. (2015) that higher education was needed to support higher growth to create sustainable economic development. This result also differed from Liao et al. (2019), who showed the correlational feedback between education and sustainable economic growth.

Meanwhile, the working-age population (15-64 years of age) positively impacts growth. The increase in economic growth follows a rise in the working-age population. A rise will follow an increase of 1 percent in the working-age population in the economic growth of 0.042 percent (pool estimation DOLS) and 0.049 percent (weighted estimation DOLS). The working-age population is a part of the population that directly participates in the production process. The production process involves interaction among workers, capital, and other inputs to produce an output. There is a specific combination of inputs used in the production process. More physical capital requires more employees, so that results in higher output. The rise in population is not inherently capable of increasing output. The population consists of non-productive age groups (0-14 years of age and 65 years of age and older) and productive age groups (15-64 years of age), and only productive age groups are involved in the production process.

If working-age groups dominate the population in a specific area, therefore this region enjoys a demographic bonus. A demographic bonus will be an advantage if it is filled with qualified workers. The qualified worker will be achieved if the school graduate has the high qualification to operate the high-tech machine and organize the production process. Their expertise and skill are enough to run the production process efficiently. They have a high knowledge to promote innovation in technology, economies, and other aspects. If this condition is met, the demographic bonus promotes an increase in output. The working-age group's positive impact on economic growth indicates that the labor force has enough skill to create additional value-added. A rise in value-added promotes rapid economic growth. Thus the increase in the working-age population encourages an increase in economic growth.

Furthermore, the demographic bonus will positively impact economic growth if there is an adequate labor demand. Conversely, if the labor demand is not enough to accommodate the job seekers, this condition makes a big problem. This problem arises due to an excess labor supply. If the labor supply is more significant than its demand, most job seekers cannot get the desired job, so they are forced into the unemployment group. Unlike developed countries, so far, Indonesia does not have unemployment benefits. It means that unemployed laborers do not have an income. Meanwhile, he has to fulfill consumption expenditure. Even though the Indonesian Government Issue omnibus law that accommodates unemployment benefit, a limited state budget restricts the government's ability to fulfill the unemployed resident's need. Therefore, the central and local government must create an additional labor demand primarily through investment.

The investment shows an additional capital into the economy. The additional capital comes from foreign investment and domestic investment. Besides a low-interest rate, the investor must consider other factors such as political stability, market size, and industrial relation. Generally, Indonesia has high political stability. Also, Indonesia has a large market size due to a large population. However, some investors see that the Indonesian industrial relation does not yet support to achieve the investor's goal. Even though the wage rate in Indonesia is low, but it is accompanied by low labor productivity. It possible that low labor productivity is associated with a low education level of labor. Based on the Central Bureau of Statistics (BPS) data, Indonesian residents mostly have not graduated the junior high school. Therefore, they do not have enough expertise and skill to run the modern machine. Therefore, they are unable to run the production process efficiently. The low labor productivity hinders investment entry.

Labor productivity is an essential factor that determines firm performance (Prosvirkina, 2015). Labor productivity is an indicator that shows how well human resources are managed and used to produce the output. The higher labor productivity is linked to the higher output. Productive workers are inputs that determine economic performance. Generally, a rise in output is realized through the use of advanced production machines. However, not all workers can operate this machinery because it requires specific skills. Only experienced staff can operate sophisticated equipment to produce more output.

So far, low labor productivity is associated with the low mean years of schooling. Therefore, the government needs to extend mean years of schooling by the compulsory education program. The higher education of labor indicated a higher knowledge so that they can accommodate new technology. Besides, the government and employer can easily give training for them to increase their skill. A rise in knowledge and skill lead to an increase in labor productivity. The economic growth will follow an increase in labor productivity. This result is also in line with Thuku et al. (2013) that showed a long-run relationship between population and economy. This study

also supported Rizk (2019) that the working-age population's growth was a dividend and stimulating GDP per capita in both the short and long run. Conversely, this finding runs counter to predictions that population aging would have little effect on productivity (Burtless, 2013).

Furthermore, the percentage of asphalted roads has a positive effect on economic growth. A rise in asphalted roads promotes an increase in economic growth. The rise in asphalted roads by 1 percent contributed to a rise in the economic growth of 0.017 percent (pool estimation DOLS) and 0.015 percent (weighted estimation DOLS). Enhanced road facilities improve transportation efficiency. An efficient transportation system solves the problem of high-cost distribution. The mobility of goods and people can take place quickly and cheaply. Infrastructure plays a significant role in supporting the production process and reduce production costs.

Considering economies of scale makes a company take place in a specific location with excellent infrastructure and concentrate all of its activities just in one venue. The firm does not set up a branch in the other location. The large scale makes the company purchase a cheap input to raise its efficiency. The direct purchase cut shortens the supply chain, so they get cheap input. Also, they get a discount due to a bulk purchase of input. This advantage can be realized if the company does not bear high transportation costs. This cost problem was overcome when the firm was located in an area with good infrastructure. The excellent infrastructure promotes smooth transportation and reduces time travel, so reduce transportation cost. The lower production cost promotes a rise in product competitiveness. It means that firm can sell its product at a lower price without bearing the loss. Therefore, low transportation costs support the firm in serving all customers from a specific location and raising its market share.

Road network is considered a key to realize a region's regional development (Sreelekha et al., 2016). The construction of road facilities, particularly in disadvantaged regions, accelerates economic activity in this area and enhances connectivity with other regions. Due to poor road infrastructure, some formerly isolated companies can get cheap input, running the production process at a low cost. Lower production costs make firm cheaply produce output. As a consequence of cheap output, the output demand increase leads to a large trade volume. Therefore, road construction rises connectivity between regions and promotes the growing demand for goods and services. Large trade promotes a boost rise in all economic activity. It means that the construction of road infrastructure encourages a rise in economic growth.

Characteristic of each region in Yogyakarta Special Region and Central Java is different from each other. Some regions located on the northern coast of Central Java have a comparative advantage in fisheries' production. Mostly fishery products come from fishing in the ocean. Meanwhile, several areas have comparative advantages in agricultural products. The vast agricultural land supports the development of crop cultivation. More, some cities have comparative advantages in the service sector due to adequate

infrastructure. The secondary sector is mostly located in the suburban area. Generally, this region has vast land with adequate infrastructure to support the development of the manufacturing sector. Improved asphalted road promotes a rise in trade among regions. An increase in trade drives up people's income. Thus, the government needs to increase the road's length and quality, especially in disadvantaged regions, to connect with growth centers.

Improving connectivity between regions, the government has built the South Coast Road linking the Wonogiri, Gunungkidul, Bantul, Kulonprogo, Purworejo, and Kebumen Cilacap Regencies. This road construction is a way to promote developing Southern Central Java and Yogyakarta Special Region and a balancer to the development of roads in the northern part of Central Java. Meanwhile, the Central Road was done to improve Boyolali, Semarang, Magelang, Temanggung, Wonosobo, Banjarnegara, Purbalingga, and Banyumas Regencies. Moreover, road maintenance on the northern coast establishes some regencies/cities in Central Java stretched from Brebes Regency to Rembang Regency. Some highways' construction was complemented by constructing some toll roads such as the Yogya-Solo, the Yogya-Bowen, and the Yogya Cilacap Toll Road. The construction of toll roads is required to speed up transportation between Yogyakarta and some Central Java cities.

Connectivity between regions will create larger positive effects if it is accompanied by intergovernmental cooperation. Intergovernmental cooperation represents two or more local governments' arrangement to accomplish a common goal, provide a service, or solve a mutual problem. The economic activity gives result optimum when the production process is run on a large scale, so the firm gets some benefit from economies of scale. So far, some regencies do not have enough economic size to produce output at low costs. Therefore, the economic cooperation between regencies is a way to overcome inefficiency problems due to their small economic size.

This finding was in line with Zhang (2013) that improvements in urban roads and significant local roads had increased the GDP share for China's manufacturing and service industry. The results also supported Yang et al. (2016) that highways' construction promoted aggregate productivity growth by facilitating company entry, exit, and reallocation. This result was contrary to Banerjee et al. (2020) that road infrastructure's construction has no significant economic growth impact.

## **Conclusion**

Positive growth spillovers have occurred between regencies/cities of the Yogyakarta Special Region and Central Java. The economic growth of a particular region is positively influenced by growth occurred in its surrounding. The complementary effect encourages inter-regional linkages. Economic growth in a specific region requires some inputs both from this region and the nearby regions. Therefore, the owners of input in the surrounding area receive compensation for their contribution to the production process. This payment includes wages, rent, and interest, which are the components forming GRDP. Economic

growth in a region stimulates a rise in income, so boost a rise in output demand. The increase in output demand in a specific region leads to a rise in economic growth in a region and its surroundings.

Meanwhile, the increase in the working-age population (15-64 years) and road improvement positively impact economic growth. Nevertheless, the rise in the mean years of schooling did not impact economic growth. The mean years of schooling in the Yogyakarta Special Region and Central Java are only 7.58 years or the equivalent to grade 2 junior high school, so most laborers do not have sufficient expertise and skills to drive up economic growth.

The government needs to improve the quality of human resources and increase regional connectivity. An improvement of human resources is made through the 12 -year compulsory education program, so the worker graduated from senior high school. They have enough knowledge, expertise, and skill to run the production process efficiently. Meanwhile, the road improvements are primarily aimed at the central and southern of Central Java. Several highways must be developed by several toll roads, such as the Yogya-Solo, the Yogya-Bawen, and the Yogya- Cilacap Toll Road. The construction of several toll roads is required to improve connectivity between cities in the Yogyakarta Special Region and Central Java.

Further, the road construction is accompanied by intergovernmental cooperation. This cooperation promotes economic activity in a large size, so the firm benefits from economies of scale. The production process can produce large value-added to boost economic growth.

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# Harnessing The Potentials of Non-Oil Sectors of The Nigerian Economy to Enhance Sustainable Growth

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## Abstract

*In the face of global oil price instability, which seems to negatively impact the Nigerian economy, this study examined how the Nigerian government and its stakeholders have explored other sectors of her economy, such as agriculture, manufacturing, and tourism, enhancing sustainable growth. In achieving this, the study employed a time series data covering 24 years (1995-2018). The variables used in the study were real gross domestic product (RGDP), tourism share of GDP, agriculture share of GDP, and manufacturing share of GDP. The unit root test using the Augmented Dickey-Fuller test was conducted to test for stationarity among variables employed. The Autoregressive Distributive Lag Bound Test for Co-integration was also employed, while the ECM was also conducted to check for the speed of adjustment. The study findings revealed that, while the Nigerian government and industry stakeholders have made significant investments in the agriculture sector through the development of improved seedlings and farm infrastructure, there is a need for more investment in the manufacturing and tourism sectors of the nation's economy to boost her gross domestic product.*

## Keywords:

Non-oil sector, agriculture, manufacturing, tourism, sustainable growth.

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## Introduction

The need to harness the non-oil sectors of developing economies' potentials towards enhancing sustainable growth cannot be overemphasized. This is so because a diverse source of income is essential for cushioning out the effect of overdependence on a sector for a nation's economic sustainability. As a developing nation, Nigeria is endowed with abundant natural resources, including the vast expanse of arable land for agriculture, and large crude oil reserves, upon which her economy thrives. Until the end of the 1960s, Nigeria was self-sufficient in terms of food production. The country was a net exporter of agricultural produce, owing to fertile soil types and suitable vegetation and climate for agriculture. However, from the early 1970s, crude oil became a primary foreign exchange earner and revenue source for Nigeria, making it the major contributor to the nation's gross domestic product (GDP).

Today, the Nigerian economy is dominated by crude oil production, and she is rated among the largest producer of the product in the world (Uma et al., 2019). Its monocultural status is further buttressed as reported by that of the N3,915.56 billion total revenue derived in June 2008, N3,133.00 billion was derived from oil (Ameh, 2009). Despite this, Nigeria has a high rate of poverty and was rated as the world's poverty capital in 2019 (Iheonu & Urama, 2019). This, amongst other reasons, can be attributed to Nigeria's dependence on a resource-based growth strategy driven by the resources generated from her crude oil product sales. However, the variability of crude oil prices in the global market has further contributed to an unstable growth in the Nigerian economy.

As the oil sector remains the mainstay of the Nigerian economy, accounting for about 95% of the country's revenue generation (Odupitan, 2017), the potentials of the non-oil sectors of Nigeria's economy, including agriculture and manufacturing (Eko et al., 2013), and tourism (Wole, 2018) have not been fully harnessed. This is despite these sectors' potential to contribute to the nation's economy significantly. For example, the agriculture sector's contribution to Nigeria's GDP was 48% in 1970, representing the second-largest Nigerian economy sector, after oil (Chukwuma, 2018), and providing employment opportunities for over 70% of the nation's population. However, in 1980, the agricultural sector's contribution to Nigeria's GDP declined by over 28% (Chukwuma, 2018). This downward slide in Nigeria's Agriculture sector's contribution to her GDP was also evident in 2015 when the sector contributed 26.2% of the nation's GDP (Chukwuma, 2018).

The decline in the agricultural sector's contribution to the Nigerian GDP is perhaps responsible for the below-average investment in the manufacturing sector, which can be attributed to the nation's high unemployment rate. For example, the unemployment rate was 11.9% in 2005 and 21.1% in 2010, representing a 10% rise in unemployment within five years. Currently, Nigeria's unemployment rate stands at 27.1%. This further shows that the agriculture sector's potentials, which can help improve the manufacturing sector and generate employment opportunities for the teeming unemployed Nigerian populace,

has not been fully harnessed. Similarly, the tourism sector's potential of the nation has not been fully harnessed to contribute to the country's economy. For example, despite the array of Nigeria's natural and human-made tourist attractions across her regions (Awaritefe, 2004; Awaritefe, 2007; Bello & Bello, 2019), the World Bank Group's 2020 report on international arrivals to Nigeria for the period 2009 to 2015 reveal that the Nigerian travel industry experienced a significant decline in international arrivals from 1,500,000 million tourist arrivals in 2009 to less than 500,000 million arrivals in 2015.

The report suggests a decline in tourist receipts by over 300,000,000 million dollars between 2008 and 2014, and the loss in tourist arrivals by 1,000,000 within the same period. This decline in both tourist arrivals and receipts can be attributed to the inability of the Nigeria destination managers and other key stakeholders to adopt or develop sustainable strategies that can help harness the sector's potentials amidst crisis events, including political crises and the current COVID-19 pandemic that can make the sector vulnerable (Majebi, 2020). However, despite the Nigerian tourism industry's vulnerability to the crisis, this key non-oil sector of the country's economy remains a viable industry for the sustainable growth of the nation. The importance of the Nigerian tourism sector to her economy is evident in the World Travel and Tourism Council's 2020 report (WTTC 2020), which shows that travel and tourism in Nigeria in 2019 accounted for: (a) 4.5% of the country's total economy; (b) NGN 6,534.4BN of the nation's GDP; (c) 4.7% of total employment, i.e., 3,354.4 million jobs across the tourism subsectors; (d) NGN864.9BN in international visitor spending.

These socioeconomic attributes of the Nigerian tourism sector can be improved to complement the revenue from the Nigerian economy's oil sector. This can be achieved when the nation's relevant government and industry stakeholders develop or adopt sustainable measures to help prevent and reduce the impact of the crisis on the country's economy (Majebi, 2020).

Muttaka (2015) examined the Nigerian economic growth trend and her over-reliance on crude oil. According to him, the country has wasted lots of opportunities to break away from underdevelopment despite its massive natural and human resources endowment due to its heavy reliance on crude oil resources, regrettably mismanaged. He identified several key drivers for economic prosperity, such as investment, governance, and regional dimensions of economic diversification and human and natural resources. He maintained that these drivers remain the prerequisite in building an enabling environment for economic sustainability through sustainable economic policies, but this has been lacking. There is no doubt that the seeming lack of sustainable measures towards harnessing the potentials of the non-oil sectors of the economy to complement the volatility in oil revenue is evident in the country's economic crisis.

For example, in 2016, Nigeria's economy slipped into recession due to a fall in global oil market price, from \$112 to \$50 per barrel. This resulted in the fall in Nigeria's public finances and caused chronic dollar shortages in the economy. Consequently, the country recorded negative growth. For example, between the last quarter of 2015 to the

first quarter of 2017, Nigeria's GDP growth rate was – 0.36%, -2.06%, - 2.34%, and -1.3%, respectively, for the four quarters of 2016. The figures were 1.3%, 0.55%, 1.4%, and 2.6% for the four quarters of 2017, showing a gradual exit from the recession from the second quarter of 2017 (Ikon, 2019).

Currently, the Nigerian economy again is on a decline due to yet another slump in global oil price, exacerbated by the ravaging effect of the coronavirus (COVID-19) pandemic. The pandemic initially slowed down, and at a point, halted economic activities worldwide for several months. This led to a fall in global oil demand such that the benchmark price in some cases was lower than the cost of production, and countries are recording low prices, and in some cases, hostile oil prices. As a result, the International Monetary Fund (IMF) had to cut its projection for Nigeria's 2020 economic growth to 2%, from 2.5% as inflation is expected to rise while deteriorating terms of trade and capital outflows will weaken the country's external position (IMF, 2020). The decline in oil price shock was unexpected and has caused significant strain on the Nigerian government's budget and currency.

This continuous predicament related to global oil price volatility has led to a continuous clamor for economic policies and programs required to cushion the effect of oil price instability on the economy's growth through the activation of specific and vibrant non-oil sectors geared toward raising required economic revenue. This becomes necessary due to the rapidly changing dynamics and volatility of the oil market that has continuously distressed the Nigerian economy (Riti et al., 2016) and the embracement of the 21st century nuclear, solar, geothermal, and other energy sources to meet the world's energy requirements and control environmental degradation.

Accordingly, Ikon (2019) argues that if the structure of Nigeria's economy were balanced in such a way that other sectors of the economy were developed, Nigeria would have managed the economic shock occasioned by the oil price fall to its advantage. Therefore, this article seeks to support this view as it explores the extent to which the Nigerian government and industry stakeholders have explored other viable economic sectors, including agriculture, manufacturing, tourism, and related subsectors, to cushion the effects of oil price instabilities on its economy.

Hence, as Nigeria is confronted with several economic challenges, its economy's diversification becomes a reliable policy to adopt. Economic diversification involves expanding economic activities, including exploring the potentials of an economy to enhance economic performance that can result in sustainable economic growth. The benefits of diversification of an economy are enormous. It allows a nation to utilize her excellent resource base to rebuild her economy maximally, and enjoy the benefits of all the linkages, synergy, economies of scale, national technology, foreign investment, human capital, exploit new opportunities, low operational costs, increased national competitiveness, improved standard of living and confidence of the citizens for a national renaissance (Suberu et al., 2015).

Options for diversifications no doubt abound in agriculture, taxation, mining,

manufacturing, tourism, entertainment, financial services, and information and communications technology (ICT) (Anyaechie & Areji, 2015), among others. In furtherance, the diversification of resources into critical sectors with particular emphasis on the manufacturing industries would reduce the exportation of valuable raw materials overseas. These materials could be transformed into domestic products through the employment of local labor, thereby creating jobs for Nigerians and at the same time multiply the benefit to the national economy.

Several studies (e.g., Esu & Udonwa, 2015; Suberu et al., 2015; Yusuff & Akinde, 2015; Kemi, 2016; Chukwuma, 2018; Ikon, 2019; Tonuchi & Onyebuchi, 2019) that examined measures being deployed by destination authorities of volatile economies to enhance the sustainable growth of their economies have employed different models. This includes the ordinary least square model, autoregressive distributed lag model, and error correction model. For example, Esu & Udonwa (2015) employed the error correction mechanism (ECM) in examining economic growth in Nigeria through diversification covering 31 years (1980 to 2011), and their study findings reveal that there is a significant negative impact on the non-oil sector on the economic growth of the country. This implies that if the non-oil sectors of the Nigerian economy were given the required attention, it would significantly influence the nation's economy.

Suberu et al. (2015) employed a time series data covering 40 years (1960-2010) in their investigation of Nigeria's diversification of her economy towards sustainable growth and economic development, and their findings reveal that, despite the drop in agriculture's contribution to Nigeria's GDP from 64.27% in 1960 to 40.84% in 2010, the sector remains viable in enhancing the sustainable growth, with sustained strategic policies designed to aid improved investment. Similarly, Yusuff & Akinde (2015) employed a time series of data spanning 18 years (1995 to 2013) in examining the tourism development and economic growth of Nigeria, and their study findings reveal that there are unilateral causality and positive long-run relationship between tourism development and economic growth.

Kemi (2016) employed descriptive and correlation analysis in investigating the diversification of the Nigerian economy through agricultural production, and her study findings revealed that agricultural production contributes 71% to employment generation, 76% to the provision of food, 32% to foreign exchange earnings, 34% to poverty reduction and 28% to the provision of raw materials. Kemi's finding reveals that the correlations between employment generation and economic growth, poverty reduction, and economic growth were positive and significant to the Nigerian economy's sustainable growth.

Chukwuma (2018) employed correlation, cointegration, and ordinary least squares regression models in their study on the diversification of Nigeria's economy through agriculture and solid minerals in the face of dwindling economy, and his study findings reveal that concrete mineral production has a significant short and long-run impact on the Nigerian economy. In the same vein, Ikon (2019) employed the Ordinary Least

Square method of regression in his study the relationship between economic diversification (proxied by money supply, inflation, import, export, credit to the private sector, and commercial bank loans to manufacturing) and industrial growth (proxied by GDP at current introductory price) in his study on economic diversification and industrial growth in Nigeria, using data which covers 17 years (2000-2017), whose study findings reveals that, there is a significant relationship between economic diversification and industrial growth. This implies that economic diversification can improve industrial growth in Nigeria. However, Tonuchi & Onyebuchi (2019) employed the autoregressive distributed lag (ARDL) model to investigate the economic diversification of Nigeria. Their findings revealed that non-oil export has a significant positive impact on Nigeria's economic growth in both the short and long run.

A common feature of these extant studies is that they sought to establish how the Nigerian economy's non-oil sectors can contribute to the country's sustainable growth, as this study does. However, in the face of dwindling revenue from the Nigerian oil sector, upon which her economy hitherto thrived, this study seeks explicitly to expound on existing literature by analyzing the extent to which vital non-oil subsectors (i.e., agriculture, manufacturing, and tourism) can contribute to the sustainable growth of the Nigerian economy. This is amidst the unpredictability of her oil revenue, owing to the instabilities in global oil prices. Moreover, it does not seem that there is any recent literature investigating the extent to which a developing economy like Nigeria harnesses its non-oil sectors' potentials to boost its dwindling oil revenue. This makes the study novel, as it aims to show if the contributions of the Nigerian economy's non-oil sectors over a specific period (see methodology section) complements the destination's revenue from the volatile global oil markets.

## **Method**

The study employed a time series data point index model covering 24 years (1995-2018). This was to help the authors analyze a time-series sequence of the variables employed for the study to understand their contributions to the Nigerian economy. This is congruent with other studies, including Suberu et al. (2015) & Yusuff & Akinde (2015) employed a time series model in investigating the diversification of the Nigerian economy towards sustainable growth.

The variables used in the study were real gross domestic product (RGDP), tourism share of GDP, agriculture share of GDP, and manufacturing share of GDP, and data have gotten were sourced from the Central Bank of Nigerian Statistical Bulletin (Various Issues), the National Bureau of Statistics and the World Bank's Development Indicator (WDI). The model adopted for the study was autoregressive distributed lag (ARDL). This model was adopted since the data's preliminary investigation showed that the data are integrated of order zero and one. The model was used to investigate both the short and long-run relationship among the variables. The model is specified as shown below:

$$\begin{aligned}
 LGDP_t = & \beta_0 + \sum_{i=1}^n \beta_1 \Delta LGDP_{t-1} + \sum_{i=1}^n \beta_2 \Delta LAGR_{t-1} + \sum_{i=1}^n \beta_3 \Delta LMAN_{t-1} \\
 & + \sum_{i=1}^n \beta_4 \Delta LTOU_{t-1} + \theta_1 LGDP_{t-1} + \theta_2 LAGR_{t-1} + \theta_3 LMAN_{t-1} \\
 & + \theta_4 LTOU_{t-1} + \varepsilon_t
 \end{aligned}$$

Where AGR is the Agriculture percent share of the GDP, MAN is the manufacturing percent share of GDP, TOU is the Tourism percent share of GDP,  $\Delta$  is the difference operator,  $L$  represents the logarithm,  $\beta_0$  is the constant,  $\beta_0$   $\beta_4$  are the coefficients of the short-run relationships,  $\theta_1$   $\theta_4$  are the coefficients of the long-run relationship and  $\varepsilon_t$  is the random error term.

Before fitting the proposed model to the data, a unit root test was first of all carried out using the Dickey-Fuller Generalised Least Squares (DF-GLS) proposed by Elliot et al. (1996), which is a modified version of the Augmented Dickey-Fuller and has been shown to perform well in a small sample size. This unit root test method was adopted for this study since the dataset falls in the category of a small sample ( $n < 30$ ).

## Results and Discussion

### Unit Root Test

The result in Table 1 shows that the variables employed were stationary at the point where the absolute value of the Dickey-Fuller Generalized Least Squares (DF-GLS) is greater than the critical value at 5%. From the table, tourism, agriculture, and manufacturing are all integrated of order one (I(1)), which means that they are stationary at first difference while RGDP is integrated of order zero (I(0)) (stationary at levels). This result implies that the regression result cannot be spurious since there is no unit root in the data. Noticeably, the mixture of both I(0) and I(1) variables would not be possible under the Johansen procedure. This gives a reasonable justification for using the bounds test approach, or ARDL model proposed by Pesaran et al. (2001).

**Table 1. Dickey-Fuller Generalized Least Squares (DF-GLS) Unit Root Test Result**

| VARIABLES | DF-GLS | 5%     | ORDER OF INTEGRATION |
|-----------|--------|--------|----------------------|
| LTour     | 4.3662 | 1.9572 | I(1)                 |
| LAGR      | 4.4926 | 1.9572 | I(1)                 |
| LMANU     | 2.8630 | 1.9572 | I(1)                 |
| LRGDP     | 2.7932 | 1.9602 | I(0)                 |

Source: Author's computation from EViews 10

### ARDL Bound Test for Cointegration

From Table 2, the result of the test for long-run relationship (Bounds test) shows that at a 5% level of significance, the F-statistic value of 4.626 is higher than the upper bound critical value of 3.67 (see Table 2). This implies that the null hypothesis of no cointegration cannot be accepted at the 5% level of significance, and we, therefore, conclude the existence of a long-run relationship among the variables employed in the study.

Table 2. ARDL Bounds Test

| F-Bounds Test  |          | Sig. | Null Hypothesis: No levels relationship |      |
|----------------|----------|------|-----------------------------------------|------|
| Test Statistic | Value    |      | I(0)                                    | I(1) |
|                |          |      | Asymptotic: n=1000                      |      |
| F-statistic    | 4.625876 | 10%  | 2.37                                    | 3.2  |
| K              | 3        | 5%   | 2.79                                    | 3.67 |
|                |          | 2.5% | 3.15                                    | 4.08 |
|                |          | 1%   | 3.65                                    | 4.66 |

Source: Author's computation from EViews 10

### Long Run Estimate

The long equation was estimated since the F-Bounds test indicated the existence of cointegration among the variables. The result in Table 3 shows that the long-run coefficient of agriculture contribution AGR to the RGDP is 3.200, which implies that a unit change in AGR will lead to a 3.2 units increase in the RGDP in the long run. The high t-value of 12.435 and the P-value of  $0.0000 < 0.05$  (level of significance) show that the relationship between agriculture and real GDP is statistically significant in the long run. Manufacturing and tourism have a positive relationship with RGDP in the long run though not statistically significant ( $P > 0.05$ ). This result is in line with Chukwuma (2018), whose study revealed that economic diversification through agriculture and other sources have a significant long-run relationship between economic growth and development.

Table 3. ARDL Long Run Form and Equation

| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
|----------|-------------|------------|-------------|--------|
| LAGR     | 3.200202    | 0.257363   | 12.43461    | 0.0000 |
| LMANU    | 1.116295    | 0.659151   | 1.693534    | 0.1212 |
| LTOUR    | 1.078913    | 0.699991   | 1.541323    | 0.1543 |
| C        | 39.34585    | 10.77594   | 3.651269    | 0.0045 |

Tonuchi & Onyebuchi (2019) also support the findings that found a long-run relationship between agriculture, manufacturing, and economic growth. In furtherance, Yusuff & Akinde (2015) revealed a positive long-run relationship between tourism

and economic growth in Nigeria. These findings show that agriculture, tourism, and manufacturing play a vital role in Nigeria's growth and development.

$$EC = LR GDP - (3.2002 * LAGR + 1.1163 * LMANU + 1.0789 * LTOUR + 39.3459)$$

**Table 4. ARDL Short Run Coefficients and Error Correction Mechanism**

| Variable           | Coefficient | Std. Error         | t-Statistic | Prob.    |
|--------------------|-------------|--------------------|-------------|----------|
| D(LRGDP(-1))       | 0.371953    | 0.103713           | 3.586361    | 0.0050   |
| D(LAGR)            | 0.988590    | 0.212593           | 4.650149    | 0.0009   |
| D(LAGR(-1))        | -0.645385   | 0.317152           | -2.034938   | 0.0692   |
| D(LMANU)           | 2.603542    | 0.437211           | 5.954886    | 0.0001   |
| D(LMANU(-1))       | 1.018973    | 0.567704           | 1.794902    | 0.1029   |
| D(LTOUR)           | -0.053128   | 0.224278           | -0.236885   | 0.8175   |
| D(LTOUR(-1))       | -0.724270   | 0.266563           | -2.717062   | 0.0217   |
| D(CointEq(-1)*)    | -0.591218   | 0.103897           | -5.690442   | 0.0002   |
| R-squared          | 0.908200    | Mean dependent var |             | 14.44091 |
| Adjusted R-squared | 0.862299    | S.D. dependent var |             | 9.597205 |

### Short-run Dynamic ARDL Model

Examining the model's short-run dynamics (see Table 4), the result shows that the collective impact of manufacturing, tourism, and agriculture on RGDP during the period under investigation is 90.8% (R-Squared 0.9082). This implies that about 91% variation in RGDP is explained by the independent variables employed in the model. The coefficient of AGR is 0.9896, which means that a unit change in the agriculture share on RGDP will cause a positive change of 0.99 units in the real GDP. The p-value of 0.0009 implies that agriculture has a significant relationship with RGDP in the short run. The previous lag value is negative and significant ( $b = -0.645$ ,  $P > 0.05$ ). Also, manufacturing has a positive significant short-run relationship with real GDP ( $b = 2.604$ ,  $P < 0.05$ ). This indicates that a unit change in manufacturing will cause a positive change 2.604 units in the RGDP. The relationship between tourism and economic growth in the short run is negative and statistically not significant ( $b = -0.0531$ ,  $P > 0.05$ ), and the relationship at the previous lag is also negative but significant ( $b = -0.724$ ,  $P < 0.05$ ). This shows that there is gradual progress in tourism in the long run.

**Table 5. Residual Diagnostic Test**

| Test               | F- statistic [df] (P-value) | Obs*R-squared [df] (P-value) |
|--------------------|-----------------------------|------------------------------|
| Serial Correlation | 0.9783 [2,8] (0.4168)       | 4.3231 [2] (0.1151)          |
| Heteroskedasticity | 1.1698 [11,10] (0.4061)     | 12.3796 [11] (0.3358)        |

Having estimated both the short and long run relationships among the variables, it imperative to measure the speed of adjustment from the short run to the long run using the ARDL error correction mechanism. ECM measures the adjustment towards the long-run equilibrium. Positive ECM indicates divergence, while negative shows convergence, which is desirable (Nkoro & Uko, 2016). The ECM value is negative (-0.5912) and statistically significant at a 5% level of significance ( $P < 0.05$ ). This implies that the speed of adjustment to long-run equilibrium is 59%. 59% of the disequilibrium in the previous period is being adjusted for in the current period.

**Table 6. Test for Normality**

| Statistics  | Value     |
|-------------|-----------|
| Mean        | -2.59e-14 |
| Median      | -0.294280 |
| Maximum     | 6.963972  |
| Minimum     | 5.206694  |
| Std. Dev.   | 2.907818  |
| Skewness    | 0.407385  |
| Kurtosis    | 2.792306  |
| Jarque-Bera | 0.648072  |
| Probability | 0.723224  |

### Post Estimation Test

Post estimation test was conducted on the residual (residual diagnostic test) to check for serial correlation, heteroskedasticity, and normality of the error (residual). The null hypothesis is stated as there is no serial correlation in the residual, no heteroskedasticity in the residual, and the error is normally distributed. The result, as presented in Table 5, shows that the probability values are more significant than the test level of significance ( $P > 0.05$ ) for both serial correlation (using Breusch-Godfrey serial correlation LM test) and heteroskedasticity (using Breusch-Pagan-Godfrey test). The results imply that the null hypothesis is not rejected. This means that there is no presence of serial correlation and heteroskedasticity. The result in Table 6 shows the Jarque-Bera statistic of 0.6481 and the  $P$ -value of 0.7232, which gives no evidence to reject the null hypothesis of normality of the residual.

### Conclusion

The study focused on ascertaining the contribution of the non-oil sector to Nigeria's economic growth since Nigeria's economy depends hugely on oil-dependent, thereby neglecting other sources of revenue and putting Nigeria at the risk of Dutch Disease. Findings revealed a positive and significant short and long-run relationship between agriculture and economic growth. Furthermore, manufacturing showed a positive

and significant relationship with economic growth in the short run but was positively insignificant in the long run. Also, tourism exhibited an insignificant negative relationship in the short run and a positive one in the long run, indicating a gradual growth process in the sector that can impact the economy if harnessed.

Findings from the study showed the importance of these sectors and the urge to improve the outputs from these sectors to aid in economic growth. To achieve this growth, diversification should be embraced with action such that macroeconomic policies geared toward harnessing the tourism sector's potentials should be introduced. Other recommendations include; a review and fortification of existing policies and incentives to support the non-oil sector's growth—secondly, an improvement in the budget allocation to sectors with the value chain to improve their output. Finally, investment incentives and packages, especially in the tourism sector, can be introduced to encourage investments in the economy's non-oil sector.

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## Government Stimulus Policy Effects to Foster Indonesia's Economic Growth: Evidence from Seventeen Years' Experience

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### Abstract

*We study the budget stimulus effects and government spending to help foster the recovery of Indonesia's current economic growth that was hit by the monetary crisis 1997 and 2008. Using government spending allocation policies through capital expenditures, infrastructure expenditures, financing through government debt, private debts, and increased productivity through export and import activities. This research provides to proves the extent to which macroeconomic variables could promote Indonesia's economic growth due to the crisis—using quantitative analysis of time series in the analysis of cointegration autoregressive distribution lag and bounds testing cointegration starting from 2001 Q4 to 2018q4 data. We can prove that in the short term, the most influential factor in economic growth is the first lag of the GDP growth itself; The first lag of exports, and the first lag of government spending and imports. However, some factors still negatively affect corruption control, government effectiveness, and government debt. While in the long term, government expenditure and imports still have a positive effect, but corruption control is still hurt GDP.*

### Keywords:

government spending, debt, export, import, control of corruption.

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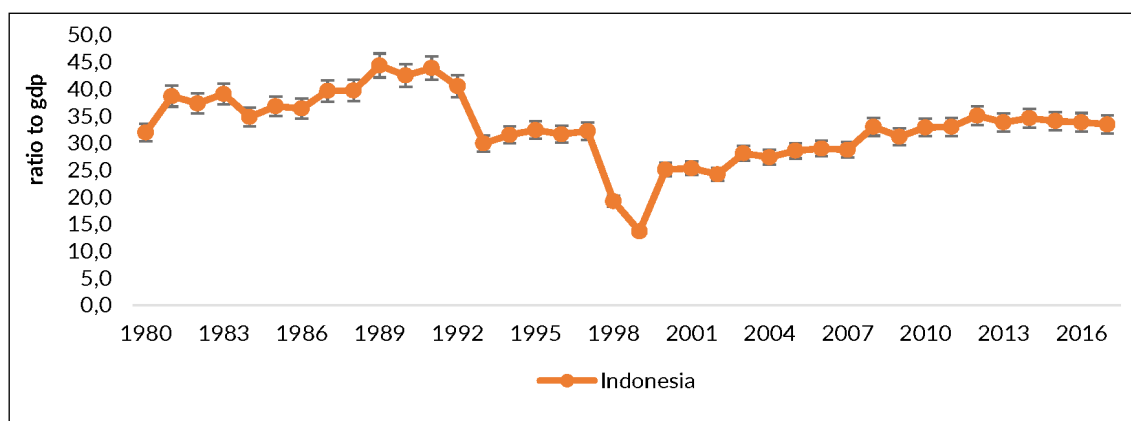
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## Introduction

In 2008-2009, Indonesia and other ASEAN countries experienced the U.S. financial crisis due to the subprime mortgage crisis after the previous year 1997 suffered a monetary crisis. The 2008-2009 financial crisis, in some cases, led to investment funds drawn from the United States to its home country to keep American banking liquidity, leading to the correction of economic and financial growth in countries with trade/Investment relations with the United States. The financial crisis is also not only in Southeast Asia but also in the European Monetary Union member states due to increasing government budgeting levels, and the accumulation of government debt levels began to impact private investments negatively (Afonso & Aubyn, 2019).

As a public finance manager, the Ministry of finance started doing efficiency programs with reduced spending, increasing infrastructure budgets to improve public services. However, on the other hand, the government cannot do to raise the income from taxation to keep the stability of the economy (tax cut policy) and give private sector stimuli like subsidy and social security programs to recover again (see Dawson, 2006; Spilimbergo et al., 2008).

Figure 1. National account, expenditure, Gross Capital Formation GDP, to GDP Percent



From some of the explanations above, the study tried to explain the empirical evidence and linkage between government spending, capital expenditure, and infrastructure spending. With the government's role in increasing inclusive growth because it has driven by a stimulus financial policy of government through three lanes: first economic infrastructure through four ministries/institutions, among others, Ministry PUPR, Ministry of Transportation, Ministry of ESDM, Non-Ministries/institutions, transfer to regional and financing. Secondly, through the social infrastructure of the Ministry of Education and Culture, the Ministry of Religion, and the third infrastructure support through BPN and the Ministry of Industry. We assume that increasing capital and infrastructure spending and government debt can improve capital formation to increase investment that will excite the business sector that can increase economic growth because it raises value-added.

According to Greene & Villanueva (1991), public sector investment in developing countries is a positive function of government investment level trend, reflected in sector investment Infrastructure. Furthermore, they also argue long-run complementary of private to public sector investment but in short-run substitutability (public sector investment appears to crowd out private sector investment).

To see the implications of some of the above views, the author investigates some of what things can improve private investment. According to Aizenman & Marion (1993), high uncertainty in finance led to the decline of private investment in developing countries. Instead, according to Erenburg (1993), Private investments in the United States increased with increased private sector spending capacity. Also, the declining interest rates and net capital inflows from overseas developing countries would increase private investments, so they also advise if there is crowding out caused by government investment. It is necessary to enforce a ceiling on the banking system credit and net capital inflow to avoid the adverse effects of expansionary demand policies that result from the crowding out of private investment.

We also compare the implementation of a private capital role enhancement policy in some developed countries. Voss (2002) determines behavior in conducting private and government investments in developed countries in the United States and Canada. It is challenging to explain complementary functions among public and private investments; But, in terms of public investment, innovations tend to follow private investments. Furthermore, Korean countries' experience can have seen that through research Deok-Ki Kim & Seo (2003), by analyzing the relationship between FDI, economic growth, and domestic investment. They found that FDI significantly affected domestic investment and economic growth; they also found that increasing domestic investment tends to cause FDI outflow. On the other hand, add the findings Deok-Ki Kim & Seo (2003); otherwise, according to FDI, FDI will re-enter due to the significant factor of foreign capital or capital reserves, labor wages, and skilled workers' land availability.

To explain the development application of growth theory of the last five years, we tried to understand and measure the linkage between public and private investments to increase economic growth is crucial for developed and developing countries. Public investment is a part of public expenditure (usually calculated in allocating government budgets, e.g., capital expenditure and infrastructure spending) and economic decisions taken within the broader general financial framework.

At the same time, private capital is an addition to public capital. Public capital, together with private and human capital, labor, and technology, is a function of production factors/Cobb Douglas function. Public investment can have linked to the growth outlook, but according to the literature, differentiated between public capital and private capital influences both macroeconomic variables. The growth of private capital will always bring positive growth because of market efficiency and competition (Afonso & Aubyn, 2019). However, on the other side of public capital in its implementation may be less efficient and effective, less competitive, and socially patterned so that it can be less competitive

with private capital and foreign capital, see also Dreger & Reimers (2016) and Cavalcanti et al. (2014). Public Investment in Indonesia has been made in several ways, such as capital expenditure and infrastructure expenditure.

Here are the results we have summarized some of the research in several countries and regions, developed and developing countries for the last five years in advance with the government spending function used to increase economic growth and Increase private investment.

The results of a summary of several previous empirical research in the last five years can have taken the following conclusions: Starting from Akram (2015) research that states to increase real GDP can use domestic debt but must have kept at a certain level to be sustainable. Further research on Zhang (2015) added that to increase productivity in the field of agriculture needs to has developed public investment, research and development on the other hand also open the market's most extensive and open investments to be able to foreign knowledge spillovers that are important to the developing world. The same year Sabry (2015) advised that the government increases bureaucratic efficiency and independence and higher regulatory quality to increase GDP.

Adding from previous research results in 2015, Amidu (2016) found that the degree of investment directed through person and institution into private housing is key to reducing financial volatility. Furthermore, Sasmal (2016) mentions the success of public expenditure on the improvement of CPMI, such as road, irrigation, power, transport, and communication, is higher; per capita earnings are also additionally greater. Public investments are more likely to increase growth than current public expenditure.

Further research results in the year 2017-2019 as follows Murova (2017) and Khanna & Sharma (2018) start by looking at that to increase the growth is by increasing the effectiveness of the public area. Nguyen (2018) said the government is raising the capital stock. Da Rocha & Saes (2018) recounted Brazil's success, attracting private agents to invest in transportation infrastructure. Furthermore, complementing Da Rocha & Saes (2018) found that financing in roads, energy, and telecom sectors have the maximum positive impact on the GDP. Sabir (2019) also says that the level of growth needs to be done by restructuring taxation and incentive for business people to create new employment. Amusa (2019) added to increase productive spending and good governance, but on the other hand, Scott-Joseph & Turner (2019) also reminded governments related to government debt could increase government costs and diminishing income sources.

The economic growth rate should increase so that the tax ratio for government budgets also increases and vice versa. To learn how GDP increases, we first studied the dynamic effects of government spending in capital expenditure and infrastructure expenditures, private debts, export and import values in encouraging increased GDP growth from the aggregate side of demand.

The rate of economic growth should increase with the increase in government debt, whether the government debt used to provide infrastructure (public goods) is still at a safe level or even burdening the country's finances. Furthermore, importation activities

have been carried out to transfer the latest technology that is a condition of endogenous economic growth according to Romer (1994) in the medium and long term. Whether the effect on productivity increases, whether the value of exports can grow following the trade balance deficit or only in consumption alone without any increase in added value, then whether the existing bureaucracy has been efficient and accountable in managing its finances.

This study combines macroeconomic indicators and governance quality indicators included in one research model that has never been done before. Economic growth was driven from within by advancing human capital in the field of research and development, and increasing the role of the government in providing public goods that can help ease business, entrepreneurship, create job opportunities and increase investment. We first studied the dynamic effects of government spending in the form of capital expenditures and government infrastructure expenditures, government and private debt, the value of exports and imports included in the equation to answer whether macroeconomic variables have impacted the increase in economic growth as conveyed by Romer. Additionally, we also study incorporate data control on corruption (COC) as the instrument (moderating variables) carried out by the government to promote targeted economic growth because corruption can cause lowering public investment and then lowering economic growth Mauro (1995).

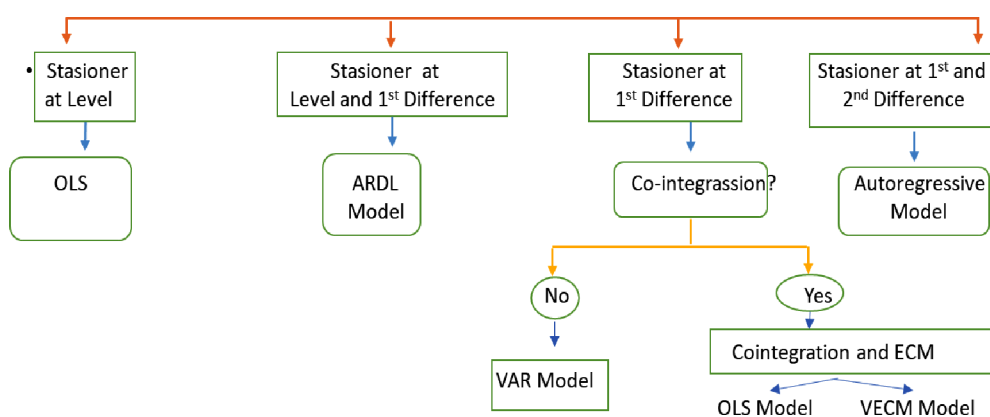
## Method

This study uses an estimation method through the ARDL cointegration analysis from the previous research. We use the development variable theory of earlier studies that have been conducted by Nguyen (2018), Akram (2015), Amusa (2019), Scott-Joseph & Turner (2019), Ning et al. (2019), Sasmal (2016), Atabaev et al. (2018), and Muthu (2017). Macro variables with time-series data generally have stationary problems, so cointegration analysis is used to anticipate this. More specifically, this study uses the Bounds Testing Cointegration method with ARDL approach to the advantage that this method does not matter the variables in the model: I (0) or I (1). Tests conducted by Pesaran et al. (2001) showed that the ARDL approach would produce estimates consistent with long-term coefficients that are asymptotically normal, even if the explanatory variables or regressors are already I (0) or I (1).

The first step to proving the effect of independent variables on our dependents is analyzed using ordinary OLS. Still, because some data time series is not stationary at the data level, we need an error correction model for short-term effects and continued cointegration tests to see the long-term relationship. There are three procedures in conducting the test: Data stationary Test (Unit Root Test, test cointegration, and forming error correction model from the residual equation cointegration. The ARDL approach of Pesaran et al. (2001) shows that the ARDL approach will generate estimates consistent with long-term coefficients. However, the details or Regressor variables are already I (0) or I (1). Estimating and identifying ARDL models can use Ordinary Least Square (OLS) when the ARDL order has been determined.

In this paper, we contribute to applying the literature using ARDL analysis using the Ministry of finance data, Federal Reserve Bank of St. Louis, and World Government Indicator between 2002q4 and 2018q4 to generate the influencing factors as well as the impact values. In that context, we also calculate the return on public and private macroeconomic investments and assess the potential effects of 2008 before and after the economic and financial crisis, by comparison with the earlier shorter time-period research, which got after the crisis. In practice, we deal with investments in conventional private investment goods conducted by the public sector (or, more specifically, the government) or the private sector).

Figure 2. Estimation Model Based on Stationarity Test



Source: Shrestha et al. (2018)

There are critical issues used to develop hypotheses. Whether government spending through capital expenditure and infrastructure expenditure (LNGOVEXP) has driven by an inclusive financial policy of government through three lanes are significant towards capital formation in economic development that has reflected an increase in GDP, for increasing GDP was also did by private participation in the form of capital and debt both domestically and internationally. Of course, the entire government and private programs are Government effectiveness of bureaucracy (LNGE) and corruption control (LNCOC), So we also include both variables. Based on the above exposure the ARDL equation used in this study was " $Y_t = \beta_0 + \beta_1 y_{t-1} + \dots + \beta_k y_{t-p} + \alpha_0 x_t + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \dots + \alpha_q x_{t-q} + \varepsilon_t$ ", where  $\varepsilon_t$  is a random "disturbance" term.

## Results and Discussion

The study ADF test at the level and first Difference of the variables to check the stationary level of data series. The unit root test results, given in Table 1, show that both variables are non-stationary at their levels but stationary at their first Difference. The process of processing the following research data is to know cointegration on the model using the ARDL Bound test method. The determination of the level of cointegration has done with the condition of critical value bounds, according to Pesaran

et al. (2001). Before estimating the ARDL model, it takes several diagnostic tests to allow the estimated ARDL model to have spared from the breach of the correlation assumptions, the specification of the function (specification error), normality, and heteroskedasticity (heteroscedasticity).

If the model has spared from the problem of best ARDL model, with optimal lag, selected based on Akaike Info Criterion (AIC) with the results of the best research model is ARDL (1, 1, 1, 1, 1, 0, 1, 0). Based on the AIC selection, the best ARDL model for the research model with a value of R-Squared Adjusted of 99.9% is the variable variation bound LNGDP can have explained by each of the independent variables of the selected ARDL model. Table 2 shows the result of the ARDL equation for the variable examined.

**Table 1. The Result of Stationary Test**

| Series    | P-Value on the data level | 1 <sup>st</sup> Difference |
|-----------|---------------------------|----------------------------|
| LNGDP     | 0.2057                    | 0.0000                     |
| LNEXP     | 0.565                     | 0.0000                     |
| LNDOMDEBT | 0.6035                    | 0.0000                     |
| LNCOC     | 0.1375                    | 0.0000                     |
| LNGE      | 0.3788                    | 0.0000                     |
| LNGOVDEBT | 0.5266                    | 0.0000                     |
| LNGOVEXP  | 0.1349                    | 0.0000                     |
| LNIMP     | 0.3964                    | 0.0000                     |

From the short-term ARDL forecast results, we can see that the most potent influence of macroeconomic variables in this study is the first lag of GDP itself, which positively impacts current GDP increases. It can be interpreted that the increase of economic growth by 1% in the previous quarter had a positive and significant impact on the current aggregate GDP of 0.31%. The findings are following the research results by (Ning et al., 2019). Furthermore, this model can also explain some critical variables and GDP that is Variable LNEXP (-1), which has a significant positive impact of 0.029%. However, LNCOC (-1) has a negative effect by-0.025%, and these results were incompatible with the research results by Azam et al. (2017) and Mauro (1995). Government debts, LNGOVDEBT (-1), also had a negative impact of-0076%, in line with research Scott-Joseph & Turner (2019). Government expenditure, LNGOVEXP (-1), has a positive impact of 0.0014% in increasing growth in line with research results by Amusa (2019), Sasmal (2016), Scott-Joseph & Turner (2019), Chotia (2018), da Rocha & Saes (2018), the imported variable (LNIMP) has a positive impact of 0.022% in line with the Dawson (2006) research results.

Table 2. ARDL test result model, selected with ARDL (1, 1, 1, 1, 1, 0, 1, 0)

| Variable       | Coefficient | Std. Error | t-Statistic | Prob.* |
|----------------|-------------|------------|-------------|--------|
| LNGDP (-1)     | 0.311970    | 0.097665   | 3.194267    | 0.0024 |
| LNEXP          | -0.017467   | 0.012697   | -1.375677   | 0.1747 |
| LNEXP (-1)     | 0.029279    | 0.010173   | 2.878190    | 0.0058 |
| LNDOMDEBT      | -0.003521   | 0.026403   | -0.133365   | 0.8944 |
| LNDOMDEBT (-1) | 0.037758    | 0.023780   | 1.587819    | 0.1183 |
| LNCOC          | 0.013692    | 0.010276   | 1.332496    | 0.1884 |
| LNCOC (-1)     | -0.025563   | 0.011535   | -2.216036   | 0.0310 |
| LNGOVDEBT      | 0.038169    | 0.033790   | 1.129575    | 0.2637 |
| LNGOVDEBT (-1) | -0.076733   | 0.031318   | -2.450124   | 0.0176 |
| LNGE           | -0.015102   | 0.014008   | -1.078131   | 0.2859 |
| LNGOVEXP       | 0.001086    | 0.000668   | 1.624881    | 0.1101 |
| LNGOVEXP (-1)  | 0.001443    | 0.000630   | 2.291957    | 0.0259 |
| LNIMP          | 0.022014    | 0.006540   | 3.366291    | 0.0014 |
| C              | 22.67361    | 3.197932   | 7.090085    | 0.0000 |
| @TREND         | 0.008286    | 0.001173   | 7.065364    | 0.0000 |

Next, we see the long-term estimated result of this ARDL model. The first step to determining the long-term estimate is to use the Akaike information criterion (Top 20 models) available in Figure 2. The best value of the model is at the AIC score -7.927436 with ARDL (1, 1, 1, 1, 1, 0, 1, 0), which is suitable for lag one fit to be used for all variables.

The next step is doing a bound test. A fundamental assumption for the ARDL Bounds Testing approach is that the estimation model's errors must be serially independent and model dynamically stable. Diagnostic checks verify that the model is no longer serially correlated and is also dynamically stable. Tests of serial correlation have been conducted using the Breusch-Godfrey LM TEST, while the CUSUM test was used to verify the stability of the model. Based on these diagnostic tests' suitable outcomes, we proceed with the estimation of the long-run equilibrium relations among the variables.

Figure 2. Akaike Information Criteria

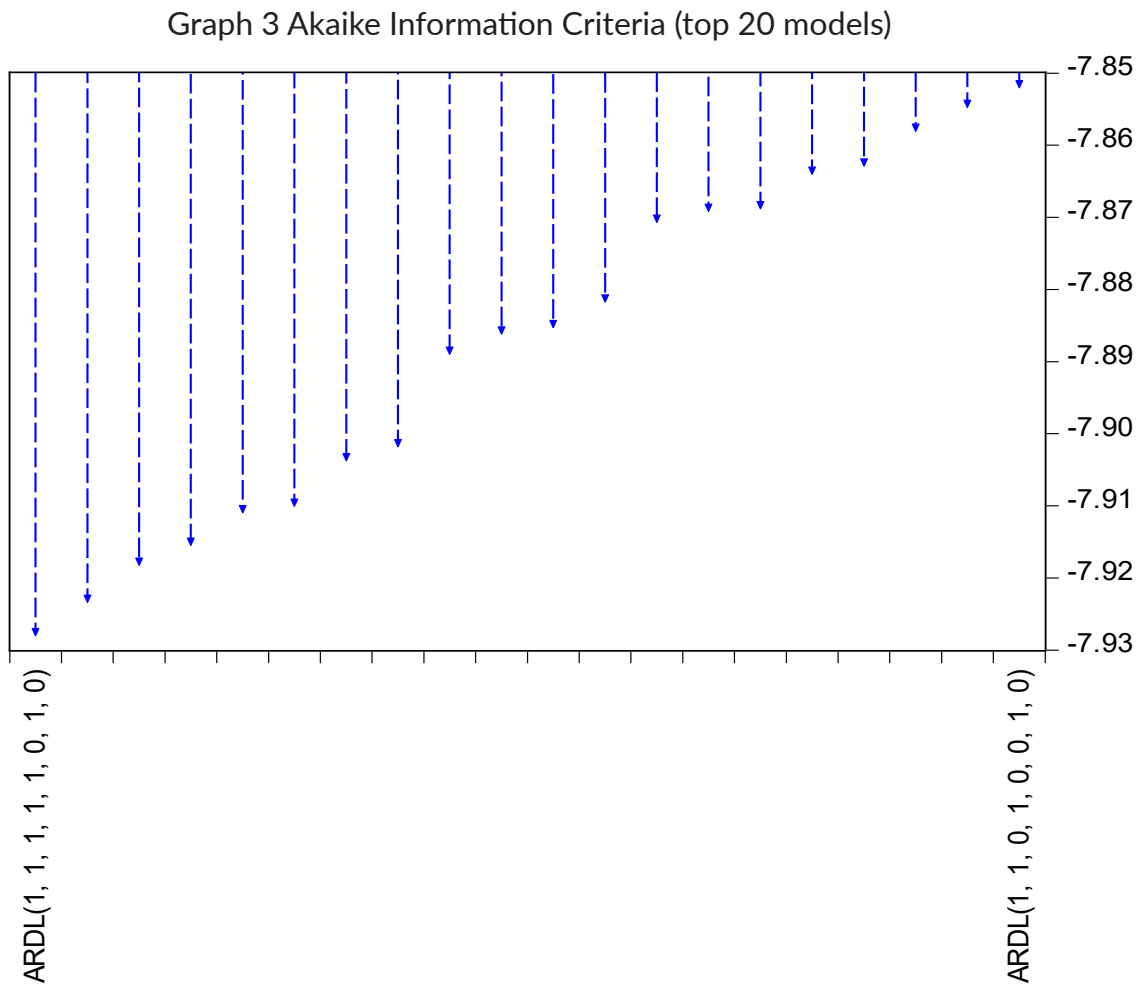


Table 3. Bound Test Result

| F-Bounds Test  |          | Null Hypothesis: No levels relationship |      |      |
|----------------|----------|-----------------------------------------|------|------|
| Test Statistic | Value    | Sig.                                    | I(0) | I(1) |
| F-statistic    | 8.985904 | 10%                                     | 1.92 | 2.89 |
| k              | 7        | 5%                                      | 2.17 | 3.21 |
|                |          | 2.5%                                    | 2.43 | 3.51 |
|                |          | 1%                                      | 2.73 | 3.9  |

The F-Statistic value test proves that the F-Statistic value is 8.985904, much higher than the upper (3,9) and lower bound (2,73) test at =1% it can have concluded there is cointegration between research variables (see Table 3). The next stage is a series of basis for analysis, while some problems in the violation of OLS assumptions include: Serial correlation, heteroskedasticity test, CUSUM test as follows, and error correction form (EC) coefficient diagnostic.

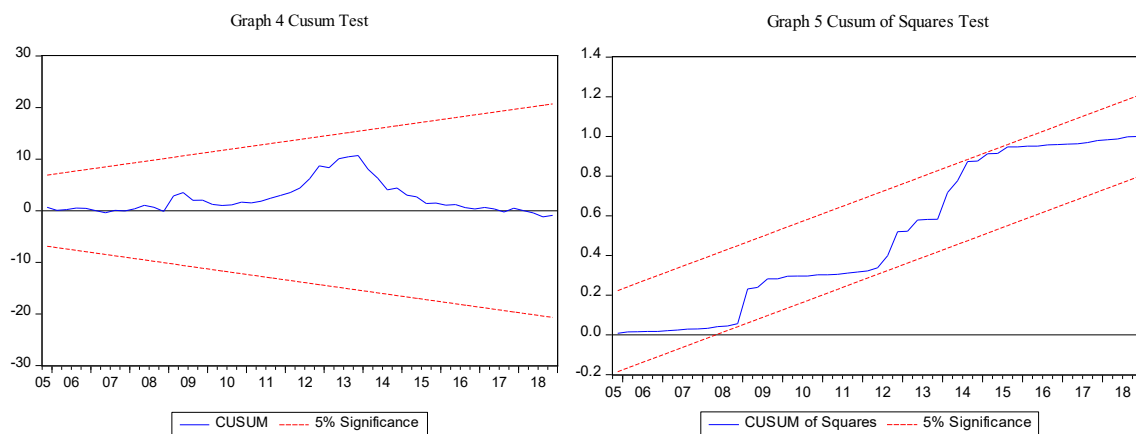
From the Breusch-Godfrey Serial Correlation LM Test results in Table 4, it can have interpreted that the probability of the occurrence of a serial Correlated is not significant, so we accept the null hypothesis (there is no serial correlation), so that the ARDL equation can be declared free of serial correlation. The next requirement is to investigate whether the model is free from heteroskedasticity symptoms using the Breusch-Pagan-Godfrey Heteroskedasticity Test. Based on the ARDL model results, it was obtained insignificant P-value results at =5% so that it can have declared the model does not occur heteroskedasticity symptoms.

**Table 4. Results of Autocorrelation and Heteroskedasticity Test**

| Breusch-Godfrey Serial Correlation LM Test     |          |                       |        |
|------------------------------------------------|----------|-----------------------|--------|
| F-statistic                                    | 0.793070 | Prob. F (1,52)        | 0.3773 |
| Obs*R-squared                                  | 1.021512 | Prob. Chi-Square (1)  | 0.3122 |
| Heteroskedasticity Test: Breusch-Pagan-Godfrey |          |                       |        |
| F-statistic                                    | 1.720968 | Prob. F (14,53)       | 0.0789 |
| Obs*R-squared                                  | 21.25160 | Prob. Chi-Square (14) | 0.0954 |
| Scaled explained SS                            | 17.04997 | Prob. Chi-Square (14) | 0.2535 |

To test the model with the stable condition, we have also tested CUSUM and the CUSUM Squares test with the model's results declared stable in the range of numbers below =5% as Figure 3.

**Figure 3. Cusum Test and Cusum of Squares Test**



The next stage is seeing the results of Long-term estimate ARDL using coefficient diagnostics (see Table 5). Cointegration and long run form with LONG term EC equations =  $LNGDP - (0.0172 * LNEXP + 0.0498 * LNDOMDEBT - 0.0173 * LNCOC - 0.0561 * LNGOVDEBT - 0.0219 * LNGE + 0.0037 * LNGOVEXP + 0.0320 * LNIMP)$  results as follows:

**Table 5. Long-Term Estimated Results Using Coefficient Diagnostics**

| Variable  | Coefficient | Std. Error | t-Statistic | Prob.  |
|-----------|-------------|------------|-------------|--------|
| LNEXP     | 0.017167    | 0.017405   | 0.986353    | 0.3284 |
| LNDOMDEBT | 0.049761    | 0.030447   | 1.634337    | 0.1081 |
| LNCOC     | -0.017253   | 0.006169   | -2.796792   | 0.0072 |
| LNGOVDEBT | -0.056050   | 0.037636   | -1.489290   | 0.1423 |
| LNGE      | -0.021950   | 0.019372   | -1.133059   | 0.2623 |
| LNGOVEXP  | 0.003676    | 0.001332   | 2.760202    | 0.0079 |
| LNIMP     | 0.031996    | 0.009010   | 3.551061    | 0.0008 |

From the results of the model in Table 5, the estimation can have noted that only the LNCOC variable has a negative and significant effect on GDP of -0.017%. The other variables such as LNGOVEXP, and LNIMP have a have an enormous impact with the coefficient of every 0.0036% and 0.031% of the extent of 1% GDP. While variables LNEXP, LNDOMDEBT, LNGOVDEBT, LNGE no significant effect on the long-term period. The final stage in the analysis and discussion using the ARDL model specifies error correction form (EC) coefficient diagnostic. The calculation result of our model related EC is negative 0.688030, which means imply that deviation from the long-term growth rate in the GDP rate is corrected by 0.68% by following a period.

## Conclusion

In Indonesia's context, in the period 2002q4 to 2018q4, in the condition of short-term, most influential factor runs of economic growth supported by the first lag GDP itself. In addition to increasing economic growth, the first lag export and government expenditures are also playing an essential role with significant effect. However, several factors are also significant but have a negative effect; the factor controls corruption and government debt. Control of corruption has probably not had positively responded, and the magnitude of government debt can also reduce economic growth because there are debt and interest burdens must have paid. While the long-term control of corruption is still correlated negatively and significantly, government spending still has a positive and significant effect. On the other hand, import has a positive significant coefficient effect on the long-term response to GDP.

Finally, according to the research results, researchers can advise the government to increase the budget of its infrastructure spending even by not increasing the amount of debt significantly and raising the tax. That program could have done by increasing domestic and foreign capital participation in an export-oriented industrialization program by utilizing the spillover from the technology of foreign financier companies. This policy may be successful for an extended period because there are capital placement and increased

workforce capacity. However, on the other end of the industrialization process, economic growth improves so that governments get a significant return on tax amount and can ultimately reduce the amount of domestic and government debt because, In the long term, it is bad for economic growth.

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## Could Palm Oil Plantation Increase Individual Expenditure? The Dutch Disease Implication in Indonesia

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**Abstract**

*Indonesia is the largest palm-oil producing country, covering almost 80 percent of global production. With the extensive production capacity, this research seeks to analyze the linkages between palm oil production and its impact on the economy by the individual monthly expenditure. To reveal the connections, this research analyzes the Dutch Disease phenomenon in Indonesia, which explains how the non-tradable sector, palm-oil industry, affects the tradable sector like the manufacturing industry. The panel data variables are selected from 2011 to 2015 within 22 provinces to see the Dutch Disease's implications. As the model is suffered from the endogeneity, the correlation of explanatory variables with the error term, the research uses the Instrumental-Variable Regression method. The analysis indicates that Indonesia was not suffered from Dutch Disease. Therefore, palm oil production could increase individual expenditure. Finally, the extension of palm oil plantations could benefit Indonesia's economy without affecting other sectors.*

**Keywords:**

individual expenditure, manufacture to service ratio, natural-resource abundance, palm oil production, the Dutch disease.

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## Introduction

Palm oil plantation is one of the success stories in Indonesia's economic growth. It can increase the farmers' incomes, regional economic development, government revenue and generate foreign exchange, *ceteris paribus*. Data finds that the \$39 billion of GDP benefits are attributable to palm oil exports, representing 2.9 million jobs worldwide (Vivek, 2019). Indonesia's situation is not much different from the world economic situation, which absorbs 8.4 million workers. It has increased four times compared to data in 2000 (PASPI, 2015). In terms of domestic consumption, because most Palm Oil is intended for export, Indonesia can enjoy up to 25 percent every year. As a major oil producer, Indonesia can also enjoy high economic growth and a controlled level of rupiah stability (Aprina, 2014).

Following the positive impact of Palm Oil production, many studies indicate that Indonesia is currently facing the Dutch Disease issue. The disease arises from a resource boom, which increases spending on non-tradable sectors disproportionately. With increased demand and opportunities in these sectors, workers leave tradable sectors like manufacturing. Thus, production in the decline of the tradable sector is not necessarily because they are costly but because they are not a priority in the short run. Consequently, labor that could develop the manufacturing sector is pulled into the service sector, and manufactured goods become more likely to be imported. Moreover, because manufacturing is more prone to learning and production process improvements, the potential gains in productivity accrue to foreign exporters. As a result, once the resource is diminished, there is less income to purchase the services, and, thus, the resource find can generate economic stagnation (Behzadan et al., 2017).

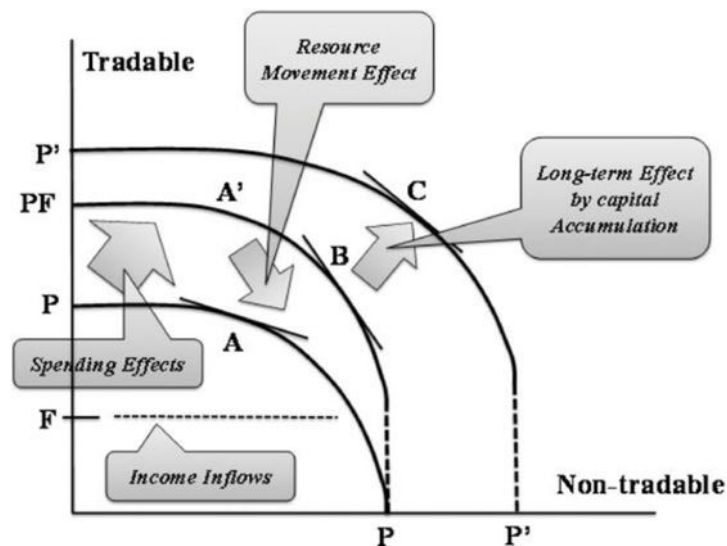
The first seed of palm oil was brought from West Africa by the Dutch colonialization and first planted on Bogor Botanical Garden in 1848. Faced with a steadily increasing population and poverty in Java, specifically, which at that time had the highest population densities in the world), the colonizers started to implement the "Kolonisatie Program" from 1905. Under this program, landless people from the island were forced to move to a less populated area, like Borneo and Sumatera. Besides reducing the population pressure on Java, the program aimed to utilize the labor to develop food-crop production in the designated provinces. The program, called the Dutch Moral Duty, can alleviate poverty in Java and secure rice supply on Java and Sumatera (Baudoin et al., 2017).

Meanwhile, Indonesia experienced a natural business cycle following the current governmental system. Each president had different concerns due to government priorities on various issues, such as what happened after the reform era. There was social unrest caused not only by the crisis but also by older grievances. The government faced a lack of clarity in its new regulation concerning export taxes, sales of new concessions, and business development hampered investment and proved detrimental to the companies. This confusion caused the palm oil industry's performance to start plummeting (Baudoin et al., 2017). The government responded by a drastic change in its industrial strategy, moving from a heavy intervention policy toward more indirect action. This shows the

government's commitment to move away from controlling the companies, providing them with funds, land grants, and regulating exchange rates focusing instead on a 'partnership' approach in which it would "shape outcomes by establishing a regulatory framework and by providing the institutional context" (McCarthy, 2010).

The changing of the governmental system in Indonesia has a significant effect on palm oil production. This has direct implications for the presence of Dutch disease in Indonesia. The disease first occurred in the Netherlands in the 1960s. At the time, the Netherlands had discovered substantial natural gas deposits in the Northern Sea. In 1977, The Economists magazine introduced it as a negative impact on a country's economy. Because of substantial natural gas deposit discovery, the Netherlands could receive large inflows of foreign income. It seemed to benefit the country's economy, but it only applied in the short term. When the Netherlands received large inflows of foreign income, accompanying financial risks such as boom-bust cycles for domestic economies and causing currency appreciation deteriorated tradable sectors' competitiveness. Assuming other variables are fixed, it is directly responsible for the sluggishness of the manufacturing sector. The SalterSwanCordenDornbusch model provided the theoretical framework for describing the Dutch Disease effect of 'capital inflows' in small open economies. The model has been applied to examine the economic impacts of foreign aids and emigrant remittances, and natural resource exports since they constitute the significant capital inflow elements (Taguchi & Khinsamone, 2018).

Figure 1. The Theoretical Framework for Dutch Disease



Source: Taguchi & Khinsamone (2018)

From the curve, the horizontal axis exhibits non-tradable while the vertical one shows the tradable allocation. The initial transformation of the non-tradable and tradable curve represents by the P-P curve. A is the initial equilibrium as the relative price of non-tradable and tradable, fixed at that point (Brahmbhatt et al., 2010). It assumes

three sectors: the natural resources sector, the non-resource tradable sector (agriculture and manufacturing), and the non-tradable sector (services and construction). The prices for both the natural resources sector and non-resource tradable sectors are set in the world market, and those in the non-tradable sector are set in the origin economy. Generally, there are two types of effects leading to Dutch Disease. First, The Spending Effect (P-PF) comes with the introduction of substantial natural resources, which will increase the domestic income, which leads to higher aggregate demand and spending by the public and private sector. Increased demand for the non-tradable sector leads to higher prices and output in the non-tradable sector. Therefore, wages in the economy will tend to rise, squeezing profits in the non-resource tradable sector, manufacturing, where prices are fixed at international levels. This effect is referred to as an appreciation of the exchange rate.

*Second*, the Resource Movement Effect ( $A' - B$ ) occurs when a boom in the natural resource sector attracts capital and labor from other parts of the economy. It tends to reduce output in the rest of the economy. Reduced output in the non-tradable sector causes the price of non-tradable to rise relative to the price of tradable, which are set by the world market. This effect is less likely in low-income economies, where most inputs used in the natural resource “enclave” are imported from abroad.

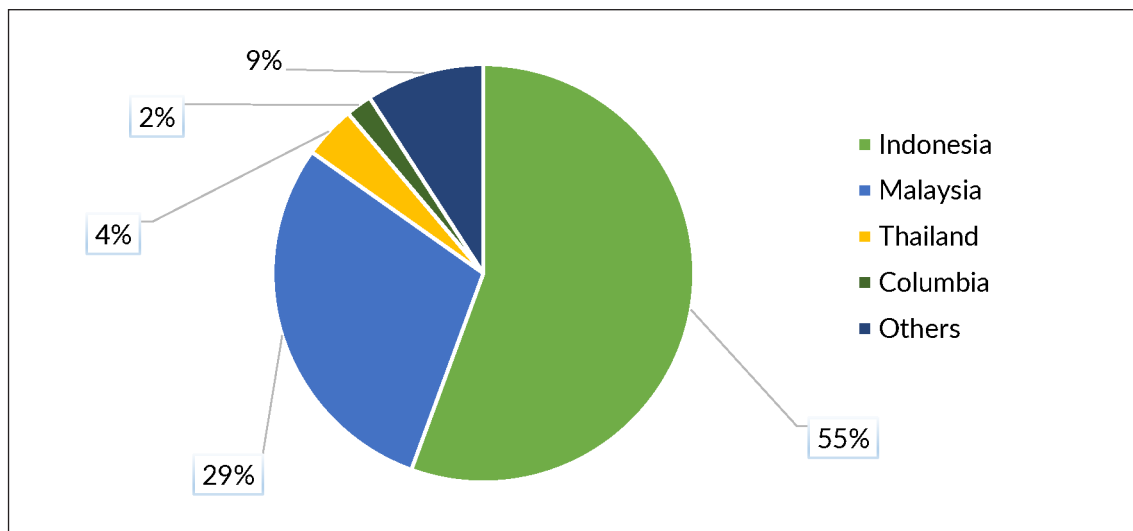
The effects result in a fall of the output share of non-resource tradable relative to the non-tradable. The rising non-tradable prices are relative to the tradable, which initiates the real exchange rate (Taguchi & Khinsamone, 2018). Experience from non-tradable booms worldwide, which supports the claims that in-resource abundant economies. Natural Capital appears to crowd out human capital, thereby slowing down the pace of economic development. There are two parts to support the statement: the income flows lower return to existing human capital, resulting in the absence of countervailing policies and reduces incentives to invest in new human capital. In the longer term, if this change of the human capital demand persists, then individuals currently in the education system will perceive that both the skill premium, the net earnings differential attributable to additional schooling, and the probability of a skilled job have fallen. On average, these will provide incentives to acquire skills through schooling (Coxhead & Shrestha, 2016).

In addition to the disease, figure 1 also describes how to manage the disease by taking a longer-term perspective. It considers the role of capital accumulation, which indicated the shift of the transformation curve further towards  $P'-P'$  when an economy utilized capital inflows for domestic capital accumulation. As a result, the relative price of non-tradable might be expected to fall from point B to point C, thereby facilitating the tradable sector's recovery. Thus, the capital accumulation effect can mitigate the economic damages caused by the original Dutch Disease effect (Taguchi & Khinsamone, 2018).

Figure 2 suggests that Indonesia is the largest palm oil-producing country in the world. Based on the data, Indonesia can compete with Malaysia in 2008 as the country with the biggest palm oil producer. Both countries controlled almost 86 percent of

world palm oil production in 2013. In the same year, the volume of exports of oil and palm oil derivative products in Indonesia was 20.8 million tons or 48 percent of the palm oil trade International, on the other hand, Malaysia exported 18,2 million tons or 42 percent of international palm oil trade value (Choong & McKay, 2014). Over 90 percent of Indonesia's vegetable oil used for food comes from palm oil, leaving very little to the coconut oil (or other oil) replaced in Indonesian diets. Any increases in palm-oil consumption come from higher overall vegetable-oil consumption rather than substitution. Substitution among vegetable oils accounted for half of Indonesia's growth in palm-oil consumption (Gaskell, 2015). As a superior plantation product, palm oil is experiencing increased production annually. On average, one of the affected industries, the Cooking oil industry, can absorb about 80 percent of the total national Crude Palm Oil (CPO) consumption.

Figure 2. The World's Five Largest Palm Oil Producer 2017



Source: USDA Foreign Agricultural Service

This study is focused on looking for the implication of the Dutch disease in Indonesia. As the theoretical explanation about the disease, usually, natural resources play an essential role. One of them is the Palm Oil sector. Simultaneously, many previous studies analyzed the implication of the Dutch Disease or the palm oil plantation effect, especially on poverty and employment, partially. Therefore, the study aims to find the palm oil plantation effect on individual monthly expenditure as the Dutch disease's implication. The research focuses on the disease is on the resource movement effect (Edwards, 2015). This research analyses the current situation of palm oil production, which is related to individual expenditure. Many previous studies analyzed the impact of palm oil production on the environment and economy, especially poverty. However, the research hypothesis is that the more palm oil manufactured could increase the level of expenditure. It can be considered in 2 scenarios. First, Indonesia's contribution to the palm oil supply chain increases the palm oil smallholders' income and the government

or cooperation labor expenditure. Second, as palm oil production increases, the higher percentage of domestic consumption on palm oil products.

## Method

The data is collected from 22 provinces in Indonesia. The remainder 12 provinces are not included since there is no palm oil production data in 11 provinces, while the other 1, North Kalimantan, was a new province of Indonesia in 2012. All variables obtain from 2011 to 2015 because there is a predicament with the Central Bureau of Statistics data of Palm Oil production in 2016. As this study mentions the individual monthly expenditure, the variable represents a household member's social and economic situation. The relative conceptual and measurement advantages of using the variable are relatively more stable over time, as households tend to smooth out their consumption, and so is a better measure of living standards. It is also easier to understand conceptually and less sensitive and probably more accurately measured (Bui et al., 2014).

The source of monthly per-capita expenditure is from the Central Bureau of Statistics of Indonesia (Badan Pusat Statistika) as the series of Average expenditure per capita per month in urban and rural areas by province and group of goods (rupiah), 2011-2018. The source of palm oil production is from Tree Crop Estate Statistics of Indonesia Publication - Ministry of Agriculture as the Palm Oil Statistics series. The Monthly Per Capita Household Education and health expenditure source, primary, junior, senior secondary net enrollment ratio, and employment rate on Agriculture, fishery, and forestry sectors are from the INDODAPOER (Indonesia Database for Policy and Economic Research) of World Bank Database. The employment rate in agriculture, fishery, and forestry is derived by dividing the number of people employed in Agriculture, Fishery, and Forestry by the labor force. The last variable is the manufacturing-service ratio. This variable is introduced as a proxy of tradable non-tradable production ratio for identifying the 'resource movement effect' in the Dutch Disease theory. The manufacturing services ratio is derived by dividing 'manufacturing in the value-added term' by 'services in value-added one,' both retrieved from the INDODAPOER (Indonesia Database for Policy and Economic Research) of the World Bank Database.

The employment rate in agriculture, fishery, and forestry is derived by dividing the number of people employed in Agriculture, Fishery, and Forestry by the labor force. The last variable is the manufacturing-service ratio. This variable is introduced as a proxy of tradable non-tradable production ratio for identifying the 'resource movement effect' in the Dutch Disease theory. The manufacturingservices ratio is derived by dividing 'manufacturing in the value-added term' by 'services in value-added one,' both retrieved from the INDODAPOER (Indonesia Database for Policy and Economic Research) of World Bank Database. Next is to choose a proper data estimation model. First, the research uses the Breusch-Pagan test of Random-effects against Pooled – Ordinary Least Square (PLS). As a result, shows the null hypothesis of pool ability is rejected. This means that there is no within-unit correlation. Hence, the result suggests the use of a Random-effect model.

**Table 1. Breusch-Pagan, Chow, and Hausman test**

| Period      | Breusch – Pagan Test: $\chi^2$ | Chow test: F | Hausman test: $\chi^2$ |
|-------------|--------------------------------|--------------|------------------------|
| 2011 – 2015 | 0.000                          | 0.000        | 0.000                  |

Source: Data processin

Second, the chow test is run to choose between pooling and fixed-effect models. The result shows that the null hypothesis is rejected, which means that the research uses a fixed-effects model. Since one test suggests using a random-effects model and the other test suggests using the fixed-effects model, the Hausman test is run. The Hausman test is used to determine the use of a fixed-effect or random-effect model. The interpretation of the test is straightforward. Suppose the p-value is less than 0.05, then reject the null hypothesis. In Stata, this means that this study will use the fixed-effect model.

Given the above test result, before running the fixed-effect model, the endogeneity test is used. Endogeneity is a term used to describe the presence of endogenous explanatory variables that are correlated to the error term, either because of an omitted variable, measurement error, or simultaneity. To test the endogeneity, the study uses the regression equation specification error test, the Ramsey Test, which allows if the model suffers from omitted variable bias. The Ramsey Test result as such:

$H_0$ : the model has no omitted variables

F (3, 104) = 8.41

Prob > F = 0.0000

From the result in Table 1, given that P-value < alpha, 0,05, the null test is rejected, which said that the model has no omitted variable. Thus, there are possible missing variables, and the model suffers from endogeneity, which causing biased coefficient estimates. Since the model is suffered from endogeneity, the Fixed-effect cannot be used. Thus, the paper uses Instrumental-Variable Regression (IV Estimates) using the two-stage least squares estimator. In this model, four variables, such as the dependent variable, included exogenous variables, including endogenous variables, and instrumental variables. The two-stage least squares (2SLS) estimator itself exploits in the sample the orthogonality conditions from all exogenous regressors and the instruments. When the model has more orthogonality conditions than parameters cannot simultaneously be satisfied in small samples (Cai & Wang, 2014).

$$\begin{aligned} \log \text{exppercapita}_{it} &= \beta_0 + \beta_1 \log \text{palmoil } w_{it} + \beta_2 \text{mos}_{it} + \beta_3 \log \text{educ}_{it} \\ &+ \beta_4 \log \text{health}_{it} + \beta_5 \text{literate}_{it} + \beta_6 \text{sener}_{it} + \beta_7 \text{affer}_{it} + \mu_{it} \end{aligned}$$

Where:

log exppercapita: Monthly Expenditure Per Capita (Log (exppercapita))

log palmoil Wit: Palm oil Production (Log (palmoil))

Wit : Exogenous regressor which is uncorrelated with  $\mu_{it}$ ,

mos : Manufacture to Service Ratio

|            |                                                                             |
|------------|-----------------------------------------------------------------------------|
| log educ   | : Monthly Per Capita Household Education Expenditure (Log (educ))           |
| log health | : Monthly Per Capita Household Health Expenditure per capita (Log (health)) |
| litrte     | : Literacy rate (in percent)                                                |
| sener      | : Net Enrollment Ratio: Senior Secondary (in percent)                       |
| affer      | : Agriculture, Fishery, Forestry Employment Rate (in percent)               |

## Results and Discussion

### Empirical Result

Before estimating the connection between palm oil plantation and individual expenditure, first examine the measure of dispersion and volatility of the eight variables. Table 2 indicates that the average manufacture to service ratio during the sample period was 6.376991 units, with higher variability of up to 7.51364 over the sample period. The variable's high variability compared to the others is mostly due to the difference in these provinces' manufacturing and service sector output. The same situation happened to the literacy rate (litrte) variable. Three parameters are applied by the Ministry of Education and Culture Indonesia to calculate the index for literacy rate, such as (1) low access to school, (2) low family literacy rate condition, and (3) low reading behavior compared to accessing other media. (Kementerian Pendidikan dan Kebudayaan, 2019).

**Table 2. Summary Statistics**

| Variable      | Mean      | Std. Deviation | Min   | Max    |
|---------------|-----------|----------------|-------|--------|
| lexppercapita | 5.857282  | 0.1037082      | 5.582 | 6.129  |
| lpalmoil      | 5.621036  | 0.7558693      | 4.209 | 6.865  |
| mos           | 6.376991  | 7.51364        | 0.468 | 32.218 |
| leduc         | 4.483355  | 0.1378366      | 4.205 | 4.859  |
| lhealth       | 4.286291  | 0.1510656      | 3.864 | 4.841  |
| litrte        | 94.65021  | 6.472106       | 64.08 | 98.88  |
| sener         | 54.21367  | 8.519343       | 30.06 | 71.228 |
| affer         | 0.7043273 | 0.7623558      | 0.022 | 3.046  |

Source: Data processing

Next is the Net Enrollment Ratio of Senior Secondary (sener). This variable explains the continuing rate or transition after enrolled at the junior secondary level. The previous research indicates that first, household welfare level is a significant determinant of the low enrollment. Second, children in areas with relatively abundant employment opportunities have a higher probability of giving up schooling, and third, girls have a significantly lower chance of continuing (Prasetyia, 2019). Table 2 also suggests that the average palm oil output during the sample period is 417,865.003 (10(5.621036)) ton. The variable is selected from 22 provinces that produce palm oil. If it has compared to other variables,

the palm oil variability is lower. One scenario of the situation is due to the different natural resource conditions.

To analyze the implication of Dutch Disease in Indonesia by merely observing the relationship between palm oil plantation (*lpalmoil*) and the Monthly expenditure per-capita (*lexppercapita*). Table 3 shows a significant and positive result of the main predictor, which is palm oil production. Palm oil was by far the fastest-growing export during the boom years, and rapid expansion of the palm oil industry had the most considerable labor market impacts among other resource sectors. The implication of the employment sector, in turn, is a robust predictor of lower earnings for wage earners. Finally, with relatively fewer formal sector jobs being created, incentives for schooling are also diminished. These results tie the resource boom directly to individual earnings and human capital outcomes. They provide microeconomic evidence for Dutch Disease, a phenomenon usually modeled only at a much higher level of generality and seldom subjected to empirical verification in the household or individual data.

This is in line with one of the effects of the Dutch Disease, the Resource Movement Effect. From 2010 to 2015, it is not the resource boom period or theoretically explained by natural resources discovery. Nevertheless, by the range of time, the increasing production shows how expansive the sector is. The resource movement tends to reduce output in the rest of the economy, attracting capital and employment.

**Table 3. The Variable Regression Result**

| Variables       | 2sls                     |
|-----------------|--------------------------|
|                 | <i>lexppercapita</i>     |
| <i>lpalmoil</i> | 0.0642**<br>(0.0260)     |
| <i>mos</i>      | 0.00278***<br>(0.00106)  |
| <i>leduc</i>    | 0.258**<br>(0.114)       |
| <i>lhealth</i>  | 0.276***<br>(0.0807)     |
| <i>literate</i> | -0.00575***<br>(0.00164) |
| <i>sener</i>    | 0.00393***<br>(0.00101)  |
| <i>affer</i>    | -0.0515***<br>(0.0114)   |
| Constant        | 3.505***<br>(0.363)      |
| Observations    | 110                      |
| R-squared       | 0.617                    |

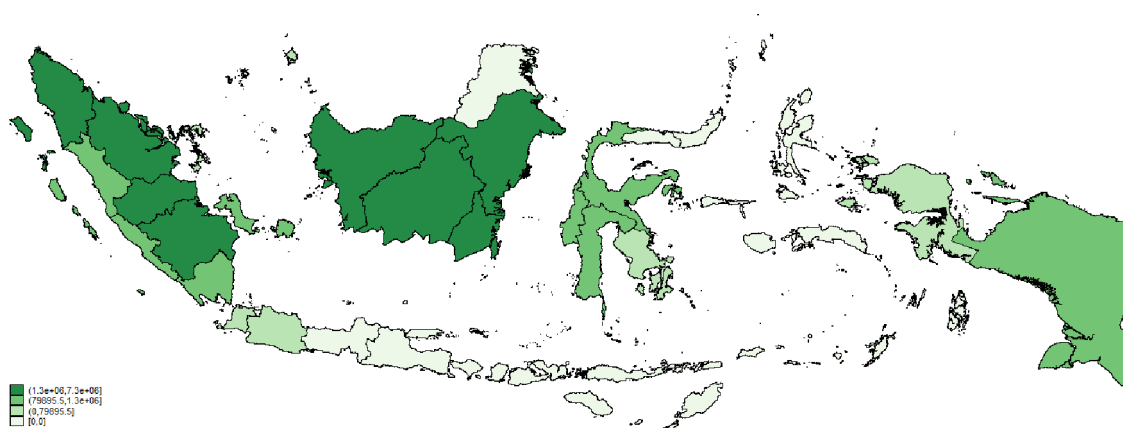
Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1  
Source: Processed on STATA 14

A 1 percent increase in palm oil production will increase monthly per – capita expenditure by 1.00027 percent. There are also positive and significant correlations between the Manufacture to Service Ratio and Monthly expenditure per-capita. A 1 – point increase of manufacture to service ratio will increase monthly per-capita expenditure by 0.278 percent. Palm oil production is significant at a 5 percent significance level. The manufacture to services ratio is significant at a 1 percent significance level. If there is no change in the predictors, *ceteris paribus*, individual monthly expenditure will increase by 3.505 percent. The R squared of 0.617 means that the model can be explained by 61.70 percent of the model's variables, and the rest, 38.30 percent of the models, is explained by the variables outside the model. A previous study mentioned that more than 18 percent of the household had increased their real income 2 to 3 times after five years of engagement in palm oil cultivation (Budidarsono et al., 2012). The manufacturing industries can create employment, which helps boost agriculture and diversify the economy to increase its foreign exchange earnings (Ehinomen, 2012).

### Palm Oil Plantation in Indonesia

Figure 3 shows the location of palm oil plantations per province in Indonesia. Both Sumatera and Kalimantan island represented approximately 96,67 percent of Indonesia's Palm Oil output in 2015. Concerning the hypothesis before, the large number of productions can initiate higher employment in the concerned province. The total area of oil palm plantations in Indonesia before 2016 over the past five years has tended to show an increase, rising around 5.38 to 10.96 percent per year. In 2011, Indonesian oil palm plantations' land was recorded at 9.13 million hectares, increasing to 10.75 million hectares in 2015 or 25.80 percent. In 2016 it was estimated that the area of oil palm plantations would decrease by 0.15 percent from 2015 to 11.12 million hectares.

Figure 3. Palm Oil Production per Province in 2015



Source: Tree Crop Estate Statistics of Indonesia Publication - Ministry of Agriculture, processed on STATA 14

For example, Riau, the highest palm-oil producing province, is blessed with a wide variety of abundant natural resources. The main one is palm oil (Susanti & Burgers,

2011). The province has the largest area of oil palm plantations in Indonesia, which is 2.29 million hectares in 2014, or 21.30 percent of Indonesia's total area of palm-oil plantations. According to the status of the concession, most oil palm plantations in 2015 were managed by large private plantations, amounting to 5.98 million hectares (53.79%), while community plantations managed 4.65 million hectares (41.88%) and large state plantations only 0.73 million hectares (6.78%) (Directorate General of Plantation, 2015).

A previous study reveals that forest-related labor (logging, non-timber forest product collection) can support up to five people per km<sup>2</sup>, while a small-scale palm oil plantation can absorb 40 – 60 people per km<sup>2</sup> (Susanti & Burgers, 2011). It means increasing employment opportunities, especially when the population increases. The combination of high earning potential, supportive road infrastructure and the ideal market leads to an influx of ever-increasing employment numbers. Besides, the palm oil plantation contributes substantially to regional incomes, mostly for rural dwellers. Moreover, the high income obtainable from palm-oil plantation means it is easier to buy food than cultivate it. So, it will increase the level of individual expenditure, regardless of the producing provinces or not. The statement is supported by the individual expenditure (lexppercapita) in Table 2, indicating lower variability over the sample period.

### **The Implication of Dutch Disease in Indonesia**

Table 3 introduced the Monthly Per Capita Household Education Expenditure variable to know Dutch Disease's implication in Indonesia. The variable is expected to have a positive correlation with the individual monthly expenditure. Education is a significant factor contributing to economically sustainable development, owing to its potential for improving cognition and skill levels, enhancing labor productivity. A previous study indicated that natural resource dependence's crowding-out effect only affects public education in some regions due to different regional development (Sun et al., 2019). The study also suggested that the government promote transfer payment among regions through economic and social policies.

The situation is in line with the Monthly Per Capita Household Health Expenditure, which positively correlates with the regression results. Theoretically, the abundance of natural resources can boost economic growth because resource abundance can help the economy by investing more in the public sector like health care. However, the previous study mentioned that the dependence on natural resources or the abundance of resources that affect health indicators lies in its mandate. They can increase financial independence by exploiting natural resources. As a result, it can reduce the public sector's reliance on taxes and discourages efficient healthcare provision (Nikzadian et al., 2019). To support this statement, the healthcare sector's provision affects the total household expenditure that simultaneously affects the healthcare sector's household expenditure. It is supported by the previous study from Molla et al. (2017), which presented a high level of health expenditure effect to the total household expenditure.

The next variable is the literacy rate. The literacy rate is defined as identifying, understanding, interpreting, creating, communicating, and computing, using printed and written materials associated with varying contexts. This variable is introduced as a continuum of learning in enabling individuals to achieve their goals, develop their knowledge and potential, and participate in their community and broader society. The research is trying to examine how the impact of literacy rate on monthly household individual expenditure. The literacy rate itself is a comprehensive concept that most previous research correlated the variable to the educational attainment from a formal institution. One of the types of literacy rate is financial literacy. A previous study examined the relationship between household consumption and financial literacy for Dutch households. The paper provided evidence for a strong positive association between couples' non-durable consumption and the male partner's financial literacy level. However, the research did not find evidence for an association between consumption growth and financial literacy (Navickas et al., 2014). As the regression result in table 3 introduced its negative correlation to monthly expenditure per-capita.

The next variable is the net enrollment ratio of senior secondary, which is introduced as the ratio of children of official school age based on the International Standard Classification of Education 1997 who are enrolled at the senior secondary level (Bietenbeck et al., 2019). This variable expectedly has a significant effect on the individual monthly expenditure. It has indirectly linked to the impact of formality earnings, which is the main predictor of the employment type. Formality is associated not only with significantly higher earnings but also with greater security and benefits. A previous study found that the formal employment premium in earnings is about 40 percent once other variation sources have been controlled, so a lower probability of formal sector employment is associated with lower expected income. Lower formality, in turn, is a predictor of lower earnings for labor. As a result, with relatively fewer formal sector jobs being created, schooling incentives are also diminished. It ties the resource boom directly to individual expenditure and human capital outcomes (Coxhead & Shrestha, 2016).

The last variable, Agriculture, Fishery, and Forestry Employment Rate, has a significant effect on individual monthly expenditure. The variable represents the palm oil sector's total employment rate, one of the agriculture sectors. The agriculture sector is diverse and remains central to the lives of many people. As a previous study suggested, the significant role of agriculture in a regional economy involves the outputs and is linked to other antecedents like those of production and labor required by other sectors (Loizou et al., 2019). Although it seems clear that economic growth entails a reduction in the relative importance of agriculture in an economy, the causal mechanism in the process by which this transformation takes place is not fully clear. There has been written about the role of innovation and economic growth in agriculture as a means of priming the pump for broader economic growth by generating an economic surplus, releasing resources to and demanding inputs from the rest of economic surplus, releasing resources to and demanding inputs from the rest of the economy (Alston & Pardey, 2014).

As previously mentioned, Dutch disease implication by palm oil production correlation to monthly expenditure per-capita is not enough to explain the disease itself. Based on the regression result, the manufacture of service ratio positively and significantly affects individual monthly expenditure. This variable is introduced to show the resource movement effect. A previous study mentioned that the increase of non-tradable resources tends to make manufacture uncompetitive (Boyce & Herbert Emery, 2011). This sector is a constant-returns-to-scale industry, with output depending upon the amount of labor used. Every natural resource-abundant economy is on its way to becoming a resource-poor manufacturing economy. The same effect is looked at in the service sector. In Indonesia, this sector has emerged as a new source of growth. This sector alone contributes to Indonesia's GDP by 51 percent in 2014. The service sector also has become the most significant source of job creation, constituting 43 percent of the total employment in the same year (Damuri, 2016).

From the perspective of the manufacture to service ratio, the study can argue that Indonesia economies in 2011 – 2015 were not suffered from the disease in which palm oil production did not cause the resource movement effect from the tradable sector to the non-tradable sector, which is manufacturing and services sector. It is supported by the previous study, which discussed the Dutch disease implication on Asia countries from 1980 – 2014 (Taguchi & Khinsamone, 2018). Finally, it can answer this research's primary purpose based on the previous section's two scenarios. First, Indonesia's contribution to palm oil production increases the palm oil smallholders' income and the government or cooperation labor expenditure. It is in line with the resource movement effect as the explanation before. Second, as palm oil production increases, the higher percentage of domestic consumption on palm oil products. Both scenarios support the increasing palm oil plantation that could increase Indonesia's monthly expenditure during the sample years.

## Conclusion

The Indonesian economy grew steadily with the expansion of palm oil production. The main findings are as follows, firstly, the Dutch disease was not identified from 2011 – 2015, from natural-resource abundance in Indonesia. Secondly, as the palm oil plantation was expanded, they are empowered more employment into the sector. It supports the first point where employment in the palm oil sector not negatively affects the tradable sector, which is represented by the manufacture to services ratio. The analysis indicates that Indonesia was not suffered from Dutch Disease. Therefore, palm oil production could increase individual expenditure. The extension of palm oil plantations could benefit Indonesia's economy without affecting other sectors.

However, the research should take into account some of the limitations that arise. First, the 22 provinces are selected because of the applicable data from the Central Bureau of Statistics as the research examines the level of expenditure for Indonesia as a whole. Second, the data are selected from 2011 to 2015, when two different presidents

had a different palm oil production policy. It is essential to take institutional change as a result of different palm oil production capacity.

Many previous studies indicated that Indonesia was facing Dutch disease concerning natural resource abundance. Nevertheless, based on this research was not, probably because of the institutional improvements. The capital accumulation effect has initiated it in institutional quality and its reformation. As long as Indonesia had accepted capital inflows in any form, the economy had been accompanied by the Dutch Disease risk.

To avoid the disease, the Indonesian government should prioritize infrastructure development, human resource development, and industrial policies to facilitate manufacturing production. First, the action policy must specify how the local production fulfills the household needs to increase household expenditure. Second, the government should focus on how to increase labor productivity through educational attainment projected by the enrollment ratio. These policy initiatives can be possibly realized under qualified institutions with good governance regarding government effectiveness, regulatory quality, and law rule.

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# Indonesia Local Industry Structure and Firms Productivity in Industrial Area

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**Abstract**

*Using three industry structure indices: specialization, diversification, and competition, we explore how local industry structure may affect firm productivity in the industrial estates. Based on unbalanced panel data of large and medium-sized industrial firms in Indonesia during 2010-2015, our study found that local industry structure influences firm productivity, measured as total factor productivity (TFP). The effect differs between firms outside the industrial estate and firms in the industrial estate. Specialization decreases the productivity of both firms in the industrial estate and outside. Diversification has a positive effect on increasing firm productivity in the industrial estate. As for firms outside the industrial estate, diversification has a negative effect, but the effect is less significant. Meanwhile, local industry competition has a positive and significant effect on firm productivity outside the industrial estate, but the effect is not significant for firms within the industrial estate. Empirically, firms in industrial estates may only benefit from a diversified local industry structure.*

**Keywords:**

local industry structure, industrial estate, firm productivity.

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## Introduction

Indonesia Government Regulation Number 142 of 2015 and Law Number 3 of 2014 define Industrial Estates as areas where industrial activities are concentrated, given that it is supported by facilities and infrastructure developed and managed by Industrial Estate Firms. Industrial estates are natural and historically have been social and territorial entities characterized by the active presence of both communities and firms Becattini (1990). In industrial estates, communities and firms tend to be close. The benefit of industrial estates is its agglomeration effect, which benefits firms from locating close to each other compared to being separated (Glaeser, 2010).

The industrial estate area is one of the policy options for forming a spatial concentration of the manufacturing industry sector. The industrial sector's spatial concentration will attract other economic activities resulting in agglomeration (Cainelli, 2008). Several previous studies have focused on the positive effects of spatial agglomeration on productivity. The most traditional one is the study of Marshallian industrial districts. An analysis of Marshallian thought was carried out, including by Gordon & McCann (2000), Boschma & Lambooy (2002), Iammarino & McCann (2006), Boschma & Ter Wal (2007). From these studies, industrial estates gained wide fame as a type of industrial organization, where long-term informal relationships between firms produced Marshall agglomeration economies and externalities that replaced the internal economies of scale in each firm (Cainelli, 2008).

The industrial estate area, which is the center of industrial activity, will provide economic benefits or positive agglomeration externalities to the firms within it.<sup>1</sup> With spatial closeness, firms and workers in specific industries located close to one another, such as in industrial areas, can gain an abundance of knowledge from the same or different technologies, access the combined labor market and skilled workers, and benefit from sharing input items. All of this can increase firm productivity (Gill & Goh, 2010). However, the benefits obtained can be dynamic and depend on the local industry's structure.

The structure of local industries in the agglomeration area can affect productivity through three types of externalities. The first is specialization externalities or localization economies, externalities that occur from firms with the same industry type. Marshall, Arrow, and Romer developed the concept of the externality of this specialization and in a dynamic context, known as Marshall-Arrow-Romer (MAR) externality (Glaeser et al., 1992). Second, namely diversification externalities or urbanization economies, externalities from the gathering of firms with diverse industrial sectors, allows sharing of ideas and

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<sup>1</sup> Fan and Scott (2003) have summarized the positive externalities of agglomeration divided the types of externalities into five main problems, namely: grouping firms at close distances can reduce transaction costs incurred per unit distance; the dense local labor market is a better opportunity for job seekers and job openings; transactional relationships also involve the flow of business information or an abundance of specific knowledge; the grouping of various producers is beneficial in encouraging the formation of alliances and profitable business organizations to increase local competitiveness, and the creation of public goods can achieve significant economies of scale due to the use of infrastructure that is spread across many individual firms in one location.

experiments between different economic activities. This second externality was developed by Jacobs and is known as Jacobs externality (Glaeser et al., 1992). The third type of externality is competition, which Porter developed to be known as Porter's externality. According to Porter, local competition plays an essential role in the firm's progress, and the primary source of pressure on the firm is to create innovative products and adopt new technologies (Glaeser et al., 1992).

According to the concept of MAR externality (specialization), spatial areas with sectors that are concentrated in certain types of industries will attract and encourage the occurrence of a large pool of labor (labor pooling), including workers who have been trained and have particular expertise in specific industrial fields. Besides, the concentration of economic activity in specific sectors will trigger the entry of specialist intermediate input goods suppliers to the area, which in turn will reduce transaction costs between suppliers and firms, as well as firms, get cheaper input goods prices due to the economies of production from suppliers that serve large-scale specialized input items. Finally, firms that are agglomerated and involved in the same sector benefit from the knowledge spillover because the geographical closeness between actors will encourage the emergence of new ideas or improvements related to products, technologies, and management of the firm's organization (Van Oort, 2015). All of these things will ultimately increase the productivity of the firms involved.

Meanwhile, according to the Jacobs externality concept (diversification), the essential source of knowledge comes from the external sector, namely, the sector outside the firm operates. In contrast to Marshall, Jacobs stressed that diverse local industries would trigger an overflow of knowledge and ultimately increase the emergence of ideas and innovations (Galliano et al., 2015). A more diverse industrial structure at close range encourages opportunities to emulate, share and recombine ideas and practices across industries (Beaudry & Schiffauerova, 2009). Complementary knowledge exchanges will encourage research and experimentation, and a more diverse economy will contribute to this complementary knowledge base. The exchange of knowledge between industries will encourage new ideas, product innovation, technological improvement, or firm organizations' improvement, which will increase firm productivity.

Like MAR, Porter argues that an abundance of knowledge in a geographically specialized and geographically concentrated industry will trigger growth. However, Porter also stressed that local competition, which is the opposite of a monopoly, will spur the search for and rapid adoption of innovations. Porter's externalities will occur maximally in areas with industries that are geographically and competitively specialized (Glaeser et al., 1992). Like Porter, Jacobs also believes that local competition will accelerate technology adoption (Glaeser et al., 1992).

Studies on the effects of agglomeration in local industry structure have been carried out in many countries. The positive, negative, and insignificant effects of externalities of specialization (MAR), diversification (Jacobs), and competition (Porter) are found in various studies (Beaudry & Schiffauerova, 2009; Knoblen et al., 2016; Rigby & Brown,

2015). Likewise with empirical studies in Indonesia, including by Kuncoro (2009), Widodo et al. (2014), Wardani & Yudhistira (2020), and Khoirunurrofik (2018).

Research by Malmberg et al. (2000), Antonietti & Cainelli (2011), Li et al. (2012), Badr et al. (2019), Cheng & Jin (2020) concluded that both specialization and diversification have a positive impact on firm performance. Meanwhile, research by Widodo et al. (2014), Galliano et al. (2015), Cieřlik et al. (2017), Wardani & Yudhistira (2020) concluded that only specialization has a positive effect, while diversification harms firm performance. Batisse (2002) found that specialization harms regional growth, while diversification has a positive impact. Not only that, Fafchamps & El Hamine (2017), using geographic zones of agglomeration at the sub-city, city, and provincial levels, find that the only specialization has a positive impact on firm productivity, while the impact of diversification is still doubtful. The research results by Fafchamps & El Hamine (2017) are in line with Wixe (2015) study, which found that specialization had a positive effect on firm productivity, while there was no substantial evidence for Jacobs' externality.

The positive effect of competition was found in Badr et al. (2019), Khoirunurrofik (2018), Wixe (2015), and Cielik et al. (2017). Meanwhile, Fafchamps & El Hamine (2017) research results and Van der Panne (2004) found the competition's negative effect. Some studies only analyze the effect of MAR and Jacobs externalities and do not analyze the externalities of competition, among them by Galliano et al. (2015), Kuncoro (2009), and Malmberg et al. (2000).

In Indonesia, specific studies portraying the character of firms in industrial areas are still limited. Existing studies so far were only comparing firm performance inside and outside the region in general and did not capture its local industry structure effect (Aritenang & Chandramidi, 2020; Sabri et al., 2018; Suharyani & Mahi, 2018; Winardi et al., 2017). Notable empirical studies in Indonesia on the effect of local industry structure are Wardani & Yudhistira (2020), Khoirunurrofik (2018), Widodo et al. (2014), and Kuncoro (2009). However, these studies have not incorporated regional specific characteristics, namely the firm's location inside or outside industrial estates. Unlike previous studies, this paper will examine the effect of local industry structure on firm productivity by differentiating between firms located inside and outside industrial estates. We want to know which one will increase firm productivity, located inside or outside the industrial estate, and co-locate firms with similar or diverse industries to boost productivity.

The agglomeration of manufacturing firms in the industrial area supposedly leads to an agglomeration economy. Law Number 3 of 2014 on Industry stated that every industrial business firm, mostly large firms, is required to be located in an industrial area. However, the Law exempted small and medium firms for this requirement, and therefore, these firms may locate either in the industrial area or outside the industrial area. The exemption may be due to perceived low-risk activities from these small and medium firms, for example, referring to the risk of environmental pollution or industries that

use unique raw materials, and thus their production processes require to be conducted in unique locations. This study examines whether firms agglomeration in the industrial estate (area) will increase firm productivity, measured in total factor productivity (TFP). Does firms with similar or diverse industries located in the same industrial area and or administrative areas (municipality or city) will increase firm productivity. Specifically, this study examines the influence of local industry structures, namely specialization, diversification, and competition, on firm productivity.

Compared with existing literature, our study's novel contribution is examining the influence of local industry structures by differentiating firms' location inside or outside industrial estates, which has never been done before in Indonesia, by focusing more on firms in industrial estates. This is due to the Indonesian government policy to require every new industrial firm to be located in an industrial area (Law 3/2014 on Industry). This study's results are expected to provide input to the government, which industrial structures are profitable for firms in industrial estates, groups of firms on co-location with similar or diverse industries that will increase firm productivity in industrial estates. Our study has also used a novel dataset, referring to a more complete data of firm location, by merging the data in *Statistik Industri* (SI) with Manufacturing Industry Directories. We identify firm location inside or outside industrial estate by looking at the details on each firm's address because of the large number of missing location data in *Statistik Industri*.

## Methods

This research uses panel data from the Large and Medium Industrial Statistics (IBS) 2010-2015 from the Central Statistics Agency (BPS). The census is carried out annually on manufacturing firms that have a minimum workforce of 20 people. Variables from IBS statistical data used in this study include firm identity number, provincial code, district code, location inside or outside the industrial area, leading product, capital percentage, total labor, income, value-added, assets, use raw materials, fuel, and electricity.

Specific to data on industrial estates, we identify that in IBS 2010-2015, there are missing values on the status of the firm of whether it is located within the industrial estate or outside the industrial estate of 75,511 observations, and therefore we merge the IBS data with IBS Directory, and database of Industrial Estate Tenants Directory to verify and to fill the missing as well as incorrect data on the location of the firm.

Overall, the data used in the study is unbalanced panel data with the number of observations used as a sample of 91,662 observations from 2010-2015. This data includes 21,127 firms (with not all firms appearing every year), 24 types of industrial sectors from ISIC-10 to ISIC-33, and 328 Regencies/Cities.

Regarding the literature review and the objectives of this study, the estimation model specification is as follows:

$$\ln(TFP_{ikjt}) = \alpha_0 + \alpha_1 z_{LQ_{kjt}} + \alpha_2 z_{Div_{kjt}} + \alpha_3 z_{Comp_{kjt}} + \gamma_0 D_{KI} + \gamma_1 D_{KI} * z_{LQ_{kjt}} + \gamma_2 D_{KI} * z_{Div_{kjt}} + \gamma_3 D_{KI} * z_{Comp_{kjt}} + \beta_1 \ln(Firm\_Labor_{it}) + \beta_2 \ln(KLratio_{it}) + \beta_3 DPMA_{it} + \beta_4 DGOV_{it} + \beta_5 DT_{ikt} + \beta_6 Firm\_Share_{it} + u_k + v_t + \varepsilon_{it} \quad (1)$$

The subscript *i* refers to firm *i*, *k* refers to the industrial sector-*k*, *j* denotes the *j<sup>th</sup>* district/city and *t* states year *t*. The *LQ*, *Div*, *Comp* variables are the primary independent variables that are variable of the specialization, diversification, and competition externalities. *D<sub>KI</sub>* is a dummy variable of the firm located inside or outside the industrial area, which is also our main independent variables. *Firm\_Labor*, *KLratio*, *DPMA*, *DGOV*, *DT*, *Firm\_Share* are control variables of firm characteristics, namely the number of employees, the ratio of capital to labor, and capital ownership by foreign firms, ownership of capital by the government, technology, and firm share. *u<sub>k</sub>* is a type of industry dummy to capture fixed effects from industry sector groups. *v<sub>t</sub>* is a dummy time to capture the fixed effect of the observation year. The definition of explanatory variables used in equation (1) and their data sources are summarized in Table 1.

Table 1. Variable Definition and Data Source

| Name of Variable                                   | Definition                                                                                                                                                                                                                                                     | Unit    |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <b>Dependent Variable</b>                          |                                                                                                                                                                                                                                                                |         |
| <b>Level: Firm</b>                                 |                                                                                                                                                                                                                                                                |         |
| Productivity ( <i>TFP</i> )                        | Firm productivity measured by <i>Total Factor Productivity</i> (in natural logarithm), calculated by the Levinsohn-Petrin method (2003)                                                                                                                        | Index   |
| <b>Independent Variable</b>                        |                                                                                                                                                                                                                                                                |         |
| <b>Level: Industry and District /City</b>          |                                                                                                                                                                                                                                                                |         |
| Specialization Index ( <i>LQ</i> )                 | Size of specialization that is, Location Quotient (LQ), shows the concentration of an industrial sector in a district/city relative to other districts/cities (standardized index value)                                                                       | Index   |
| Diversification Index ( <i>Div</i> )               | Size of diversification, showing the diversity faced by an industry in a particular region (standardized index value). This study follows the diversification index used by Khoirunurrofik (2018) and Marrocu, Paci, and Usai (2013).                          | Index   |
| Competition Index ( <i>Comp</i> )                  | Size of competition, showing competition between firms in the same sector in a particular region relative to competition between firms in the same sector nationally (standardized index value). To measure competition, it also follows Khoirunurrofik (2018) | Index   |
| <b>Level: Firm</b>                                 |                                                                                                                                                                                                                                                                |         |
| Dummy of Industrial Area ( <i>D<sub>KI</sub></i> ) | Firm located within Industrial Estates will be valued 1 and 0 if other.                                                                                                                                                                                        | 1 and 0 |

| Name of Variable                                                | Definition                                                                                                                                                                                                                                                              | Unit                                                                                                |
|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Firm size by the number of labor employed ( <i>Firm_Labor</i> ) | Firm size, measured by the number of workers (in natural logarithms)                                                                                                                                                                                                    | person                                                                                              |
| Capital per worker ratio ( <i>KLratio</i> )                     | It is measured by the amount of firm capital value divided by the number of workers (in natural logarithms).                                                                                                                                                            | rupiah/ person                                                                                      |
| Dummy foreign ownership ( <i>DPMA</i> )                         | The dummy status of capital ownership by foreign firms is worth 1 if foreign shares ownership is more than 10% and 0 if others.                                                                                                                                         | 0 and 1                                                                                             |
| Dummy ownership by the government ( <i>DGOV</i> )               | The government's dummy status of firm capital ownership is worth one if the ownership of firm shares by the central government or local government is at least 50% and 0 if others.                                                                                     | 0 and 1                                                                                             |
| Dummy Technology ( <i>DT</i> )                                  | The firm's technology dummy is based on the UNIDO classification. Divided into three industry groups, namely low technology industries (ISIC 10-19, 25 and 31), medium technology industries (ISIC 22-24, 32.33), high-medium technology industries (ISIC 20-21, 26-30) | Categorical dummy (1 for low technology, 2 for medium technology, and 3 for high-medium technology) |
| Firm share from market share ( <i>Firm_Share</i> )              | Firm size, measured by market share, is the ratio of firm output to total output in the ISIC 2-digit industrial sector                                                                                                                                                  | Percent                                                                                             |

Notes: The data source for the variables used in this table comes from data *Statistik Industri* (SI) for 2010-2015. Specific for firm location variables (*D\_KI*), using combined data from the SI and Manufacturing Industry Directories.

There are heterogeneous characteristics among firms. Each firm also has fixed and does not vary between time (time-invariant), for example, firm management factors or endowments owned by the firm. There is also a potential endogeneity problem due to reverse causality between productivity and agglomeration. Agglomeration externalities can improve productivity, but firms may also self-select locating in high productivity areas that affect the local industry structure. Therefore, the panel data estimation method used in this study is the fixed effect model. Estimation with the fixed-effect model is also expected to overcome the endogeneity problem.

## Results and Discussion

The empirical model specification in equation (1) was estimated using large and medium industrial data from 2010 to 2015. The number of observations used to estimate 91,662 samples consisting of 5,260 observations was sampled from firms in industrial estates, and 86,402 observations were sampled from firms outside the industrial estate. A statistical summary of the variables used for research is shown in Table 2.

Table 3 is an estimation result using fixed effects that is by controlling firm-specific fixed effects. In addition to controlling the firm's fixed effects, the regressions in columns (1) through column (5) have also controlled industry-specific fixed effects and year-specific fixed effects. Column regression (1) displays regression only for the primary study variable

(baseline). The results show that firms' average productivity ( $\ln TFP$ ) in the industrial area is not significantly different from firms outside the industrial area. Besides, the local industry structure's effect on firms in the industrial area does seem to be different from those firms outside the industrial area is only diversification externalities. For firms in the industrial area, diversification has a positive and significant effect, although only at the 10% level, to increase firm productivity.

**Table 2. Summary Statistics**

| Variable                   |                | Location | Obs.  | Mean   | Sd    | Min    | Max    | Mean Difference |
|----------------------------|----------------|----------|-------|--------|-------|--------|--------|-----------------|
| (1)                        |                | (2)      | (3)   | (4)    | (5)   | (6)    | (7)    | (8)             |
| Firm Productivity          | (lnTFP)        | Non-IE   | 86402 | 10.778 | 1.412 | 4.145  | 18.998 | -1.536*         |
|                            |                | IE       | 5260  | 12.315 | 1.334 | 6.585  | 20.192 |                 |
| Spezialization             | (z_LQ)         | Non IE   | 86402 | -0.028 | 0.455 | -0.278 | 29.672 | 0.037*          |
|                            |                | IE       | 5260  | -0.066 | 0.281 | -0.277 | 2.193  |                 |
| Diversification            | (z_Div)        | Non IE   | 86402 | 0.359  | 1.091 | -1.071 | 3.879  | -1.412*         |
|                            |                | IE       | 5260  | 1.771  | 1.164 | -1.009 | 3.879  |                 |
| Competition                | (z_Comp)       | Non-IE   | 86402 | 0.665  | 2.024 | -0.362 | 37.404 | -0.129*         |
|                            |                | IE       | 5260  | 0.795  | 1.227 | -0.350 | 37.404 |                 |
| Location Dummy             | (D_KI)         | Non-IE   | 86402 | 0      | 0     | 0      | 0      |                 |
|                            |                | IE       | 5260  | 1      | 0     | 1      | 1      |                 |
| Firm Labor                 | (lnFirm_labor) | Non IE   | 86402 | 4.085  | 1.153 | 2.996  | 10.958 | -1.009*         |
|                            |                | IE       | 5260  | 5.095  | 1.270 | 2.996  | 10.166 |                 |
| Capital per Worker Ratio   | (lnKLratio)    | Non-IE   | 86402 | 9.972  | 1.769 | -6.632 | 25.110 | -1.291*         |
|                            |                | IE       | 5260  | 11.263 | 2.146 | -0.518 | 26.513 |                 |
| Dummy Foreign Ownership    | (DPMA)         | Non-IE   | 86402 | 0.062  | 0.242 | 0      | 1      | -0.531*         |
|                            |                | IE       | 5260  | 0.593  | 0.491 | 0      | 1      |                 |
| Dummy Government Ownership | (DGOV)         | Non-IE   | 86402 | 0.016  | 0.126 | 0      | 1      | 0.009*          |
|                            |                | IE       | 5260  | 0.007  | 0.084 | 0      | 1      |                 |
| Dummy Technology Intensity | (DT)           | Non-IE   | 86402 | 1.342  | 0.621 | 1      | 3      | -0.662*         |
|                            |                | IE       | 5260  | 2.003  | 0.883 | 1      | 3      |                 |
| Firm Market Share          | (firm_share)   | Non-IE   | 86402 | 0.070  | 0.698 | 0.0000 | 70.238 | -0.262*         |
|                            |                | IE       | 5260  | 0.332  | 1.358 | 0.0002 | 33.756 |                 |

Note: \* t-test results on the mean difference in all variables indicate significant average differences between firms outside IE (industrial estate) and firms in IE.

Source: Authors processed

**Table 3. Estimation Results: Fixed Effect Estimation**

| Dependent:<br>LnTFP      | (1)<br>FE            | (2)<br>FE            | (3)<br>FE            | (4)<br>FE            | (5)<br>FE            |
|--------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| z_LQ                     | -0.018<br>(0.017)    | -0.034**<br>(0.016)  | -0.041**<br>(0.016)  | -0.038**<br>(0.016)  | -0.037**<br>(0.016)  |
| z_Div                    | -0.020<br>(0.014)    | -0.022<br>(0.014)    | -0.020<br>(0.015)    | -0.023<br>(0.014)    | -0.023<br>(0.014)    |
| z_Comp                   | 0.011***<br>(0.003)  | 0.010***<br>(0.003)  | 0.010***<br>(0.003)  | 0.011***<br>(0.003)  | 0.012***<br>(0.003)  |
| D_KI                     | -0.798<br>(0.719)    | -0.946<br>(0.706)    | -0.827<br>(0.704)    | -0.806<br>(0.705)    | -0.855<br>(0.705)    |
| zLQ_KI                   | -0.209<br>(0.153)    | -0.237<br>(0.150)    | -0.273*<br>(0.151)   | -0.272*<br>(0.150)   | -0.249*<br>(0.150)   |
| zDiv_KI                  | 0.090*<br>(0.048)    | 0.072<br>(0.047)     | 0.089*<br>(0.050)    | 0.124***<br>(0.047)  | 0.108**<br>(0.047)   |
| zComp_KI                 | -0.009<br>(0.016)    | -0.005<br>(0.016)    | -0.004<br>(0.016)    | -0.005<br>(0.016)    | -0.006<br>(0.016)    |
| lnFirm_labor             |                      | 0.108***<br>(0.009)  | 0.109***<br>(0.009)  | 0.109***<br>(0.009)  | 0.108***<br>(0.009)  |
| lnKLratio                |                      | -0.077***<br>(0.003) | -0.077***<br>(0.003) | -0.077***<br>(0.003) | -0.077***<br>(0.003) |
| DPMA                     |                      | -0.045<br>(0.034)    | -0.041<br>(0.034)    | -0.041<br>(0.034)    | -0.044<br>(0.034)    |
| DGOV                     |                      | 0.043<br>(0.053)     | 0.045<br>(0.053)     | 0.042<br>(0.053)     | 0.041<br>(0.053)     |
| DT                       |                      | -0.581***<br>(0.132) | -0.580***<br>(0.132) | -0.572***<br>(0.132) | -0.580***<br>(0.132) |
| firm_share               |                      | 0.364***<br>(0.009)  | 0.362***<br>(0.009)  | 0.363***<br>(0.009)  | 0.364***<br>(0.009)  |
| _cons                    | 10.761***<br>(0.073) | 11.682***<br>(0.186) | 11.975***<br>(0.399) | 11.645***<br>(0.203) | 11.668***<br>(0.186) |
| N                        | 91662                | 91662                | 91662                | 91662                | 91662                |
| R <sup>2</sup>           | 0.062                | 0.098                | 0.105                | 0.100                | 0.099                |
| F                        | 133.741              | 191.555              | 41.266               | 130.014              | 172.034              |
| P                        | 0.000                | 0.000                | 0.000                | 0.000                | 0.000                |
| Industry_FE              | YES                  | YES                  | YES                  | YES                  | YES                  |
| Year_FE                  | YES                  | YES                  | YES                  | YES                  | YES                  |
| Province* Time Trend     | NO                   | NO                   | YES                  | NO                   | NO                   |
| Island*Time Trend        | NO                   | NO                   | NO                   | YES                  | NO                   |
| Java-Non Java*Time Trend | NO                   | NO                   | NO                   | NO                   | YES                  |

Note: Standard errors in parentheses; \* Significant at 1%; \*\* Significant at 5%; \*\*\* Significant at 10%.

Source: Authors processed

Meanwhile, diversification does not significantly affect productivity for firms not located in the industrial area. There is no significant effect of specialization on firm productivity both outside and inside the specialization's industrial area. The three indicators of local industry structure are competition index in the region that does have consistent effect for both firms within and outside the industrial area. The three regressions in columns (3), (4), and (5) Table 3 give consistent results, an improved estimation in comparison to estimation results of column (1) that only include the variable of interest. When controlled with specific trends in each region, the effect of specialization and diversification on firms in industrial estates becomes significantly different from firms outside industrial estates. The effect of specialization is significantly different at the 10% level. While the effect of diversification is statistically significant at the 10% level when controlled at the provincial level, 1% at the island level, and 5% at the Java and Outer Java levels. With different results between column (2) and column (3), (4) and (5) regression shows that the regression results in column (2) are not yet robust, and there are specific trends at the provincial or island level that affect the impact of specialization and diversification firms in industrial estates are significantly different from those outside the region.

The estimation results with this fixed effect show that there is an influence of local industrial structure on firm productivity, and there are differences in the impact between firms in the industrial area and outside the industrial area. From the column models (3), (4), and (5) in Table 3, the value of  $R^2$  is not much different, but the column model (5) gives a more excellent F value, so that model (5) is better in explaining the influence of local industry structure on productivity. A comparison of the magnitude of its influence on firms inside and outside the industrial estate is summarized in Table 4.

**Table 4. Comparison of the magnitude of local industry structure on firms inside and outside the industrial estate**

| Variable                              | Outside IE                    | Difference with IE              | Inside IE                                               |
|---------------------------------------|-------------------------------|---------------------------------|---------------------------------------------------------|
| Average productivity ( <i>lnTFP</i> ) | 11.668<br>(significant at 1%) | -0.855<br>(not significant)     | 10.813<br>(not significantly different with outside IE) |
| Specialization ( <i>z_LQ</i> )        | -0.037<br>(significant at 5%) | -0.249<br>(significant at 10 %) | -0.286                                                  |
| Diversification ( <i>z_Div</i> )      | -0.023<br>(not significant)   | 0.108<br>(significant at 5%)    | 0.085                                                   |
| Competition ( <i>z_Comp</i> )         | 0.012<br>(significant at 1%)  | -0.006<br>(not significant)     | 0.006<br>(not significantly different with outside IE)  |

Source: Authors calculation

Table 4 shows that although the average productivity within an industrial estate is not significantly different from a firm outside an industrial estate, the effect of the structure

of the local industry is significantly different under certain conditions. Specialization hurts firm productivity inside and outside the industrial estate. Increasing specialization by one standard deviation, decreasing firm productivity outside the industrial estate by 3.7%, and decreasing firm productivity inside the industrial estate by 28.6%.

Diversity externalities has different effects on firm productivity inside and outside the industrial area. For firms outside the industrial estate, diversification does not affect firm productivity. As for firms in industrial areas, diversification has a positive effect on increasing productivity. Increasing diversification by one standard deviation will increase firm productivity in the industrial area by 8.5%. The effect of diversification is more substantial and more favorable for firms in this industrial area in line with the results of Caragliu et al. (2016) and Marrocu et al. (2013) for the case in European countries that the effect of diversification is more favorable in dense regions, such as areas within industrial estates that show more urban situations. The effect of competition on firms in the industrial area has not been significantly different from firms outside the industrial area. Increasing competition by one standard deviation will increase firm productivity by 1.2%. This is consistent with Porter's theory that competition in similar industries will increase firm productivity compared to a monopoly environment. The positive effect of the competition is also in line with Badr et al. (2019), Khoirunurrofik (2018), Cieřlik et al. (2017), Wixe (2015), and Widodo et al. (2014).

There is a difference in the type of local industry structure that affects firm productivity, which is between firms inside and outside the industrial area. Comparing the local industry structure's total impact on firms inside and outside the industrial area, firms in the industrial area benefit the most from the diversification externalities. Meanwhile, firms outside the industrial area only benefit from the externality of the competition. Furthermore, based on the average value of the diversification index in Table 2, firms located in the industrial area are more diverse, and in that context, the externality of diversification increases firm productivity. Unlike the case with firms outside the industrial estates based on the average value of the diversification index in Table 2, the firms' diversity is lower, and thus diversity externalities from other sectors (Jacobs' externalities) do not significantly influence firm productivity.

**Table 5. The proportion of Firms by Location and Category of Specialization**

| Location   | Category                     | 2010   | 2011   | 2012   | 2013   | 2014   | 2015   |
|------------|------------------------------|--------|--------|--------|--------|--------|--------|
| Outside IE | <i>Non-Specialized Firm*</i> | 30.44% | 29.55% | 29.66% | 29.26% | 28.89% | 27.29% |
|            | <i>Specialized Firm**</i>    | 62.19% | 63.05% | 62.81% | 61.28% | 61.69% | 63.45% |
| Inside IE  | <i>Non-Specialized Firm*</i> | 1.94%  | 1.97%  | 2.04%  | 2.68%  | 2.58%  | 2.34%  |
|            | <i>Specialized Firm**</i>    | 5.42%  | 5.43%  | 5.49%  | 6.77%  | 6.83%  | 6.92%  |

Note: \**Non-Specialized Firm* is a firm that operates in a type of industry that is not a district/city specialization sector, namely an industry with an LQ index value of less than or equal to 1. \*\* *Specialized Firm*, which is a firm that operates in a type of regency/city specialization industry, namely industries with LQ index values above 1.

Source: Calculated from SI data

Based on MAR theory, the externality of specialization should have a positive effect on productivity. However, the results of the estimation did not match what was expected. The specialization effect is also harmful to firms outside the industrial area, although nationally, firms outside the industrial area have, on average higher specialization index. The negative effect of this specialization is in line with the results of Combes (2000) research for studies in France, Batisse (2002) in China, Marrocu et al. (2013) for old countries in Europe, and Zhang (2017) for the manufacturing industry in China. According to Marrocu et al. (2013), the influence of harmful specialization can occur because agglomeration's economic factors are more significant. For example, congestion and competition between firms and similar industries cause additional costs for the firm (Marrocu et al., 2013). As shown in Table 5, firms operating in the type of industry, which are specialized sectors of the district/city (specialized firm), are mostly located outside the industrial area, amounting to around 60%. Besides, firms outside the industrial estate are mostly small firms, and their productivity is lower. If competition in a similar industry is robust, small firms tend to lose competitiveness and productivity decline.

Detail analysis on firms inside industrial estates, we explore what type of local industry structures affect firms' productivity inside the industrial estate. The influence of local industrial structures on firms in industrial estates (*Inside IE* in Table 4) shows that specialization, namely a group of firms with similar industries in industrial areas, harms firm productivity. This means that agglomeration of similar industries that provide MAR externality, through the labor pool, sharing intermediate input, and knowledge spillover does not occur in industrial estates. The study of Aritenang and Chandramidi (2020) stated that the primary motivation for firms located in industrial estates is not to obtain agglomeration economies from similar industries but for pragmatic reasons such as land availability and infrastructure (electricity, water, easy transportation) and security in industrial estates. Besides, specific industrial sectors that dominate an industrial area (specialization) are characterized by a protectionist view of knowledge and information for fear that sharing information can make them lose their competitiveness (Aritenang & Chandramidi, 2020). Meanwhile, diversification has a positive effect on firm productivity in industrial estates. This suggests that Jacobs' externality, which increases productivity through cross-industry knowledge spillover, is possible in industrial estates. Companies in industrial estates work together with complementarity in their value chains (Aritenang & Chandramidi, 2020). This pattern of cooperation will encourage cross-industry knowledge spillover and increase firm productivity.

For robustness checks, a regression is carried out on firm sub-samples based on locations inside and outside the industrial area, with the results shown in Table 6. Columns (1), (3), and (5) in Table 6 are the estimation results for a sub-sample of firms located within the industrial area, where added control of fixed effects is specific to the island level in column (3) and at the Java level Outside Java in column (5) interacted with time trend. While columns (2), (4), and (6) are the estimation results

for a sub-sample of firms located outside the industrial area, where added control of fixed effects are specific to the island level in column (4), and at the level of the Outer Java islands Java in column (6,) interacted with time trend. In general, both for firms in the industrial area and for firms outside the industrial area, the estimation results are consistent with the previous regression results summarized in Table 4, but with a different level of significance.

**Table 6. Estimation Results Sub Sample (Fixed Effect)**

| Dependent:<br>LnTFP      | (1)<br>IE            | (2)<br>Non IE        | (3)<br>IE            | (4)<br>Non IE        | (5)<br>IE            | (6)<br>Non IE        |
|--------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| z_LQ                     | -0.488***<br>(0.176) | -0.030*<br>(0.016)   | -0.433**<br>(0.178)  | -0.034**<br>(0.016)  | -0.472***<br>(0.177) | -0.034**<br>(0.016)  |
| z_Div                    | 0.100**<br>(0.050)   | -0.024*<br>(0.014)   | 0.069<br>(0.054)     | -0.025*<br>(0.014)   | 0.066<br>(0.054)     | -0.025*<br>(0.014)   |
| z_Comp                   | 0.000<br>(0.018)     | 0.011***<br>(0.003)  | 0.001<br>(0.018)     | 0.012***<br>(0.003)  | 0.001<br>(0.018)     | 0.013***<br>(0.003)  |
| lnFirm_labor             | 0.023<br>(0.029)     | 0.117***<br>(0.009)  | 0.020<br>(0.030)     | 0.119***<br>(0.009)  | 0.021<br>(0.029)     | 0.117***<br>(0.009)  |
| lnKLratio                | -0.095***<br>(0.012) | -0.075***<br>(0.003) | -0.097***<br>(0.012) | -0.075***<br>(0.003) | -0.095***<br>(0.012) | -0.076***<br>(0.003) |
| DPMA                     | -0.055<br>(0.090)    | -0.042<br>(0.036)    | -0.053<br>(0.090)    | -0.036<br>(0.036)    | -0.057<br>(0.090)    | -0.040<br>(0.036)    |
| DGOV                     | -0.596**<br>(0.245)  | 0.081<br>(0.055)     | -0.587**<br>(0.250)  | 0.078<br>(0.055)     | -0.584**<br>(0.245)  | 0.080<br>(0.055)     |
| DT                       | 0.617<br>(0.475)     | -0.727***<br>(0.138) | 0.580<br>(0.476)     | -0.717***<br>(0.138) | 0.601<br>(0.476)     | -0.727***<br>(0.138) |
| firm_share               | 0.350***<br>(0.020)  | 0.369***<br>(0.010)  | 0.348***<br>(0.020)  | 0.368***<br>(0.010)  | 0.348***<br>(0.020)  | 0.369***<br>(0.010)  |
| _cons                    | 11.834***<br>(0.766) | 11.675***<br>(0.189) | 12.006***<br>(0.770) | 11.660***<br>(0.205) | 11.917***<br>(0.768) | 11.670***<br>(0.188) |
| N                        | 5260                 | 86402                | 5260                 | 86402                | 5260                 | 86402                |
| r <sup>2</sup>           | 0.130                | 0.097                | 0.134                | 0.099                | 0.131                | 0.098                |
| F                        | 16.830               | 198.404              | 12.261               | 130.213              | 14.940               | 176.467              |
| P                        | 0.000                | 0.000                | 0.000                | 0.000                | 0.000                | 0.000                |
| Industry_FE              | YES                  | YES                  | YES                  | YES                  | YES                  | YES                  |
| Year_FE                  | YES                  | YES                  | YES                  | YES                  | YES                  | YES                  |
| Island*Time Trend        | NO                   | NO                   | YES                  | YES                  | NO                   | NO                   |
| Java-Non Java*Time Trend | NO                   | NO                   | NO                   | NO                   | YES                  | YES                  |

Note: Standard errors in parentheses; \* Significant at 1%; \*\* Significant at 5%; \*\*\* Significant at 10%.

Source: Authors processed

The specialization effect is significantly negative on firm productivity inside and outside the industrial area, with a more negative value for firms in the industrial area. Meanwhile, the effect of diversification is different for firms inside and outside the industrial area. For firms in the industrial area, diversification is positive on firm productivity, but the effect is significant only in column (1). When controlled by region-specific effects at the island level that are interacted with time trends in columns (3) and (5), the effect of diversification on firm productivity in an industrial area is positive but not significant. The reduced significance of diversification on firms in this industrial area may be due to the smaller number of sub-samples when controlled by observations grouped by island group and year. As for firms outside the industrial area, diversification is negative and significant at the 10% level. For the competition, the effect is positive but not significant on firm productivity in the industrial area. As for firms outside the industrial estate, competition is positive and significantly increases firm productivity.

For robustness checks, estimations are also conducted using balanced panel data from 2010-2015 and are controlled by firm age, with firm observations included in the SI survey in 2006. This is done to determine whether the influence of specialization and diversification on firm productivity is also affected by the industry's maturity. Duranton & Puga (2001), with their "nursery cities" concept, state that mature industries will be more productive in specialized areas while young industries and small firms will be important in diversified areas. Estimation results with fixed effects on the balance panel data can be seen in appendix 1 for the entire sample and appendix 2 for sub-samples based on location inside and outside the industrial area.

For both the overall sample and sub-sample, the estimation results are consistent with the estimation results from the unbalance panel in Table 4. Specialization has a negative and significant effect on firm productivity inside and outside the industrial area, with a more significant decrease in firms' productivity in the industrial area. The effect of diversification is positive for firm productivity in industrial estates and negatively for firms outside the industrial area. While competition has a positive effect on firm productivity outside the industrial estate, its effect on the industrial area is not significant. The findings of consistent estimation results in Table 4 show that the influence of local industry structures on firms' productivity inside and outside industrial estates and the magnitude of the influence is robust.

## **Conclusion**

This study aims to determine the effect of local industry structure on firm productivity in the industrial area. By using unbalanced panel data, this result shows that there is an effect of local industry structure on firm productivity, and the effect is different on the firm in the industrial area. Specialization decreases both firms' productivity in an industrial area and outside industrial area, with a more significant reduction in productivity for firms in industrial estates. Diversification also gives a

different effect. For firms in the industrial area, diversification has a positive effect on increasing firm productivity. As for firms outside the region, diversification has a negative effect on firm productivity though the effect is less significant. In regard to competition indicator, there is a positive and significant effect of competition on firm productivity outside the region. However, the effect is not significant for firms' productivity in the industrial area.

From our empirical results, firms in the industrial area benefit from a diversified local industry structure. As the government requires large firms in an industry to be located in an industrial area, the government and the estate management need to arrange new firms' location regarding the industrial area aligning to a favorable environment for increasing productivity. Because the firms' presence in the industrial area alone empirically has not make the productivity of firms in the area higher than firms outside the industrial area. The government needs to make policies that can increase firm productivity in the industrial area by structuring its industrial structure.

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## Appendix 1.

Estimation Results Overall Sample with Balanced Data Panel (Fixed Effect)

| Dependent:<br>Ln TFP     | (1)<br>FE            | (2)<br>FE            | (3)<br>FE            | (4)<br>FE            | (5)<br>FE            |
|--------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| z_LQ                     | -0.025<br>(0.020)    | -0.041**<br>(0.019)  | -0.045**<br>(0.019)  | -0.042**<br>(0.019)  | -0.044**<br>(0.019)  |
| z_Div                    | -0.023<br>(0.016)    | -0.024<br>(0.015)    | -0.025<br>(0.016)    | -0.026*<br>(0.015)   | -0.026*<br>(0.015)   |
| z_Comp                   | 0.012***<br>(0.003)  | 0.011***<br>(0.003)  | 0.012***<br>(0.003)  | 0.012***<br>(0.003)  | 0.013***<br>(0.003)  |
| D_KI                     | -0.775<br>(0.704)    | -0.935<br>(0.689)    | -0.801<br>(0.688)    | -0.816<br>(0.689)    | -0.849<br>(0.689)    |
| zLQ_KI                   | -0.196<br>(0.165)    | -0.263<br>(0.162)    | -0.299*<br>(0.162)   | -0.298*<br>(0.162)   | -0.277*<br>(0.162)   |
| zDiv_KI                  | 0.114**<br>(0.051)   | 0.094*<br>(0.050)    | 0.097*<br>(0.054)    | 0.145***<br>(0.051)  | 0.133***<br>(0.050)  |
| zComp_KI                 | -0.011<br>(0.024)    | -0.003<br>(0.023)    | -0.004<br>(0.023)    | -0.002<br>(0.023)    | -0.004<br>(0.023)    |
| lnFirm_labor             |                      | 0.093***<br>(0.010)  | 0.094***<br>(0.010)  | 0.094***<br>(0.010)  | 0.093***<br>(0.010)  |
| lnKLratio                |                      | -0.082***<br>(0.004) | -0.081***<br>(0.004) | -0.082***<br>(0.004) | -0.082***<br>(0.004) |
| DPMA                     |                      | -0.026<br>(0.037)    | -0.019<br>(0.037)    | -0.022<br>(0.037)    | -0.024<br>(0.037)    |
| DGOV                     |                      | 0.025<br>(0.057)     | 0.020<br>(0.057)     | 0.025<br>(0.057)     | 0.026<br>(0.057)     |
| DT                       |                      | -0.532***<br>(0.145) | -0.547***<br>(0.145) | -0.524***<br>(0.145) | -0.532***<br>(0.145) |
| firm_share               |                      | 0.333***<br>(0.009)  | 0.332***<br>(0.009)  | 0.332***<br>(0.009)  | 0.333***<br>(0.009)  |
| Firm Age                 |                      | 0.107***<br>(0.002)  | -0.046<br>(0.102)    | 0.107***<br>(0.019)  | 0.112***<br>(0.002)  |
| _cons                    | 10.860***<br>(0.083) | 9.825***<br>(0.213)  | 13.470***<br>(2.448) | 9.784***<br>(0.504)  | 9.713***<br>(0.214)  |
| N                        | 67841                | 67841                | 67841                | 67841                | 67841                |
| R <sup>2</sup>           | 0.064                | 0.102                | 0.110                | 0.104                | 0.103                |
| F                        | 106.659              | 155.210              | 33.754               | 105.609              | 139.532              |
| P                        | 0.000                | 0.000                | 0.000                | 0.000                | 0.000                |
| Industry_FE              | YES                  | YES                  | YES                  | YES                  | YES                  |
| Year_FE                  | YES                  | YES                  | YES                  | YES                  | YES                  |
| Province* Time Trend     | NO                   | NO                   | YES                  | NO                   | NO                   |
| Island*Time Trend        | NO                   | NO                   | NO                   | YES                  | NO                   |
| Java-Non Java*Time Trend | NO                   | NO                   | NO                   | NO                   | YES                  |

Note: Standard errors in parentheses; \* Significant at 1%; \*\* Significant at 5%; \*\*\* Significant at 10%.

Source: Authors processed

## Appendix 2.

Estimation Result on Sub Sample with Balanced Data Panel (Fixed Effect)

| Dependent:<br>Ln TFP     | (1)<br>IE            | (2)<br>Non IE        | (3)<br>IE            | (4)<br>Non IE        | (5)<br>IE            | (6)<br>Non IE        |
|--------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| z_LQ                     | -0.459**<br>(0.190)  | -0.035*<br>(0.019)   | -0.456**<br>(0.191)  | -0.038*<br>(0.019)   | -0.438**<br>(0.191)  | -0.039**<br>(0.019)  |
| z_Div                    | 0.119**<br>(0.054)   | -0.026*<br>(0.015)   | 0.083<br>(0.059)     | -0.029*<br>(0.015)   | 0.078<br>(0.058)     | -0.028*<br>(0.015)   |
| z_Comp                   | 0.019<br>(0.027)     | 0.012***<br>(0.003)  | 0.020<br>(0.027)     | 0.013***<br>(0.003)  | 0.022<br>(0.027)     | 0.014***<br>(0.003)  |
| lnFirm_labor             | 0.025<br>(0.031)     | 0.101***<br>(0.010)  | 0.026<br>(0.031)     | 0.102***<br>(0.010)  | 0.023<br>(0.031)     | 0.101***<br>(0.010)  |
| lnKLratio                | -0.100***<br>(0.013) | -0.080***<br>(0.004) | -0.097***<br>(0.013) | -0.080***<br>(0.004) | -0.100***<br>(0.013) | -0.080***<br>(0.004) |
| DPMA                     | 0.091<br>(0.097)     | -0.048<br>(0.041)    | 0.082<br>(0.097)     | -0.043<br>(0.041)    | 0.084<br>(0.097)     | -0.046<br>(0.041)    |
| DGOV                     | -0.644**<br>(0.256)  | 0.068<br>(0.058)     | -0.531**<br>(0.266)  | 0.063<br>(0.058)     | -0.631**<br>(0.256)  | 0.068<br>(0.058)     |
| DT                       | 0.445<br>(0.521)     | -0.660***<br>(0.152) | 0.453<br>(0.521)     | -0.653***<br>(0.152) | 0.430<br>(0.521)     | -0.662***<br>(0.152) |
| firm_share               | 0.333***<br>(0.020)  | 0.333***<br>(0.010)  | 0.328***<br>(0.020)  | 0.332***<br>(0.010)  | 0.332***<br>(0.020)  | 0.333***<br>(0.010)  |
| Firm Age                 | 0.079***<br>(0.009)  | 0.109***<br>(0.002)  | 0.069***<br>(0.011)  | 0.107***<br>(0.019)  | 0.069***<br>(0.011)  | 0.115***<br>(0.002)  |
| _cons                    | 10.904***<br>(0.857) | 9.718***<br>(0.216)  | 11.110***<br>(0.869) | 9.735***<br>(0.508)  | 11.140***<br>(0.864) | 9.602***<br>(0.217)  |
| N                        | 4346                 | 63495                | 4346                 | 63495                | 4346                 | 63495                |
| R <sup>2</sup>           | 0.141                | 0.101                | 0.148                | 0.103                | 0.143                | 0.102                |
| F                        | 15.601               | 158.834              | 11.542               | 104.418              | 13.903               | 141.520              |
| P                        | 0.000                | 0.000                | 0.000                | 0.000                | 0.000                | 0.000                |
| Industry_FE              | YES                  | YES                  | YES                  | YES                  | YES                  | YES                  |
| Year_FE                  | YES                  | YES                  | YES                  | YES                  | YES                  | YES                  |
| Island*Time Trend        | NO                   | NO                   | YES                  | YES                  | NO                   | NO                   |
| Java-Non Java*Time Trend | NO                   | NO                   | NO                   | NO                   | YES                  | YES                  |

Note: Standard errors in parentheses; \* Significant at 1%; \*\* Significant at 5%; \*\*\* Significant at 10%.

Source: Authors processed

## Can Revenue and Human Development Promote Happiness: Study on Provinces in Indonesia

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**Abstract**

*This study seeks to see the relationship between the human development index (HDI) and gross regional domestic product (GRDP) variables on the happiness of economic growth data for provinces in Indonesia. The method used in this research is regression and path analysis. This study proves that happiness is not caused by the income (GRDP) of a region but rather significantly by one of the dimensions of HDI, namely the education dimension. The relationship through the variable between using path analysis through the indirect effect of the GRDP intermediary also significantly affects the education dimension. About 60% of the variable quality of education plays a role in happiness. If the effect is through an intermediary variable, the real influence of the variable quality of education on happiness is 65%. Other variables such as health and economy, directly or indirectly, do not significantly affect the level of happiness.*

**Keywords:**

Human development, happiness, gross domestic product.

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## Introduction

Central Bureau of Statistics (BPS) released the 2017 Indonesia's happiness index per province, which according to the authors, resulted in an interesting fact that the happiest province was North Maluku province in the first place, while DKI Jakarta was in fourth place in the happiness index. This result is impressive because, according to BPS data, North Maluku is not the province with the highest per capita income or the highest regional PAD in Indonesia. North Maluku is also not the province with the highest Human Development Index in Indonesia.

There were variations in the population's happiness level between provinces in Indonesia, ranging from 67.52 to 75.68. Of the 34 provinces in Indonesia, 24 provinces whose people have an average Happiness Index above the national Happiness Index (70.69) and ten other provinces are below the average national happiness. Furthermore, the three provinces with the highest Happiness Index score were North Maluku (75.68), Maluku (73.77), and North Sulawesi (73.69). Meanwhile, the provinces of Papua, North Sumatra and, East Nusa Tenggara were the three provinces that turned out to have the lowest Happiness Index with each index value of 67.52, 68.41, and 68.98. This result is impressive because, according to BPS data, North Maluku is not the province with the highest per capita income or the highest regional PAD in Indonesia. North Maluku is also not the province with the highest Human Development Index in Indonesia (BPS, 2018).

This fact contradicts the opinion that economic variables such as income, wealth, or employment are essential factors for a good quality of life, individually and socially. More prosperous people usually enjoy better health services, thus having better health rates, longer life expectancies, lower infant mortality rates, and higher access and education. Wealthier people have more freedom to choose. All of this confirms the notion that those who have more opportunities to be happier than those who are poor. This controversial result certainly raises many questions, especially about indicators and measurements of happiness itself. Provinces that are known as low-income provinces have a higher happiness index than relatively more affluent provinces. On the other hand, North Maluku is one of the provinces with the lowest GDP in Indonesia and has the highest happiness index in Indonesia.

The relationship between GDP and Happiness has long been criticized by some experts, giving birth to the Easterlin paradox. Easterlin at least asked in his famous writing in 1974 whether "increasing everyone's income will increase the happiness of all?" when he bases his observations on a measure of happiness that remains unchanged over the long run in a country with a high GDP rate. The relationship between GDP per capita and Happiness becomes a debate among experts in seeing the connection, what factors have a relationship with increasing happiness. GDP per capita, however, cannot be ignored by experts as a determining variable for happiness.

Some research linking specific periods to happiness and income suggests that happiness and income rise and fall together. Connor provides research evidence of how

the great recession of 2007-09 had a short-term effect, when America's incomes fell, proving that happiness fell to the lowest level on record. Bartolini & Sarracino (2014) empirically tested and found a relationship between happiness and a decrease in GDP over time, when their research proved that in the long run with a period of at least 15 years and found no significant relationship between GDP and happiness. The researchers also conducted research that looked at income levels for happiness. The study later found that there was a relationship between income (GDP per capita) and happiness levels with various income thresholds ranging from \$ 10,000 (Frey & Stutzer, 2002), \$ 12,000 (Kahneman & Deaton, 2010).

The paradox of the relationship between income and happiness also encourages experts to examine the various factors that influence happiness. Economists suspect and prove various relationships between happiness and several other social variables through several studies. These studies further confirm various factors other than GDP per capita that influence happiness, for example, socio-economic and socio-demographic conditions. Health (physical) (Veenhoven, 1991), age (Blanchflower & Oswald, 2008), marriage (Stack & Eshleman, 1998), political, economic, and personal freedom (Veenhoven, 2012), democracy (Dorn et al., 2007), entrepreneurship (Hundley, 2001), voluntary work (Meier & Stutzer, 2008), social relations (Helliwell et al., 2009), intelligence (Veenhoven & Choi, 2012). Studies such as Oswald (1997), Gerdtham & Johannesson (2001), Frey & Stutzer (2002) emphasize socio-demographic factors to explain happiness. Several other studies include success in education (Blanchflower & Oswald, 2004) and physical health (Dolan et al., 2008) as causes of happiness.

These various variables emphasize one factor that stands out: the main factor explaining the insignificant phenomenon at a certain level of GDP per capita towards happiness, namely social capital accommodated in Human development. This research paper will focus on two social capital, namely health and education, the Human Development Index dimensions, plus one economic factor: a decent standard of living. The three of them are accommodated in the Indonesian Human Development Index issued by BPS.

Coleman (1988) previous research confirmed one dimension used by this paper, namely education. Student educational attainment will increase life satisfaction. Also, participation in various activities increases students' self-esteem, cognitive abilities, memory, and creativity. Human development will reduce student dropout rates (Behzad, 2002) and increase educational attainment and achievement, increasing happiness (Ghamari, 2012). Another dimension of HDI used in this paper is health. Human development will usually increase health-promoting behaviors (Majeed & Liqat, 2019; Majeed & Ajaz, 2018; Kessler, 1997), such as outdoor activities, sports, and social collaboration. These activities lower levels of stress, depression and improve physical and mental health. According to Kawachi et al. (1997), Better health increases happiness both directly and indirectly. Positive health outcomes directly increase happiness levels. Indirectly, healthier individuals work more efficiently and have high productivity, which leads to higher

per capita income and lower stress levels. Also, healthier students are more active and have higher efficiency. Therefore, good health enhances educational attainment, which is positively related to happiness.

The link between Human development and Happiness can be traced through the sources of happiness. This source of happiness is closely related to improving the quality of life. The connection between the source of happiness and human development can be started from factors considered a source of happiness. The factors that can be considered sources of happiness and indicate the quality of life are; health, education, and unemployment. Several studies link GDP and human development through channels of improving the quality of life. Improved quality of life will make an increase in the human development index. The relationship between GDP and an increase in the quality of life can be detailed as follows: A higher per capita income is always accompanied by an increase in labor productivity, which means more excellent choice in the use of opportunities and time. As Sen (2001) argues, by increasing the freedom to make economic choices, growth has implications for improving people's welfare and quality of life. An increase in GDP is also usually followed by an increase in education and resources for personal development. Economic growth (increased GDP) also leads to higher life expectancy, decreased child mortality, and underweight children (Becker et al., 2005; Easterlin & Angelescu, 2009).

Several opinions have linked economic growth with happiness that can at least refer to several writings. Several studies admit that there is indeed a close relationship between GDP and happiness because the dimension of happiness related to economic growth (GDP) does have a relationship, but to some extent. For example, linked life expectancy to economic growth, pollution, well-being, unemployment and happiness, increased crime, and happiness (Tella & MacCulloch, 2008). However, in the GDP per capita, this influence still has limitations, as revealed by Layard's research. In their research, Kahneman & Deaton (2010) found that when income has passed a certain threshold, the level of happiness does not appear to depend on per capita income. This opinion is also shared by Inglehart et al. (2008).

GDP per capita, HDI, and Happiness, in this context, are reasonable to be seen as things that might influence each other. When GDP per capita is no longer the final goal because it is considered not to accommodate welfare as a whole, GDP growth is only the cause of an economy's ultimate goal. An alternative that is more accommodating in measuring welfare is happiness, so it is exciting to see the various relationships between income, HDI, and happiness. Based on the above phenomena, this study focuses on the relationship between per capita income, the human development index, and its effect on happiness. This research's novelty is how the direct relationship between HDI and happiness, the relationship between GRDP and Happiness, and the GRDP relationship as a variable between HDI and happiness.

## Methods

The Indonesian human development index compiled by BPS concerns at least three things that are near related to the theory of human development and growth, namely Life Expectancy, Average Length of Schooling, and public consumption. This study uses secondary data obtained from the Central Bureau of Statistics publication on the study variables. Data were collected from all provinces in Indonesia in 2014-2017. The variables used are GDP per capita province, Human Development Index per province, and happiness index.

The data analysis technique uses four methods of analysis, namely descriptive analysis to analyze individual variable data, correlation method (Pearson Correlation / Product Moment) to explain the trend of the two variables studied, regression model method, and path analysis to see the relationship and relationship path of the variables being modeled.

The structural equation in this study is formulated in two sub-structural equations as follows:

- a. The equation of the first substructure path:

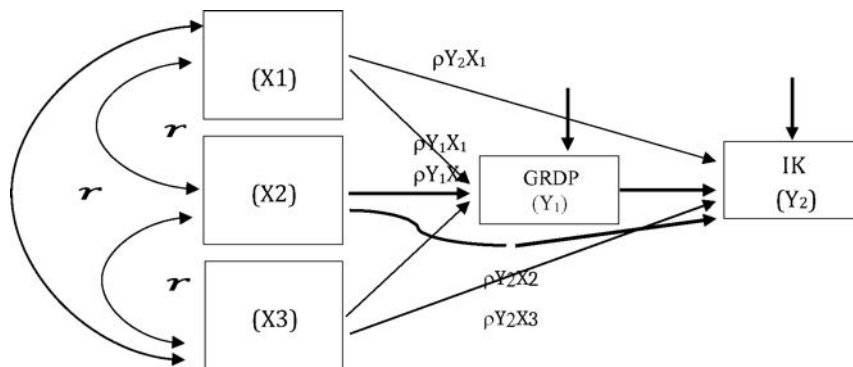
$$Y_1 = \rho Y_1 X_1 + \rho Y_1 X_2 + \rho Y_1 X_3 + \varepsilon_1$$

- b. The second substructure path equation:

$$Y_2 = \rho Y_1 X_1 + \rho Y_1 X_2 + \rho Y_1 X_3 + \rho Y_2 Y_1 + \varepsilon_2$$

The two equations can be seen in the relationship between variables and the relationship path depicted in Figure 1.

Figure 1.  $X_1$ ,  $X_2$ , and  $Y_1$  to  $Y_2$  Path Diagrams



Information:

- $X_1$  = HDI variable in Economic Dimensions
- $X_2$  = HDI variable in education dimension
- $X_3$  = HDI Variable in health dimensions
- $Y_1$  = PDRB intervening variable
- $Y_2$  = The dependent variable Happiness Index (IK)
- $r_{X_1 X_2}$  = Correlation Coefficient  $X_1$  to  $X_2$
- $\rho Y_1 X_1$  = Path Coefficient of  $Y_1 X_1$
- $\varepsilon_{1,2}$  = Other factors that influence  $Y_1$ ,  $Y_2$

## Result and Discussion

The general description of the per capita GRDP conditions of the provinces in Indonesia in 2017 illustrates that there are three main groups, namely the middle to upper group (above 80 million / year), medium (value between 40 million / year to 80 million / year) and middle to lower (under 40 million / year). The middle class and above are occupied by two provinces, namely DKI Jakarta and East Kalimantan. The middle group is occupied by five provinces, namely Riau, Riau Islands, North Kalimantan, Papua, and West Papua. The rest goes to the lower middle.

The Happiness Index value in Indonesia's provinces in 2017 describes a fairly good condition in all provinces. If we use a size range of 0 to 100 for this Happiness index, then using the 3rd quartile (index 50 - 75) as the boundary for good conditions, all provinces are in a good category, and only North Maluku province is in good condition. once (index > 75). The distribution of data in the provinces above illustrates that feeling happy in these provinces is not always in line with the material conditions. Several provinces showing low-income levels turned out to have good levels of happiness. The Human Development Index (HDI) value in provinces in Indonesia in 2017 illustrates a fairly good condition in all provinces. If we use a size range of 0 to 100 for this Happiness index, then using the 3rd quartile (index 50 - 75) as the boundary for good conditions, all the provinces are in a good category, and the provinces of DKI Jakarta, East Kalimantan, and DI Yogyakarta who are in excellent condition (index > 75).

## Correlation Analysis

Correlation analysis on the three variables of GRDP per capita, HDI, and Happiness Index using product-moment correlation (Pearson) found that the relevant correlations for the three variables occurred only in the HDI and IK variables and the GDP per capita and HDI variables, while between the HDI and Happiness Index (IK) variables, the correlation that was built did not occur significantly.

Table 1. Pearson Correlation between Variables

| Variable | PDRB | IK   | IPM    |
|----------|------|------|--------|
| PDRB     | 1    | .167 | .491** |
| IK       |      | 1    | .383*  |
| IPM      |      |      | 1      |

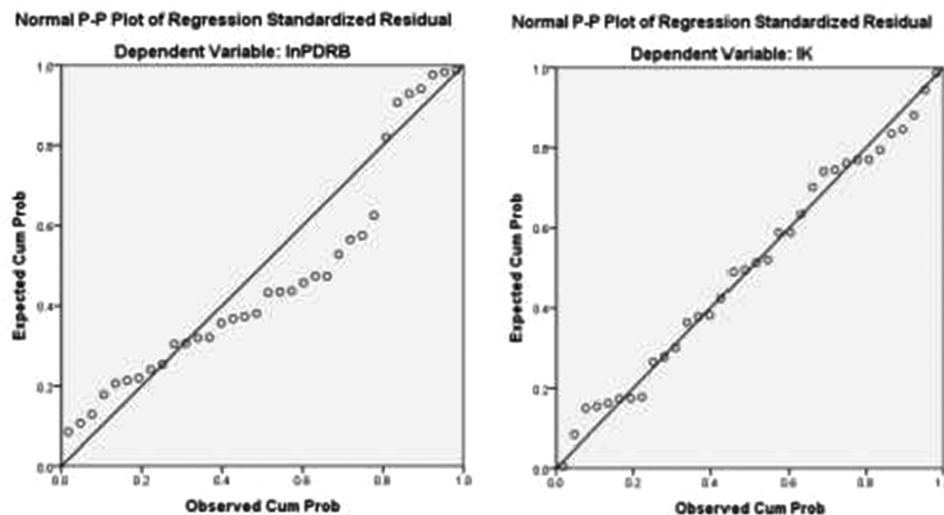
Source: data processed

Based on Table 1, GRDP has a very weak correlation with the Happiness Index (IK) with a value of 0.167, in which the Human Development Index (HDI) has a better and moderate correlation to happiness than GRDP. The correlation between GDP per province and HDI variables is in a moderate relationship, meaning that the two

variables' tendency is neither too strong nor too weak. Many theories have explained the theoretical relationship between the two. Likewise, the results of previous studies also show this. Likewise, in the relationship between the HDI and CI variables, the correlation coefficient also shows intermediate results (0.383), which means that between the two variables tends neither too strong nor weak in the relationship. This is following previous research, which states that there is an influence of the human development index variable on happiness (Costanza et al., 2009; Deaton & Stones, 2013)

Although HDI and GRDP are significantly correlated and HDI and IK are also correlated, the data findings show that IK is not significantly related to GRDP. This is the same age as previous research, which states that the relationship between income and happiness is weak. This illustrates that the material in the form of capital accumulation, which is reflected in GRDP, is not always in line with its citizens' happiness. Qualitatively, the hypothesis that explains that happiness is in line with the achievement of economic progress, it turns out that the results of this correlation coefficient do not show significant evidence.

Figure 2. Normality P-P Plot Test Models 1 and 2



## Model Analysis

Testing the model normality assumption shows that the two models are normally distributed. Normality testing using the Normal P-P Plot on the residual (error) of the two model equations produces a residual pattern that spreads around the diagonal line. This shows that the residuals are distributed following a normal distribution. Table 2 shows the value of multicollinearity, where each HDI variable has a relationship value. The value of the Health variable with an economic index of 0.614. The education index score has a value of 0.531 for the economy, and the Health index is 0.428 for education.

Table 2. Correlation between Variables

|      | PDRB | IK   | IAHH              | IPKK | IEDU |
|------|------|------|-------------------|------|------|
| PDRB | 1    | .167 | .392              | .492 | .327 |
| IK   | .167 | 1    | .207              | .202 | .53  |
| IAHH | .392 | .207 | 1                 | .614 | .428 |
| IPKK | .492 | .202 | .614              | 1    | .531 |
| IEDu | .327 | .539 | .428 <sup>*</sup> | .531 | 1    |

Source: processed data

Multicollinearity testing on the independent variables used by Pearson correlation between independent variables obtained results as shown in Table 2. The correlation coefficient value above the value of 0.8 indicates that there is collinearity between these variables. Conversely, if the correlation coefficient value has a value below the value of 0.8 indicates the absence of multicollinearity in the modeled independent variable. Testing for homoscedasticity using the Glejser test on the two models used can be seen in Table 3. The regression coefficient significance value in the two models, which is not significant, indicates no heteroscedasticity in the model built.

Table 3. Summary of the Glejser test

| Model 1  | Dependent Variable: absRes1 | Model 2  | Dependent Variable: absRes2 |
|----------|-----------------------------|----------|-----------------------------|
| Variable | Sig.                        | Variable | Sig.                        |
| IPKK     | .346                        | IPKK     | .524                        |
| IEdu     | .753                        | IEdu     | .401                        |
| IAHH     | .232                        | IAHH     | .578                        |
|          |                             | InPDRB   | .970                        |

Source: processed data

### The goodness of fit test

The suitability of the structural model built in this study will be tested by testing the model's significance (F test) and the coefficient of determination, explaining how much the model can describe the variation in the dependent variable. The results of data processing using the SPSS v23 software package, a general test of the model's accuracy, gave significant results in both models. Model 1 with Probability value (P-value = 0.028) <0.05, then the test decision rejects H0. This result means that the structural model built significantly can be used to model the influence of the AHH, PKK, and Education variables on GDP per capita.

Based on Table 4, the general test of the second model's suitability also yields a significant value. The probability value (P-value = 0.028) <0.05 then the test decision rejects H0. This result means that the constructed structural model can be used

significantly to model the influence of the AHH, PKK, Education, and GRDP per capita variables on the Happiness Index (IK).

**Table 4. Test F model structures Model 1 and Model 2**

|            | Model 1 |      | Model 2 |                   |
|------------|---------|------|---------|-------------------|
|            | F       | Sig. | F       | Sig.              |
| Regression | 3.484   | .028 | 3.183   | .028 <sup>b</sup> |

Source: processed data

Table 5, summarizes the coefficient of determination of the two models. The first model produces a value of  $R^2 = 0.258$ , which means that the quality model of human resources with the proxies of AHH, PKK, and education as its dimensions can explain per capita income behavior by 25.8%. Simultaneously, the rest is explained by other variables that are not included in the model. The second model produces a value of  $R^2 = 0.305$ , which means that the quality model of “Happiness” with the Happiness Index (IK) proxy can be explained by AHH, PKK, Education per capita GRDP of 30.5%. In comparison, the rest is explained by other variables that are not included in the model.

**Table 5. The Coefficient of Determination of model 1 and model 2**

| Model 1 |                | Model 2           |                |
|---------|----------------|-------------------|----------------|
| R       | R <sup>2</sup> | R                 | R <sup>2</sup> |
| .508    | .258           | .552 <sup>a</sup> | .305           |

Source: processed data

### Estimated Model Parameters

Model 1 wants to show how the relationship between IP and GRDP, and model 2 shows the direct relationship between HDI and the happiness index without intermediate variables. In model 1, the estimation results explain that only the Family Consumption Expenditure (PKK) variable significantly affects the per capita GRDP variable (rejects  $H_0$ ) at the level of significant ( $\alpha$ ) 10%. The other model variables show less significant results. This indicates that only the quality of human resources from an economic standpoint has a significant impact on welfare quality (as a proxy for GDP per capita). Meanwhile, from the dimensions of education and health, it does not significantly affect it.

In model 2, the estimation results explain that only the education variable significantly affects the IK variable (rejects  $H_0$ ) at the level of significant ( $\alpha$ ) 5%. The other model variables show less significant results. This indicates that only the quality of human resources in terms of education significantly affects Happiness’s quality (using the Happiness Index as a proxy). Meanwhile, PDRB per capita, Family Consumption Expenditure (PKK), and Life Expectancy Rate (AHH) did not significantly affect. This

finding is also in line with the correlation coefficient values obtained between the HDI and IK variables. This means that the trend/correlation between the HDI and IK variables is confirmed by the regression model made. The trend relationship between the two variables is limited to the trend and the causality relationship. However, this relationship is only significant in the education dimension. This finding is different from previous research, which states that health variables influence happiness (Kawachi et al., 1997; Majeed & Samreen, 2021; Dolan et al., 2008; Majeed & Liqat, 2019; Kessler, 1997), but it is in line with research. The education variable has a significant effect on the happiness variable (Coleman, 1988; Behzad, 2002; Ghamari, 2012; Veenhoven & Choi, 2012).

**Table 6. Estimation results of model parameters**

| Model 1    |        |      | Model 2    |         |      |
|------------|--------|------|------------|---------|------|
| Variable   | B      | Sig. | Variable   | $\beta$ | Sig. |
| (Constant) | 6.205  | .001 | (Constant) | 57.801  | .000 |
| IAHH       | 3.156  | .255 | lnPDRB     | .238    | .671 |
| IPKK       | 3.502  | .092 | IAHH       | .731    | .932 |
| IEdu       | -1.001 | .655 | IPPK       | -4.773  | .464 |
|            |        |      | IEdu       | 22.010  | .003 |

Source: processed data

In the first model, the estimation results explain that only the Family Consumption Expenditure (PKK) variable significantly affects the per capita GRDP variable (rejects  $H_0$ ) at the level of significant ( $\alpha$ ) 10%. The other model variables show less significant results. This indicates that only the quality of human resources from an economic standpoint has a significant impact on welfare quality (as a proxy for GDP per capita). Meanwhile, from the dimensions of education and health, it does not significantly affect it.

In the second model, the estimation results explain that only the education variable significantly affects the IK variable (rejects  $H_0$ ) at a significant 5% level. The other model variables show less significant results. This indicates that only the quality of human resources in terms of education significantly affects Happiness's quality (using the Happiness Index as a proxy). Meanwhile, GRDP per capita, family consumption expenditure, and life expectancy rate did not significantly affect. This finding is also in line with the correlation coefficient values obtained between the HDI and IK variables. This means that the trend/correlation between the HDI and IK variables is confirmed by the regression model made. The trend relationship between the two variables is limited to the trend and the causality relationship. However, this relationship is only significant in the education dimension. The influence of the Education variable on the Happiness variable is positive. If the Education variable increases by one percent, there will be an increase in the Happiness variable by 22%.

## Path Analysis

Path analysis in this research is used to determine the relationship between independent variables in influencing the dependent variable. The independent variable directly affects the dependent variable, or through the intervening variable seen from the relationship's coefficient on each of the possible alternative paths from the hypothesized model structure. From the two models formulated, the structural equation is formulated as follows:

Structural Equations I:

$$Y_1 = \rho Y_1 X_1 + \rho Y_1 X_2 + \rho Y_1 X_3 + \varepsilon_1$$

Which:

$$Y_1 = \text{GRDP}$$

$$X_1 = \text{HDI\_Eco}$$

$$X_2 = \text{HDI\_Edu}$$

$$X_3 = \text{HDI\_Health}$$

$$\rho Y_1 = \text{Path Coeff}$$

The estimated effect of each independent variable that has been standardized for the first model is shown in Table 7. In the first structural model, there are no intervening variables, so that the total effect is the same as the direct effect. The direct effect of the education quality variable on GDP per capita is 7.3%, while other variables influence the rest. The health variable (AHH) directly affects the per capita GRDP variable by 13.2%, while other variables influence the rest. The economic variable (PPK) directly affects the per capita GRDP variable by 37.2%, while other variables influence the rest.

**Table 7. Summary of the results of the coefficient of influence for Model 1**

| Variable        | Standardized Coefficients |
|-----------------|---------------------------|
| IAHH            | .132                      |
| IPPK            | .372                      |
| IEdu            | .073                      |
| $\varepsilon_1$ | $\sqrt{1-0.258}= 0.86$    |

Source: processed data

From the three variables being modeled, it was found that the economic variable was the variable that most affected GRDP per capita. These results explain, in general, the HDI variable has a relatively small effect on GRDP per capita, but of the three dimensions of HDI that make up HDI, the economic dimension has the most significant influence.

Structural Equations 2:

$$Y_2 = \rho_{Y_2X_1} + \rho_{Y_2X_2} + \rho_{Y_2X_3} + \rho_{Y_2Y_1} + \rho\varepsilon_1 + \rho\varepsilon_2$$

Which:

$Y_2$  = Happiness index

$Y_1$  = GRDP Per capita

$X_1$  = HDI\_Eco

$X_2$  = HDI\_Educ

$X_3$  = HDI\_Health

$\rho_y$  = path coefficient

The results of data processing using the SPSS v23 software package obtained an estimate of the effect of each independent variable that has been standardized for Model 2 is shown in Table 8. There is an intervening variable in the second structural model, namely the per capita GRDP variable so that there are a direct influence pathway and influence through intermediate variables. The total effect is obtained from the sum of the direct and intermediate effects of the relationship between the variables.

Table. 8 Summary of the results of the coefficient of influence for Model 2

| Direct Effect $Y_2$            |                       |
|--------------------------------|-----------------------|
| Variable                       | $\rho$                |
| lnPDRB                         | .077                  |
| IAHH                           | .017                  |
| IPKK                           | -.165                 |
| IPend                          | .602                  |
| Effects of $Y_2$ through $Y_1$ |                       |
| IAHH                           | .017 * .077 = 0.002   |
| IPKK                           | -.165 * .077 = -0.013 |
| IEdu                           | .602 * .077 = 0.046   |
| Total Effect To $Y_2$          |                       |
| IAHH                           | 0.02                  |
| IPKK                           | -0.18                 |
| IEdu                           | 0.65                  |

Source: processed data

The direct effect of the education quality variable on Happiness is 60%, while other variables influence the rest. The health variable directly affects the happiness variable by 2%, while other variables influence the rest. The economic variable directly affects the Happiness variable inversely by 17%, while other variables influence the rest. Meanwhile,

if the effect is through intermediate variables, then the influence of the quality of education variable on Happiness is 5%, while other variables influence the rest. The health variable affects the happiness variable by 0.2%, while other variables influence the rest. The economic variable affects the happiness variable inversely by 1%, while other variables influence the rest.

The real influence of the education quality variable on Happiness is 65%. The health variable directly affects the happiness variable by 2%. The economic variable has a total effect on the happiness variable inversely by 18%. The effect of economic variables directly or indirectly on the happiness variable, which has an inverse relationship, is an exciting finding in this path analysis. This explains that the quality of happiness is inversely proportional to human resources' quality in its economic dimension. These findings confirm the Esterlin paradox against which the study was based. From the three variables being modeled, it was found that the education variable was the variable that had the most significant influence on happiness. The total effect value that is greater than the effect value without the intervening variable shows that the intervening variable's predictive model is better than the one without the intervening variable. This means that happiness is obtained through the per capita GRDP route.

This study once again proves that the education variable in this model has a significant effect on happiness. This also strengthens previous research from Coleman (1988), Behzad (2002), Ghamari (2012), and Veenhoven & Choi (2012), that education is very influential on happiness. The health variable in this model directly affects the Happiness variable. However, it is minimal, namely 1.7%. The economic variable directly affects the Happiness variable inversely by 16.5%, meaning that the greater the economic variable, the lower the level of happiness. This explanation is possible with the expenditure approach, where the effect of inflation is then making expenses bigger, will make happiness decrease (Tella & MacCulloch, 2007).

## Conclusion

Based on the result, several conclusions were obtained to prove the hypothesis and the pattern of the relationship between variables. This study proves that there is no significant relevance indicating that per capita income growth is an indicator of welfare and happiness. This research shows that the effect of the quality of human resources on welfare with the proxy of GRDP per capita is only explained from the economic dimension. In comparison, happiness can only be explained from the quality of human resources from the dimension of education. Although GRDP per capita is a variable between achieving happiness, from a theoretical point of view, there is an anomaly in human resources quality in terms of material welfare and happiness. The finding of an inverse relationship between the economic dimensions of human resource quality and happiness (IK) confirms the Easterlin paradox, which is the research background. These findings prove that income per capita is not necessarily the main factor that causes happiness, although it is still a factor taken into account in

measuring the variables that cause happiness. This research also shows that by adding an intermediate variable, in the form of GRDP, the education variable can be a little better in influencing happiness.

The implication of this research for this policy is to increase the level of happiness of its citizens, and the (local) government is more focused on improving the factors that are important and significant in increasing the happiness of its population, namely HDI, especially the level of education and not always oriented to increasing income. However, this study does not suggest neglecting the increase in people's income, because in the short term and at certain income levels, the increase in income is still an essential factor in increasing people's happiness.

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## Monetary Policy and Nigeria's Trade Balance, 1980-2018

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**Abstract**

*Several countries have integrated monetary easement into their foreign policy to faucet the gains from trade thereby, assuring that market forces determine monetary policy instruments such as interest rate and exchange rate. It is on this note and this paper empirically evaluate the effect of monetary policy on Nigeria's trade balance using the Autoregressive Distributed Lag Model on the time series data spanning from 1980 to 2018. The findings reveal that monetary policy tools of real interest and effective exchange rate have a long-run co-integration relationship and significant adverse effects on Nigeria's trade balance both in the short-run and long-run. Thus, the paper concludes that monetary policy is a veritable tool through which Nigeria can maintain a favorable trade balance. Therefore, policymakers should step on measures that will maintain low-interest rates to sustain a flexible exchange rate and remove all rigidities associated with the international payment system.*

**Keywords:**

autoregressive distributive lag, monetary policy, trade balance.

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## Introduction

Over time, countries have increasingly opened their borders to international trade to tap from the benefits of international economic integration and the need to transact with/buy from other countries of the world (Haile, 2017; Sakanko & David, 2019). The interaction between countries has been suggested to improve their incomes and enhance their growth (Ramzan et al., 2013; Sakanko & David, 2019; Sakanko & David, 2017). Moreover, the opening up of economies provides opportunities for individuals/businesses to invest outside their country and access a more comprehensive range of goods and services and raw materials. To tap into the gains from trade, various countries have incorporated financial liberalization into their trade policy, ensuring that market forces determine monetary policy instruments such as interest rate and exchange rate.

Economic theory suggests that its management of monetary policy tools would influence a country's foreign trade position. Given a small economy operating a floating exchange rate regime with perfect capital mobility, a decrease in interest rate would depreciate the country's currency. The higher exchange rate would make prices of foreign goods relatively expensive and thus, discourage imports. At the same time, currency depreciation would make the country's goods less expensive in the international market. Hence, exports would increase. Overall, net exports would improve. On the other hand, an increase in the interest rate would imply a currency appreciation. The currency appreciation would make domestic products more expensive relative to foreign goods, leading to a decline in net exports (Mundell, 1963; Fleming, 1962).

Nigeria is adjudged to be an open economy, albeit a small open economy, due to the inability to influence foreign income and the world interest rate. However, the country asserts appreciable monetary policy independence, coupled with the implementation of diverse forms of exchange rate regimes – with the current being the managed floating exchange rate regimes – in more recent times (Onuchuku et al., 2018). The Central Bank of Nigeria (CBN)– the monetary authority – is vested with the mandate of managing the internal and external macroeconomic balance through its monetary policy, using exchange rate targeting and monetary targeting frameworks to implement its monetary policy. In recent years, the CBN has relied on the policy framework of market base techniques driven by increased bank credit to the domestic sector to strengthen the stabilization of the naira exchange rate and the interest rate and manage the growth of money supply towards improving economic activities (Enoma & Isedu, 2011; Onuchuku et al., 2018; Danmola & Olateju, 2013; Fasanya et al., 2013).

Nigeria's market-based policy stance gained prominence in the mid-1980s, especially with the adoption of the Structural Adjustment Programme (SAP) in 1986. This has resulted in the reduction/removal of the country's rigidities associated with monetary policy management. Consequently, interest rate ceilings have ceased to be operated. More so, the Naira exchange rate has been allowed to be determined by market forces. Hence, the Naira exchange rate has changed over time, from an average of ₦3.32 to US\$1 in 1986 to an average of ₦306.08 to US\$1 in 2018. However, the country's

trade balance has not reflected this trend. Nigeria's trade balance has instead fluctuated over time. The statistics show that from 1986 to 1990 net exports grew by an average of 90%, and from 1991 to 1995 it grew by an average of 7%.

Nevertheless, the second half of the 1990s recorded a negative average growth rate for net exports of -75%. In the 2000s, while net exports grew by an average of 0.01% and 143% in the first and second halves of the first decade, respectively, between 2011 and 2015, net exports grew by an average of -9%. Moreover, the country recorded a deficit in net exports in 2016 and 2017. Furthermore, the consequences are that it reduces the domestic companies' competitive strength, weakens local currency, reduces income and national savings. This would ultimately affect the national income and are critical to economic and financial stability. As such, appropriate policies would be needed to reverse them.

Notwithstanding, despite adopting the market base policy, Nigeria's trade balance often has been fluctuating. Usually, this should encourage exports and improve foreign exchange earnings and, on the other hand, reduce imports and thus increase foreign reserves and the current account balance of payments through improved trade balances. However, this has not been the case over time in Nigeria. Although it was argued that deficit does not cause a significant long-term effect for the whole economy, it is better off by allowing foreign capital investment inflow and running deficit than the shortfall in savings force to reduce investment.

The empirical study of Imoughele & Ismaila (2015) discovered that financial policy would regulate external imbalances. However, the findings of (Bonga-Bonga, 2017; Oluyemi & Isaac, 2017; Michael & Emeka, 2017; Adeyemi & Ajibola, 2019) confirmed the contrarily view in Nigeria that the monetary policy has no binding effect on Nigeria trade balance. These studies suffer from some flaws by including imports and exports as part of the analysis's informative variables, for example, Micheal & Emeka (2017). This raises endogeneity issues as these same variables together constituted the explained variable. Simultaneously, that of (Bonga-Bonga, 2017; Adeyemi & Ajibola, 2019) standard rule of econometrics analysis was violated. This includes a check for the unit root of the series that is incredibly paramount as its outcome determines the proper technique of study to be adopted. Another gap identified in this study was a few empirical attempts to examined the effect of monetary policy on Nigeria's trade balance.

This study aims to handle these gaps by providing empirical proof of monetary policy's effects on Nigeria's trade balance. The study was set out following the Mundell-Fleming framework, utilized similar variables as those previously used. Hence, the analysis variables are restricted to interest rate, exchange rate, and net exports. Moreover, the analysis followed a robust estimation procedure of the ARDL technique towards getting plausible estimates that explain the link between the monetary policy instruments and Nigeria's trade balance. This study's main objective was to examine the effect of monetary policy on Nigeria's trade balance between 1980 to 2018.

## Methods

This study utilizes secondary data. Secondary data is already available data collected by someone other than the researcher. The choice was motivated by data availability on the variables employed and is very simple to use. The study used time series data sourced from the World Bank Development Indicators. The data sourced include Net export - the difference between the export and import value of goods and services traded in a country, usually a year. Calculated ( $X - M = NEX$ ), where  $X$  is export,  $M$  denotes import, and  $NEX$  represents net export. The real interest rate - the approved percentage charge for credit/money obtained or borrowed from financial institutions or wealthy individuals-and the real effective exchange rate is measured as Naira's amount is changing for international currency. The data was analyzed using the Autoregressive Distributive lag model developed by Pesaran et al. (2001). The method was used to obtains plausible and robust results to determine the short-run and long-run effect of monetary policy on Nigeria's trade balance and bounds test for co-integration. The ARDL was built on the assumption that the variables are stationary at the level  $I(1)$  or the first difference  $I(0)$  or mixture, no variable stationery at the second difference  $I(2)$ , the data must be free from autocorrelation and Heteroskedasticity.

The analysis in this paper was built upon the Mundell-Fleming model. The model allows for trade amongst countries and has it that net exports ( $NX$ ) depend on the real exchange rate ( $\varepsilon$ ). Thus,

$$NEX = f(\varepsilon) \quad (1)$$

The real exchange rate is defined as

$$\varepsilon = eP/P^* \quad (2)$$

where  $e$  is the nominal exchange rate,  $P$  is the domestic price level, and  $P^*$  is the foreign price level. A major assumption of the Mundell-Fleming model is that of an open economy with perfect capital mobility. Hence, for any two countries involved in trade, the return on investments in the home country must equal the return on investments abroad. This is known as the interest rate parity condition and can be represented by:

$$1 + i = (1 + i^*)e / (Ee') \quad (3)$$

where  $i$  and  $i^*$  are the nominal interest rate in the home country and abroad, respectively.  $e$  represents the exchange rate, and  $Ee'$  is the future expected exchange rate. From equation 3, the gross return on investment in the home country is represented by the value on the left-hand side, while the expected gross return on investment abroad is shown by the value on the right-hand side. The interest rate parity condition thus holds; when the domestic interest rate is lower than the foreign interest rate, the exchange rate should appreciate, and if the domestic interest rate is higher than the foreign, the exchange rate depreciates. Equation 3 can be rewritten as

$$e = (1 + i)Ee' / (1 + i^*) \quad (4)$$

Equation 4 shows that a higher domestic interest rate would appreciate the exchange rate (holding foreign interest rate and the future exchange rate constant). The currency appreciation makes domestic products more expensive relative to foreign goods, resulting in lower net exports. For an open economy, equation 4 suggests that net exports are also determined by interest rate. Therefore, equation 1 can be modified to include the influence of interest rate on net exports as follows:

$$NEX = f(\varepsilon, i) \quad (5)$$

Under the Mundell-Fleming model, prices are exogenous hence, any differences between real and nominal variables can be ignored unless exogenous changes to prices or inflation expectations are considered. Thus, equation 5 can be rewritten as

$$NEX = f(\varepsilon, r) \quad (6)$$

Whereis  $r$  the real interest rate. To achieve the objective of this paper, equation 6 was estimated as represented in equation 7:

$$NEX_t = \alpha - \beta_1 RINT_t - \beta_2 REER_t + \mu_t \\ t = 1, 2, 3, \dots, 39 \quad (7)$$

NEX, RINT, REER denote net exports, real interest rate, and real effective exchange rate.  $\mu$  is the error term, and the subscript  $t$  represents the period.  $\alpha$  is the intercept, and  $\beta_1 - \beta_2$  are coefficients of the regressors. The negative sign denotes a prior expectation of the estimates. Real interest rates and real effective exchange rates are expected to have inverse effects on net export.

## Results and Discussion

The descriptive statistics of the variables employed in the analysis of the paper is as shown in Table 1. The summary statistics reveal that the mean values for NEX, RINT, and REER throughout the study are 6.446, 0.101, and 154.053, respectively. The deviations from the mean scores were 5.71 for NEX, 14.60 for RINT, and 121.72 for REER. The highest deviation is that recorded for REER. Also, the Skewness of 0.77 for NEX, -2.59 for RINT, and 1.71 for REER imply that while most of the data points of NEX and REER lie on the right-hand side of the normal curve that for RINT are to the left-hand side of the normal curve. The Jarque-Bera test for normality's probability values shows that NEX is normally distributed at a 10% level of significance, whereas RINT and REER are normally distributed at a 5% level of significance.

Table 1. Descriptive Statistics

|              | NEX      | RINT      | REER     |
|--------------|----------|-----------|----------|
| Mean         | 6.445688 | 0.101028  | 154.0531 |
| Std. Dev.    | 5.707774 | 14.60288  | 121.7197 |
| Skewness     | 0.771817 | -2.593902 | 1.712246 |
| Kurtosis     | 3.679599 | 12.11553  | 5.094967 |
| Jarque-Bera  | 4.622577 | 178.7602  | 26.18855 |
| Probability  | 0.099133 | 0.000000  | 0.000002 |
| Observations | 39       | 39        | 39       |

Source: Authors' Computation (2020)

The procedure for estimating the study's empirical model involved testing first the time-series properties of the individual data towards ascertaining the appropriate procedure to be used in the estimation. Consequently, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests for unit root were conducted, and the results are presented in Table 2.

Table 2. Results of the Test for Unit Root

| Series | Level      |           | First Difference |            |
|--------|------------|-----------|------------------|------------|
|        | ADF        | PP        | ADF              | PP         |
| NEX    | 4.5868***  | 4.5349*** | 4.2245***        | 17.0511*** |
| RINT   | -4.5111*** | 4.5111*** | 4.3061***        | 11.9827*** |
| REER   | 1.8796     | 1.9944    | -4.2476***       | 4.2411***  |

\*\*\* significant at 1% level and \*\* significant 5% level

Source: Authors' Computation (2020)

The null hypothesis of the tests has it that a particular series has a unit root. Hence, Table 2 shows that while NEX and RINT are stationary at level, REER attained stationary only after the first difference, in both the ADF and PP tests. The results of the unit root tests suggest the possibility of a long-run relationship among the variables. Therefore, the Autoregressive Distributive Lag (ARDL) Bounds test was used to establish whether such a long-run relationship exists. The result of the ARDL Bounds test is as shown in Table 3.

Table 3. Result of the Bounds Test

| Test Statistics | Value  | Significance | I(0) | I(1) |
|-----------------|--------|--------------|------|------|
| F-statistics    | 6.7593 | 10%          | 3.17 | 4.14 |
|                 |        | 5%           | 3.79 | 4.85 |

Note: The automatic lag selection was used to determine the maximum lag length.

Source: Authors' Computation (2020)

Given that the F-statistics value (6.7593) is greater than the upper boundary at 10% and 5% level of significance, the variables are said to have a long-run relationship, implying

that the response variables have a long-run relationship with the dependent variable. Hence, the use of the ARDL model was considered appropriate. The ARDL model was estimated to capture both the short-run and long-run effects of interest rate and exchange rate on Nigeria's net exports. The short-run estimates are presented in Table 4.

Before considering the ARDL estimates, the model was evaluated for multicollinearity, normality, serial correlation, Heteroskedasticity, and stability. As shown in Table A2 in the appendix, the result of the multicollinearity test reveals that the variance inflation factor (VIF) was less than 10. Hence, the regressors included in the model were not highly correlated. The result of the Jarque-Bera test for normality of residuals presented in figure A1 in the appendix indicates that the residuals are normally distributed. From the lower part of table 4, it can be seen that the probability values for the Breusch-Godfrey Serial Correlation LM test and Breusch-Pagan-Godfrey Heteroskedasticity test are all greater than 0.05; thus, the null hypotheses of no serial correlation and homoscedasticity were not rejected.

Furthermore, the probability value (0.85) of the Ramsey RESET test for stability is more significant than 0.05. Hence, we fail to reject the null hypothesis that the model is correctly specified. Moreover, the result of the Cumulative Sum of Recursive Residuals and Cumulative Sum of Recursive Residual squares presented in figure A2 and figure A3 (see appendix) respectively concur with the result of the Ramsey RESET test that the model is correctly specified.

Table 4. Short-run Estimates of the ARDL Model

| Independent Variable                          | Dependent Variable: NEX |              |
|-----------------------------------------------|-------------------------|--------------|
|                                               | Coefficient             | t-statistics |
| Constant                                      | 10.66055***             | 4.125647     |
| NEX(-1)*                                      | -1.117052***            | -4.461215    |
| RINT**                                        | -0.174052**             | -2.051212    |
| RECH**                                        | -0.018895**             | -2.312711    |
| Diagnostic Tests                              |                         |              |
| Test                                          | F-statistic             | Probability  |
| Breusch-Godfrey Serial Correlation LM Test    | 0.1242                  | 0.8832       |
| Breusch-Pagan-Godfrey Heteroskedasticity Test | 1.7459                  | 0.1546       |
| Ramsey RESET Test                             | 0.0341                  | 0.8548       |
| Number of Observations                        | 39                      |              |

\*\*\*significant at 1% level, \*\* significant at 5% level.

Source: Authors' Computation (2020)

The short-run estimates shown in Table 4 indicate that the lagged value of net exports, real interest rate, and real effective exchange rate all have an inverse relationship with net exports. Specifically, a unit increase in net exports' lagged value would lead to a decline in current net exports equal to 1.12, and a 1 percentage point increase in real

interest rate would result in a 0.17 decrease in net exports. Also, a unit increase in the real effective exchange rate would reduce net exports by 0.02. This finding implies that an open economy with a depreciated exchange rate and the low-interest rate will record more net exports. This outcome supported the discovery of Aftab & Aurangzeb (2002), Ajie & Nenbee, 2010; Adamu & Itsede, 2014; Costamagna (2014), Nizamani et al. (2016), but contrarily to the findings of Bonga-Bonga (2017), Michael & Emeka (2017), and Adeyemi & Ajibola (2019) in Nigeria. For the long-run dynamics of the effects of interest rate and exchange rate on net exports, the results are presented in Table 5.

Table 5 shows that in the long-run, both the real interest rate and real effective exchange rate have a negative and statistically significant relationship with net exports at 10% and 5% level, respectively. This agrees with the a priori expectation. While a 1 percentage point increase in real interest rate would decrease net exports by 0.16, a unit increase in the real effective exchange rate will decrease net exports by 0.02. Ncube & Ndou (2013) obtain this collaboration result.

**Table 5. Results of the Long-run Estimation**

| Independent Variable   | Dependent Variable: NEX |              |
|------------------------|-------------------------|--------------|
|                        | Coefficient             | t-statistics |
| RINT                   | -0.155814*              | -1.776648    |
| REER                   | -0.016915**             | -2.639334    |
| Number of Observations | 39                      |              |

\*\* significant at 5% level, \* significant at 10% level.

Source: Authors' Computation (2020)

Generally, it is formative to note that these monetary policies (interest rate and exchange rate), based on this study's findings, the real interest rate has more impact on net export than the real effective exchange rate. This could be tagged to how the paramount interest rate stands to influence the exportation of goods and services because domestic companies required affordable interest to enhance borrowing to expand productions. Hence restructuring and development of Nigeria financial institutions to deliver more credit become unavoidable while fluctuating exchange rate. According to Mundell-Fleming's assertion, in any two countries with an open economy and perfect capital mobility, the return on investments in the home country must equal the return on investments abroad. This is known as the interest rate parity condition. The theory states further that exporting countries' interest rate has a powerful inflicting mechanism that easily influences the trading partner. This happens because of the perfect mobility of factors among them.

## Conclusions

The objective of this paper was to evaluate the effects of monetary policy on Nigeria's trade balance. The findings from the analysis revealed that real interest rates and real effective exchange rates have significant and adverse effects on net exports in both the short-run and long-run. Therefore, we conclude that monetary policy is a veritable

tool through which Nigeria can attain a favorable trade balance, and the followings are policy implications. The monetary authority in Nigeria is implored to implement measures that will maintain low-interest rates and sustain flexible exchange rates and remove all rigidities associated with the international payment system. This can be achieved by making available more credit to financial institutions and discontinuing sector allocations of foreign exchange. Also noteworthy is the need to improve the nation's productive capacity so that the nation is better positioned to take advantage of the opportunities that could arise from the liberalization of the financial sector. This way, the country would effectively consolidate its trade balance.

The policymakers should achieve independent financial stability for export and import banks in Nigeria to guarantee their easy and affordable credit access to potential investors to increase local productions to promote economic growth and development. Sometimes access to credit is guaranteed, but the protocols are cumbersome. It is also suggested that policymakers should make sure that the unrestricted process to access funds is provided. This is because interest is found to have a tremendous negative and significant effect on net export in Nigeria.

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## E-money and Stock: Empirical Evidence from Indonesia and Thailand

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### Abstract

*E-money is a type of electronic or digital payment that replaces cash payments. These technological developments will have an impact on reducing the use of cash. The use of e-money possibly affects stock, which is a form of securities. Therefore, the purpose of this study is to assess the relationship between e-money and stock. The study uses the two-stage least squares model to analyze quarterly data for 2011Q1-2019Q4. The study found no relationship between stock and e-money in Indonesia, whereas, in Thailand, there was a relationship between stock and e-money. There is no relationship between e-money and stock in Indonesia and Thailand. The study recommends the Indonesian government or central bank adopt the policies that Thailand has implemented in stock that affects e-money. Stocks can affect the use of e-money due to the profits or losses of the stock that will impact the use of e-money.*

### Keywords:

e-money, stock, two-stage least squares.

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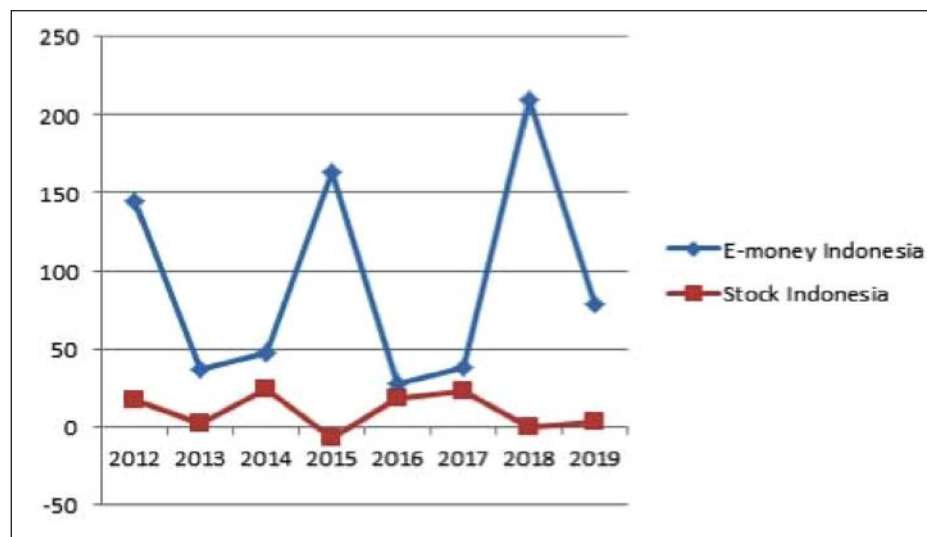
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## Introduction

The development of e-money in Indonesia and Thailand is inseparable from the development of the payment system. Indonesia started using e-money in 2009, whereas Thailand began using it in 2010, with transaction values increasing from year to year. Indonesia is one of the main drivers of e-money growth in Southeast Asia, Malaysia, Singapore, the Philippines, and Thailand. Differences in the development of e-money in Indonesia and Thailand can be seen in Figures 1 and 2. Indonesia will be the largest equity market in Southeast Asia, with a total value of shares on the Indonesia Stock Exchange of \$ 529 billion. The value of the Indonesian stock market is now approaching Thailand's, which is in decline. Thailand, which took over from Singapore as the largest Southeast Asian equity market in May 2019, is struggling with the strengthening of the Baht and its SET index as a benchmark. These developments make Indonesia and Thailand relevant case studies.

Market capitalization offers a significant explanation for the existence of short-term dependency, while liquidity is associated with long-term dependency. After isolating general shocks in time, market volatility has a more significant impact on efficiency (Todea & Ple, 2013). When expected inflation decreases, investors invest more in the stock market, long-term bonds, and unappreciated real balances, which reduces short-term deposits (Lioui & Tarelli, 2019). This research will discuss e-money transactions and stock in Indonesia and Thailand. Figures 1 and 2 show the fluctuations in e-money and stock in both countries.

Figure 1. E-money and Stock in Indonesia



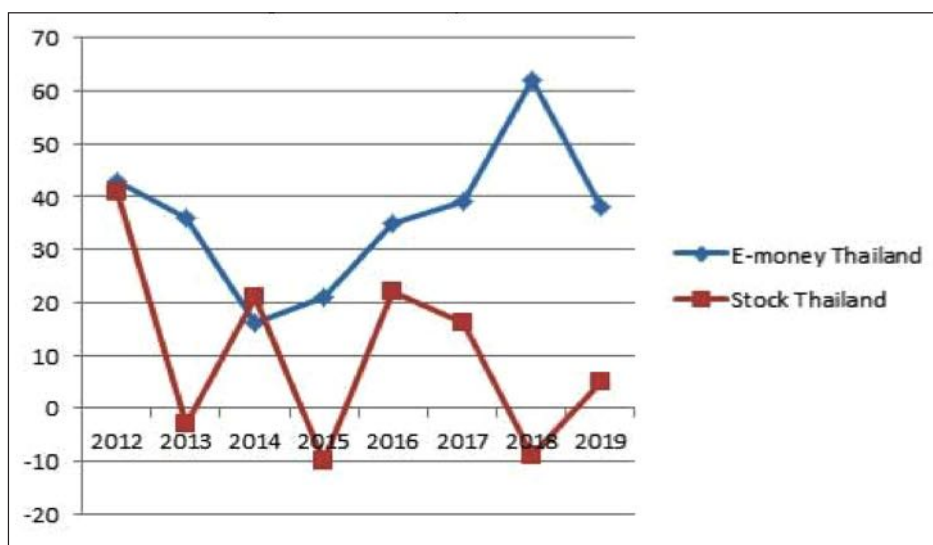
Source: Author Calculations

Kartika & Nugroho (2015) found that gross domestic product, M1, and money circulation positively and significantly affected electronic money transactions. Igamo (2018) tested the variables of payment efficiency and money demand function and found that the

increase in the level of consumption and M1 growth, in the long run, is influenced by electronic money. Igamo's long-term analysis found that the increase in electronic money use has a positive and significant impact on consumption levels. Moreover, this increase has a negative and significant impact on narrow money growth (M1).

A study by Chhapra et al. (2018) indicated a significant impact of the monetary policy component (discount rate, inflation, money supply, and exchange rate) on the stock and bond markets. Moreover, Sidik et al. (2018) found that financial inclusion causes an increase in demand for base money (M0) in developed countries. Conversely, an increase in financial inclusion decreases the demand for base money (M0) in developing countries.

Figure 2. E-money and Stock in Thailand



Source: Author Calculations

Majid (2018) studied the volatility of monetary policy variables, interest rates, exchange rates, and the money supply. The study found that all these variables affect the volatility of Islamic and conventional stock markets. This finding implies that the same factors determine the volatility of Islamic and conventional stock markets. Thus, to stabilize the market, volatility in the money supply, interest rates, and exchange rates must be controlled. Neda (2014) found that e-money can replace the currency in circulation, which is part of the monetary aggregate of the Central Bank. Its effect is not significant, as the Central Bank noted a shallow currency decline in circulation due to the increased use of e-money. Al-laham & Al-tarawneh (2009) found that the development of e-money will affect the effectiveness and implementation of monetary policies.

Tiberiu et al. (2019) found that currency substitution is related to the sensitivity of money demand toward the interest rate spread between Central and Eastern European countries and the Eurozone. Furthermore, Bahmani-oskooee & Nayeri (2020) uncovered that increasing uncertainty could stimulate the public to hold more cash to cover their uncertain future expenses. Conversely, if an increase in uncertainty is associated with an

increase in the expected level of inflation, the public can choose to have less cash and more real assets to hedge against inflation in the future.

A study by Belongia & Ireland (2019) shows a stable demand for money that links monetary aggregates (interest rates). Besides, Jawadi & Sousa (2013) found that the demand for money is related to inflation. On the other hand, their study showed that the elasticity of money demand is related to inflation, interest rates, GDP, and variations in exchange rates. Lioui & Tarelli (2019) studied the long-term portfolio choices by investors who hold real balances, stock indices, multiple bonds, and money market accounts. They found that investors allocate more to the stock market, long-term bonds, and unappreciated real balances when expected inflation decreases, thereby reducing short-term deposits. Furthermore, Todea & Ple (2013) showed that foreign portfolio investment has a positive and significant effect on the information efficiency of the eleven Central and Easter stock markets in Europe during the 1999-2010 period.

Based on Figures 1 and 2, e-money and stock in Indonesia and Thailand fluctuate each year. This study aims to analyze and explain the variables that affect e-money and stock in Indonesia and Thailand. The study applies a novel approach by studying the relationship between e-money with stock. Based on the findings, the study develops policy recommendations for the governments of Indonesia and Thailand.

## Method

The analysis model uses Two-Stage Least Squares (TSLS) because of the many uses of e-money compared to stock. This shows the relevance of assessing how e-money and stock are related in Indonesia and Thailand. After obtaining the TSLS results for Indonesia and Thailand, the study compares these findings to see which country has better TSLS results. The study uses data for the period of 2011Q1-2019Q4. The variables used in this study are e-money, stock, economic growth, interest rates, inflation, real effective exchange rates, and money supply. Tables 1 and 2 provide a description and sources of the research data.

**Table 1. Description of Variables and Data Sources for Indonesia**

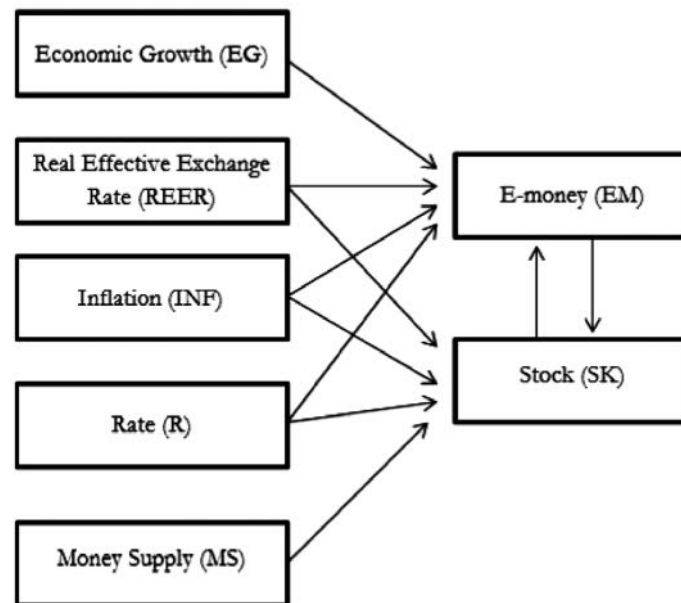
| Variable                            | Description                                                                            | Sources                            |
|-------------------------------------|----------------------------------------------------------------------------------------|------------------------------------|
| E-money (EM)                        | E-money Transaction Value                                                              | Bank Indonesia                     |
| Stock (SK)                          | Market Capitalization - the aggregate number of shares                                 | Indonesia Stock Exchange           |
| Economic Growth (EG)                | Real GDP based on 2010 constant                                                        | Statistics Indonesia               |
| Real Effective Exchange Rate (REER) | The relative price of the currencies of two countries in trading in goods and services | Bank for International Settlements |
| Inflation (INF)                     | Customer Price Index                                                                   | Bank Indonesia                     |
| Rate (R)                            | Deposits rate in percentage per annum                                                  | International Monetary Fund        |
| Money Supply (MS)                   | Nominal values of M2                                                                   | Bank Indonesia                     |

Table 2. Description Variables and Data Sources for Thailand

| Variable                            | Description                                                                            | Sources                            |
|-------------------------------------|----------------------------------------------------------------------------------------|------------------------------------|
| E-money (EM)                        | E-money Transaction Value                                                              | Bank of Thailand                   |
| Stock (SK)                          | Market Capitalization - the aggregate number of shares                                 | Bank of Thailand                   |
| Economic Growth (EG)                | Real GDP based on 2010 constant                                                        | Bank of Thailand                   |
| Real Effective Exchange Rate (REER) | The relative price of the currencies of two countries in trading in goods and services | Bank for International Settlements |
| Inflation (INF)                     | Customer Price Index                                                                   | Bank for International Settlements |
| Rate (R)                            | Deposits rate in percentage per annum                                                  | International Monetary Fund        |
| Money Supply (MS)                   | Nominal values of M2                                                                   | Bank of Thailand                   |

The simultaneous equation model consists of two or more endogenous variables, and an exogenous variable influences each endogenous variable. For more details, see the conceptual framework for the simultaneous equation model in Indonesia and Thailand in Figure 3.

Figure 3. Conceptual Framework for the Simultaneous Equation Model in Indonesia and Thailand



Based on the conceptual framework in Figure 3, the simultaneous equation model in Indonesia and Thailand can be written with the following equation:

$$\ln EM_{1t} = \alpha_{10} + \alpha_{11} \ln EG_{1t} + \alpha_{12} REER_{2t} + \alpha_{13} INF_{3t} + \alpha_{14} R_{4t} + \alpha_{15} \ln SK_{2t} + \varepsilon_{1t}$$

$$\ln SK_{2t} = \alpha_{20} + \alpha_{21} REER_{2t} + \alpha_{22} INF_{3t} + \alpha_{23} R_{4t} + \alpha_{24} \ln MS_{5t} + \alpha_{25} \ln EM_{1t} + \varepsilon_{2t}$$

where:

EM and SK : endogenous variables  
EG, REER, INF, R, MS : exogenous variables  
 $\alpha_{10}$  and  $\alpha_{20}$  : constants  
 $\alpha_{11} - \alpha_{25}$  : structural parameter  
 $\varepsilon_t$  : residual  
Ln : natural logarithm

## Results and Discussion

To find out whether simultaneous equations are identified or overidentified, the study assesses whether  $Kk$  is greater or smaller than  $m-1$ : ( $Kk < m-1$ ): identified or ( $Kk > m-1$ ): overidentified. The identification of simultaneous equations can be seen in Table 3. Based on the results of identifying simultaneous equations in Table 3, the simultaneous equation model is found to be overidentified. Therefore, the study uses the Two-Stage Least Squares (TSLS) method of analysis.

Table 3. Identification of Simultaneous Equations

| Variables | K/m | Equation (1) | Equation (2) | Identification |
|-----------|-----|--------------|--------------|----------------|
| Endogen   | 2   | 1            | 1            | Overidentified |
| Exogen    | 7   | 4            | 4            | Overidentified |

Source: Author Calculations

This section presents the estimation results for the simultaneous e-money equations and the simultaneous stock equations for Indonesia and Thailand in the equations below:

Simultaneous E-money equation for Indonesia:

$$\ln EM_{1t} = -153.418 + 14.443 \ln EG_{1t} - 0.022 REER_{2t} - 0.061 INF_{3t} - 0.211 R_{4t} - 2.560 \ln SK_{2t}$$

Simultaneous Stock equation for Indonesia:

$$\ln SK_{2t} = 1.884 + 0.0003 REER_{2t} - 0.012 INF_{3t} - 0.011 R_{4t} + 0.904 \ln MS_{5t} - 0.008 \ln EM_{1t}$$

Simultaneous E-money equation for Thailand:

$$\ln EM_{1t} = -99.402 + 5.776 \ln EG_{1t} + 0.022 REER_{2t} + 0.040 INF_{3t} + 0.064 R_{4t} + 1.466 \ln SK_{2t}$$

Simultaneous Stock equation for Thailand:

$$\ln SK_{2t} = -7.583 + 0.007 REER_{2t} + 0.020 INF_{3t} - 0.091 R_{4t} + 1.427 \ln MS_{5t} - 0.036 \ln EM_{1t}$$

The coefficient of determination is useful to measure the ability of the model to explain endogenous variables. Specifically, the smaller the value of  $R^2$ , the more limited the model's ability to explain endogenous variables. Vice versa, the greater the value of  $R^2$ , the better the model's ability to explain endogenous variables. Tables 4 and 5 present the coefficient of determination  $R^2$  for e-money and stock in Indonesia and Thailand.

**Table 4. Coefficient of Determination for E-money and Stock in Indonesia**

| Endogenous Variables | Coefficient of Determination |
|----------------------|------------------------------|
| E-money              | 0.899                        |
| Stock                | 0.938                        |

Based on Table 4, the coefficient of determination  $R^2$  for e-money in Indonesia shows that the variables of economic growth, real effective exchange rate, inflation, interest rates, and stock contribute 89.9 percent to e-money in Indonesia. Meanwhile, the remaining 10.1 percent is influenced by other variables not included in the e-money equation. Moreover, the coefficient of determination  $R^2$  for the stock is 93.8 percent, which shows the real effective exchange rate, inflation, interest rates, money supply, and e-money to stock in Indonesia. Meanwhile, the remaining 6.2 percent is influenced by other variables not included in the stock equation.

**Table 5. Coefficient of Determination for E-money and Stock in Thailand**

| Endogenous Variables | Coefficient of Determination |
|----------------------|------------------------------|
| E-money              | 0.931                        |
| Stock                | 0.924                        |

Based on Table 5, the coefficient of determination  $R^2$  for e-money in Thailand is 93.1 percent, this shows the contribution of the variables of economic growth, the real effective exchange rate, inflation, interest rates, and stock e-money in Thailand. Meanwhile, the remaining 6.9 percent is influenced by other variables not included in the e-money equation. The coefficient of determination  $R^2$  for the stock is 92.4 percent. This shows the real effective exchange rate, inflation, interest rates, money supply, and e-money to stock in Thailand. Meanwhile, the remaining 7.6 percent is influenced by other variables not included in the stock equation.

**Table 6. F-Test Statistic for Indonesia and Thailand**

| Variables           | F-Test | Probability |
|---------------------|--------|-------------|
| E-money (Indonesia) | 54.859 | 0.0000      |
| Stock (Indonesia)   | 90.536 | 0.0000      |
| E-money (Thailand)  | 84.535 | 0.0000      |
| Stock (Thailand)    | 72.642 | 0.0000      |

The F-test shows whether all exogenous variables influence the endogenous variables. The results of the F-tests for Indonesia and Thailand can be seen in Table 6. Based on table 6, the e-money equations produced F-values of 54,859 and 84,535 for Indonesia and Thailand. Therefore, economic growth, the real effective exchange rate, inflation, interest rates, and stock influence e-money in Indonesia and Thailand. Furthermore, the

stock equations resulted in F-values of 90,536 and 72,642 for Indonesia and Thailand, respectively. Thus, the real effective exchange rate, inflation, interest rates, money supply, and e-money influence stock in Indonesia and Thailand.

The t-test shows the influence of the exogenous variables on the endogenous variables. The T-test results for e-money and stock in Indonesia and Thailand can be seen in Tables 7 and 8. Based on Table 7, economic growth (EG) influences e-money in Indonesia and Thailand with a probability value of 0.0004 and 0.0026, respectively. These values are smaller than 0.10, which signals a positive and significant relationship based on Kartika & Nugroho (2015). This finding explains that an increase or decrease in economic growth (EG) will affect fluctuations in e-money. The interest rate (R) has probability values of 0.0725 (Indonesia) and 0.7395 (Thailand) that are smaller than 0.10, which signals a negative and significant relationship based on various studies (Belongia & Ireland, 2019; Jawadi & Sousa 2013; Tiberiu et al., 2019).

**Table 7. T-Test for E-money in Indonesia and Thailand**

| Variables | Coefficient (Indonesia) | Probability | Coefficient (Thailand) | Probability |
|-----------|-------------------------|-------------|------------------------|-------------|
| EG        | 14.443***               | 0.0004      | 5.776***               | 0.0026      |
| REER      | -0.022                  | 0.5232      | 0.002                  | 0.8994      |
| INF       | -0.061                  | 0.5309      | 0.040                  | 0.3747      |
| R         | -0.211*                 | 0.0725      | 0.064                  | 0.7395      |
| SK        | -2.560                  | 0.2521      | 1.466*                 | 0.0990      |

This finding explains that an increase or decrease in interest rates (R) will decrease or increase e-money. For Thailand, stock (SK) affects e-money with a probability value of 0.0990, which is smaller than 0.10 and signals a positive and significant relationship. Thus, an increase or decrease in stock (SK) will have an impact on e-money.

**Table 8. T-Test for Stock in Indonesia and Thailand**

| Variables | Coefficient (Indonesia) | Probability | Coefficient (Thailand) | Probability |
|-----------|-------------------------|-------------|------------------------|-------------|
| REER      | 0.0003                  | 0.9470      | 0.007                  | 0.1356      |
| INF       | -0.012                  | 0.2915      | 0.020                  | 0.3176      |
| R         | -0.011                  | 0.5095      | -0.091                 | 0.1169      |
| MS        | 0.904***                | 0.0000      | 0.064**                | 0.0174      |
| EM        | -0.008                  | 0.8213      | 1.427                  | 0.7453      |

Based on table 8, the money supply affects stock with a probability value of 0.0000 (in Indonesia) and 0.0174 (in Thailand). These values are smaller than 0.10, so the money supply has a positive and significant relationship (see Chhapra et al., 2018; Majid, 2018). Consequently, an increase or decrease in the money supply (MS) will affect stock (SK) in Indonesia and Thailand.

This section compares the TSLS results, coefficient of determination, the F-test, and the t-test. This statistical analysis uncovered that Thailand has the best results for the e-money and stock equations because stocks influence e-money. An increase or decrease in stock will have an impact on fluctuations in e-money. Conversely, the influence of Indonesian interest rates is more significant than in Thailand because interest rates impact e-money.

The stock can affect the e-money in Thailand. The public will look at if the stock of economics will be observed if the stock is performing good performance will have an impact performance that will impact the value of the value (profit) will have an impact on the value of the e-money. In the event of the increase in the use of e-money. In comparison, it will affect the increase in the use of e-Money. At the same time, it will affect the increase in the use of e-money.

In contrast, it will affect the increase in the use of e-money. In comparison, it will affect the increase in the use of e-money. While the stock of poor performance will impact the reduction of value (loss) will impact the decrease of e-money. The interest rate policy can affect the e-money in Indonesia. The public will look at interest rate policies whether interest rates will increase or decrease. If the interest rate increases, the economic interest will save the banking money due to the added value. Where if interest rates decreased will have an impact on increased e-money

## Conclusion

This study discusses the causal relationship between economic concepts based on e-money and stock in Indonesia and Thailand. The analysis model uses Two-Stage Least Squares (TSLS) to assess the variables that affect e-money and stock in Indonesia and Thailand. The determinants are economic growth, interest rates, inflation, real effective exchange rate, and money supply, and the analysis uses quarterly data for the period of 2011Q1-2019Q4. The results show that economic growth and interest rates significantly affect e-money in Indonesia, whereas economic growth and stock have a significant effect on e-money in Thailand. Moreover, the money supply has a significant effect on the stock in Indonesia and Thailand. The study found no relationship between stock and e-money in Indonesia, whereas, in Thailand, there is a relationship between stock and e-money. There is no relationship between e-money and stock in Indonesia and Thailand.

Based on the findings, the study recommends that the Indonesian government or central bank consider Thailand's policies in stock that affect e-money. Stocks can affect the use of e-money due to the profits or losses of the stock that will impact the use of e-money. Whereas the government or the central bank of Thailand can design policies inspired by Indonesia's interest rate policy, the public will pay attention to the interest rate whether it has increased or decreased as it will determine the use of e-money.

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## The Determinants of Economic Growth: Empirical Study of 10 Asia-Pacific Countries

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### Abstract

*The purpose of this research to examine the influence of corruption (CPI), foreign investment (FDI), population growth, and government spending on economic growth in 10 Asia-Pacific countries (such as New Zealand, Australia, Singapore, Japan, South Korea, Malaysia, China, Thailand, Indonesia, Vietnam), and to prove the Hypothesis sand wheels theory whether corruption causes a decline and slows down economic growth. This study uses panel data from 10 Asia Pacific countries with the period 2009-2018. The results showed that corruption (CPI), foreign investment (FDI), population growth, and government expenditure simultaneously affect economic growth. Partially, corruption (CPI) does not significantly affect economic growth, while foreign investment (FDI), population growth, and government expenditure have a significant positive effect on economic growth. The results of the research can be used as a reference for policymakers that to increase economic growth in 10 Asia Pacific countries can be done by creating a conducive business climate, providing ease of doing business, increasing population growth followed by increasing the quality of human capital and increasing government expenditure on infrastructure and resource development human beings to create quality economic growth.*

### Keywords:

economic growth, corruption, FDI, Population Growth, Government Expenditure, Sand the Wheels Theory.

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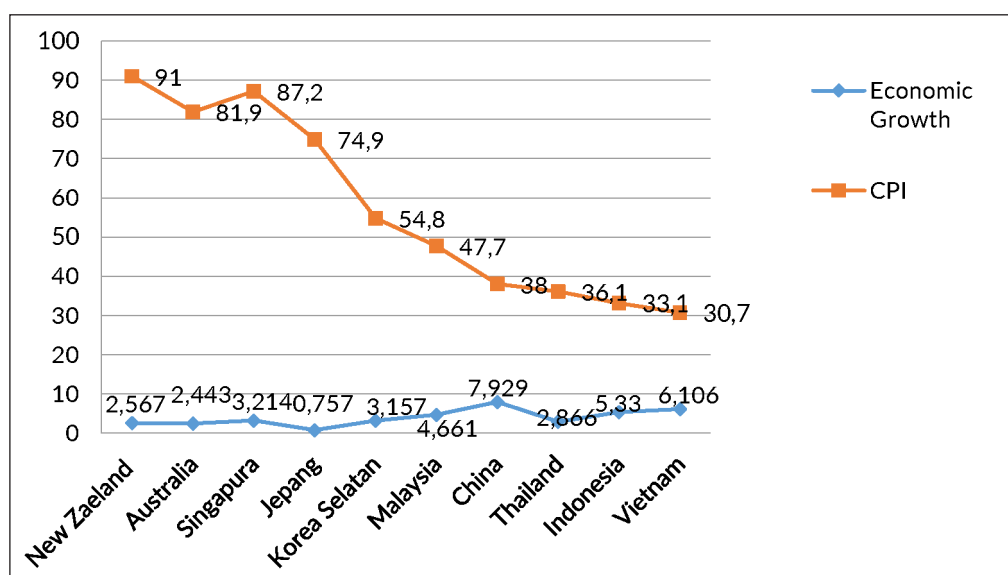
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## Introduction

In recent decades, countries worldwide have competed in increasing their economic growth, including countries in the Asia-Pacific Region. The history of economic upheaval has colored many Asia-Pacific countries, for example, the Monetary Crisis in 1998, which caused many falls in all sectors for countries in Asia. The financial crisis in 2008 also caused many countries to feel the impact, including in the Asian region- Pacific. Economic growth is a continuous change in input-output or the Gross Domestic Product (GDP) in a region.

The higher the economic growth reflects the better development and economic activities in the region of the country. Several factors can affect economic growth, namely capital accumulation, technology used, and population. However, other variables can affect the economic growth of each country, one of which is corruption. Corruption is a global phenomenon and a problem in every country. Corruption can enter into economic, social, and even cultural aspects.

Figure 1 Average Economic Growth and CPI



Source: Transparency International, World Bank 2008-2018 (processed)

Based on Figure 1, the average Corruption Perception Index (CPI) or the Corruption Perception Index (IPK) and economic growth during 2009-2018. The CPI value shows that the higher the CPI value, the cleaner the country will be from corruption. However, it shows that countries with high CPI values above 50, such as New Zealand, Singapore, Australia, Japan, and South Korea, have low economic growth, but countries with low CPI values tend to have high economic growth. Regarding corruption and economic growth, historians and political experts generally debate corruption harming economic growth. A widespread view is that corruption can violate the rules of efficient resource allocation in an economy.

Research conducted by D'Agostino et al. (2012) in 53 African countries during 2003-2007 shows that corruption and the military's burden reduce the rate of per capita economic growth. Corruption can increase economic efficiency only if the actual government is above the optimal level, which implies that the level of corruption can maximize economic growth (Dzhumashev, 2014). The results of panel data 22 in developing countries during 2001-2012 show a statistically significant negative relationship between corruption and economic growth (Shera et al., 2014).

Haque & Kneller (2015) also examined using panel data from 63 countries for the period 1980-2003, showing that corruption reduces the returns on public investment and makes it ineffective in increasing economic growth. Another research conducted by Obamuyi & Olayiwola (2019) in India and Nigeria shows that with the transmission mechanism, corruption has a negative impact on economic growth through investment and human resources in both countries. Corruption decreases the growth rate of per capita income directly by reducing the productivity of existing resources and indirectly affects the reduction in investment. Corruption shows a decline in growth in all provinces in Indonesia, with corruption levels below the threshold of 1,765 points, and the destructive effect of corruption appears to be stronger for provinces with levels of corruption above the threshold (Alfada, 2019).

However, the results of Ugur's (2014) research show that corruption does not significantly affect GDP per capita and is negative. Huang (2016), using the Granger causality prediction in thirteen Asia Pacific countries during the period 1997-2013, shows that there is no significant effect of corruption on economic growth. Lutfi et al. (2020), in four ASEAN countries, Indonesia, Malaysia, Thailand, and Vietnam, from 2004 to 2015 also show that corruption does not significantly affect economic growth.

The other independent variables in this study are FDI or foreign investment directly entering a country, population growth, and government expenditure. According to the results of research conducted by Nizar et al. (2013) that FDI has a significant positive effect on economic growth and can reduce the national poverty rate. FDI has a significant positive effect on economic growth. FDI is an essential part of the investment that can stimulate economic growth. FDI is still the driving force for China's economic growth in the new era (Hong, 2014). The results of research conducted by Belloumi (2014) show that there is no Granger causality from FDI to short-term economic growth in Tunisia. FDI has a significant positive effect on economic growth in Eurozone countries (Pegkas, 2015).

FDI contributes positively to economic growth, primarily through the abundance of knowledge, and higher technological developments are proxied by government and business R&D (Silajdzic & Mehic, 2015). In the short term, there is no effect of FDI on economic growth, but in the long run, FDI has a significant positive effect on economic growth (Putra et al., 2017). Prawira et al. (2017) found that FDI has a positive effect on Indonesia's economic growth, which is consistent with Adam Smith's classical theory that natural resources, human resources, and capital are the three determining factors for economic growth. FDI has a significant positive effect on economic growth (Akisik et al., 2020; Bunte et al., 2018).

Apart from corruption and FDI, population growth can increase economic growth, even though economic growth depends on many factors. A country's population can drive economic development because it is the subject of development itself, and economic growth will increase if the population has high productivity. Population growth is an essential factor for economic growth and may even contribute to increasing per capita output growth in some cases. Population growth has a significant positive effect on economic growth. A high population means a larger number of workers, which indicates lower wages, lower production costs, and sustainable economic growth (Ali et al., 2013). J.S.Mills in classical theory, states that population growth will increase demand and economic growth due to the increase in output produced (Rochaida, 2016).

In low-income countries, rapid population growth is likely to be detrimental in the short and medium-term because it leads to many dependent children. In the long term, it will be a demographic dividend in these countries as young people become productive adults (Peterson, 2017). By Kremer's theory, population growth has a significant and positive impact on economic growth in the short and long term (Azam et al., 2020). There is a long-term positive relationship between an aging population and GDP per capita in Bangladesh (Mamun et al., 2020). However, research by Lai & Cheung (2016) shows that there is no population influence on economic growth in Hong Kong.

Public funding can also use to create more economic activity to prevent recessions and increase economic growth. The results of Wahyuni et al. (2014) using the path test show that government expenditure has a significant positive effect on economic growth. Government support is needed in an economy that is considered the most effective means of intervention. Wu et al., (2010) that Granger's panel causality test results from 180 countries support Wagner's law and the hypothesis that Government expenditure helps economic growth. Increased uncertainty in government expenditure policies has a sizeable negative impact and a lasting effect on economic activity (Kim, 2019). Government expenditure on infrastructure and technology has a significant positive effect on economic growth, but government expenditure on education and the economy does not significantly affect the economy (Dinh Thanh et al., 2020).

Based on the empirical results of previous research, shows that the effect of corruption on economic growth is still ambiguous apart from that from Figure 1 also shows that 10 Asia Pacific countries that have high average CPI values have low average growth and vice versa, this indicates a problem on this topic. This research will contribute by focusing on 5 Asia Pacific countries with a CPI value above 50 with economic growth below 5% and five countries with a CPI value below 50 with economic growth above 5% besides this research. Besides that, this research also includes other variables in GDP, CPI, FDI, Population Growth, and Government expenditure using the latest data. It is exciting for the author to examine whether corruption, FDI, population growth, and government expenditure affect countries' economic growth in the Asia and Pacific region. So, this research aims to examine the determinant of economic growth in 10 Asia-Pacific countries.

## Method

This study divides into two variables: independent variables that affect or cause the change or the emergence of the dependent variable. Researchers as independent variables determined corruption, FDI, Population Growth, and Government expenditure. The dependent variable in this study is economic growth using GDP data. The data used is panel data, namely data from longitudinal and cross-section. In panel data analysis, it is known that there are several approaches used, including the OLS (Ordinary Least Square) model approach or the least-squares approach (regression). Several significance tests are needed to choose the right model, including the Hausman test and the Chow test. The chow test is used to determine whether the appropriate model is the common effect or the fixed effect. Likewise, the Hausman test is to find out the best model using a fixed effect or random effect. In this case, the research object consists of 10 Asia-Pacific countries, namely Australia, New Zealand, Singapore, Japan, South Korea, China, Malaysia, Thailand, Indonesia, and Vietnam, and within ten years from 2009-2018. The data used in this study are secondary data obtained from Transparency International (corruption index) and World Bank reports, as well as several national and international journals (See Table 1).

This study uses panel data regression with the research model as follows:

$$\ln \text{GDP}_{it} = \beta_0 + \beta_1 \text{corruption}_{it} + \beta_2 \ln \text{FDI}_{it} + \beta_3 \text{Pop}_{it} + \beta_4 \ln \text{Govspend}_{it} + e_{it}$$

Where:

$\beta_0$  : Intercept for country 1

$\beta_1$  to  $\beta_6$  : Regression coefficient

$\ln \text{GDP}$  : Natural Log of Economic Growth

Corruption : Corruption Perception Index

$\ln \text{FDI}$  : Log Natural Total foreign investment

$\ln \text{Govt}$  : Natural Logs of Government expenditure and Population Growth

**Table 1. Operational Definitional**

| Variable                          | Operational Definition                                                                                                                                                                                                                                    | Source                           |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>Dependent Variable</b>         |                                                                                                                                                                                                                                                           |                                  |
| Gross Domestic Product (GDP)      | Gross Domestic Product (GDP) GDP is the value of all goods and services produced by a country during a certain period.                                                                                                                                    | World Bank                       |
| <b>Independent Variable</b>       |                                                                                                                                                                                                                                                           |                                  |
| Corruption Perception Index (CPI) | An index of corruption perceptions in the public sector, which has a scale score from 0 to 100. The score is close to or equal to 0, a very corrupt country, while a score of 100 means that it is clean from Transparency International (TI) corruption. | Transparency International (TI). |
| Foreign direct investment (FDI)   | Foreign investment or FDI is the flow of foreign capital into a country.                                                                                                                                                                                  | World Bank                       |
| Population growth                 | Population growth is the average population growth in each country (%)                                                                                                                                                                                    | World Bank                       |
| Government expenditure            | Government expenditure uses the final total data of all government expenditures within a certain period of data from the Bank Word.                                                                                                                       | World Bank.                      |

## Results and Discussion

Panel data consists of three approaches: the Cammon effect model, fixed-effect model, and random effect model. Based on Table 2, the results of the Chow test conducted obtained a value (Prob> F) of the Fix effect of 0.0000 or less than the alpha level of 0.05 so that  $H_0$  is rejected and  $H_1$  is accepted, which indicates that the Fixed Effects Model (FEM) is a suitable model used in estimation. Furthermore, FEM will be compared with the Random Effects Model (REM) with the Hausman test.

Table 2. Chow Test

| Fixed effect test | Prob > F= 0.0000 |
|-------------------|------------------|
|-------------------|------------------|

Source: Author's Computation (2020)

Based on Table 3, the Hausman test conducted shows that the probability column's random cross-section value is 0.2958 or more excellent than the alpha level of 0.05, so that  $H_0$  is not rejected. However, according to Wooldridge (2018), failure to reject  $H_0$  in the Hausman test means that the estimation of REM and FEM close enough that it does not matter if you choose one or both. This study, the model chosen is FEM. This result is because the data used is at the state level, so conceptually it is better to use FEM. Also, considering that each country has different cultures and government systems so that the intercept between countries may vary.

Table 3. Hausman Test

| Hausman Test | Prop >chi2 = 0.2958 |
|--------------|---------------------|
|--------------|---------------------|

Source: Author's Computation (2020)

A simultaneous test is used to determine whether all independent variables jointly affect the dependent variable. If the calculated F value is greater than the F table, then the independent variables together significantly affect the dependent variable or reject  $H_0$  and accept  $H_1$ . Based on the simultaneous test from the table above, the F-statistic value is 985.59, and the Prob> F value is 0.0000 smaller than 0.05, meaning that together the independent variables CPI, lnFDI, population, and Government expenditure can explain the dependent variable of economic growth in 10 Asia Pacific countries during 2009-2018.

The Adjusted  $R^2$  value is used so that the variations described are not biased. Based on Table 4, the determination value taken from Adjusted  $R^2$  is 0.961, meaning that economic growth is influenced by the level of corruption (CPI), foreign investment (FDI), population growth (pop), and Government expenditure (govspend) the variation can be explained by 96.10% where other variables explain the remaining 3.90%.

Table 4. Panel Regression Result

| Variable                | Pooled              | Fixed                 | Random              |
|-------------------------|---------------------|-----------------------|---------------------|
| CPI                     | -0.0069<br>(0.000)* | -0.0013906<br>-0.257  | -0.0018<br>-0.177   |
| lnFDI                   | 1.88541<br>(0.000)* | 0.4269951<br>(0.044)* | 0.43106<br>(0.038)* |
| Pop                     | 0.04189<br>-0.327   | 0.0333447<br>(0.001)* | 0.03381<br>(0.001)* |
| lnGOVSPEND              | 0.83904<br>(0.000)* | 0.9354561<br>(0.000)* | 0.93258<br>(0.000)* |
| CONS                    | 6.38942             | 3.694089              | 3.79185             |
| R <sup>2</sup>          | 0.9755              | 0.9787                | 0.9786              |
| Adjusted R <sup>2</sup> | 0.9745              | 0.961                 | 0.9625              |
| F statistic             | 945.38              | 985.59                | 4127.07             |
| Prob (F-statistic)      | 0.000000            | 0.000000              | 0.000000            |

p < 0.05\* ; p < 0.1\*\*

The t difference test is used to test how far the independent variable's influence affects the dependent variable with the assumption that the other independent variables are constant. If the significance probability value > 0.05, then the hypothesis is rejected, or the independent variable does not affect the dependent. Conversely, if the probability of significance < 0.05, the hypothesis is accepted, based on the partial regression test in the table above, it can be concluded that:

Based on the regression test results, Table 4 shows that the CPI variable has a negative and insignificant effect on economic growth with a coefficient of -0.0013906 and a probability value of 0.257. Based on Figure 1, which has been described above, the average CPI figure during 2008-2018 shows that a group of countries such as New Zealand, Australia, Singapore, Japan, and South Korea have a high average CPI but low economic growth. On the contrary, countries that have a lower average CPI value have higher economic growth. This result shows that corruption in the 10 Asia Pacific countries has not become a significant barrier or driver in economic growth.

This study is in line with Ugur's (2014) research, which found that corruption does not significantly affect GDP per capita and negatively. Also, the results of Huang's (2016) research using the Granger causality prediction in thirteen Asia Pacific countries during the period 1997-2013 show no significant effect of corruption on economic growth. Research conducted by Lutfi et al. (2020) in four ASEAN countries, Indonesia, Malaysia, Thailand, and Vietnam, from 2004 to 2015 also shows that corruption does not significantly affect economic growth.

The test results show that the FDI variable has a significant positive effect on economic growth with a coefficient of 0.4269951 and a probability value of 0.044. This result shows that foreign investment or FDI in the 10 Asia-Pacific countries has a significant positive effect on economic growth where the higher the incoming foreign investment, the higher the economic growth. Therefore, the ease of doing business, including the facilities provided by a country, a good investment climate with easy bureaucracy, and safe state conditions, will increasingly attract investors and make a country very competitive to attract foreign investors. The amount of incoming capital can be used as a driving force in a country's economy, and there is a transfer of technology in it to increase the productivity of these countries that then increases economic growth.

These results are supported by research by Prawira et al. (2017), which found that FDI has a positive effect on economic growth by Adam Smith's classical theory that natural resources, human resources, and capital are the three determining factors for economic growth. This research is also supported by research (Akisik et al., 2020; Putra et al., 2017; Silajdzic & Mehic, 2015) that FDI has a significant positive effect on economic growth.

The test results show that the population growth variable has a significant positive effect on economic growth with a coefficient of 0.0333447 with a probability value of 0.001. Population growth leads to increased demand and increased workforce as a result of additional population. This will increase production capacity and increase the number of goods or services in the market, indicating a country's economy is running and increases economic growth. Thus population growth must be followed by developing the quality of human resources, such as through education, training, and others, so that population explosion does not occur, which will become a burden to the state. If population growth and per capita GDP growth were genuinely independent, a higher population growth rate would result in a higher rate of economic growth. GDP per capita growth will improve the economic welfare of (Piketty, 2015). J.S.Mills in classical theory, it states that population growth will increase demand and economic growth due to the increase in output produced (Rochaida, 2016).

Population growth is an essential factor for economic growth and may even contribute to increasing per capita output growth in some cases. In low-income countries, rapid population growth is likely to be detrimental in the short and medium-term because it leads to many dependent children. There will likely be a demographic dividend in these countries, as young peoples will become a productive adult (Peterson, 2017). By Kremer's theory, the population growth has a significant and positive impact on economic growth in the short and long term (Azam et al., 2020). There is a long-term positive relationship between an aging population and GDP per capita in Bangladesh (Mamun et al., 2020).

The government expenditure variable has a significant positive effect on economic growth with a coefficient of 0.9354561 with a probability value of 0.000. Government expenditure can run the economy in a country because usually, the government distributes the budget in productive things such as infrastructure development, education, and

personnel expenditure to improve the economy. It is hoped that economic growth can increase. This research is supported by Wahyuni et al. (2014); the path test results show that government expenditure has a significant positive effect on economic growth. Government support is needed in an economy that is considered the most effective means of intervention.

This study is also by the research of Wu et al. (2010) that Granger's panel causality test results from 180 countries support Wagner's law and the hypothesis that Government expenditure helps economic growth. Also, Olaoye et al. (2019) show that Government expenditure has a positive effect on economic growth in 15 countries of the West African Economic Community (Ecowas). The influence of government expenditure is very much dependent on the quality of institutions; Africa must develop a healthy institutional environment. Sedrakyan & Varela-Candamio (2019), the results of research in Armenia and Spain during 1996-2014 show that the state government positively influences economic growth. So, the government should increase the government spending to stimulate the economic growth.

## Conclusion

Based on the results of data analysis and discussion in this study, it can conclude that corruption (CPI), foreign investment (FDI), population growth, and government expenditure simultaneously affect economic growth. Partially, corruption (CPI) does not significantly affect economic growth, while foreign investment (FDI), population growth, and government expenditure have a significant positive effect on economic growth. The results of the research can use as a reference for policymakers that to increase economic growth in 10 Asia Pacific countries can be done by creating a conducive business climate, providing ease of doing business, increasing population growth followed by increasing the quality of human capital and increasing government expenditure on infrastructure and resource development human beings to create quality economic growth. The study results show that currently, the CPI level has not become a significant factor to encourage or inhibit economic growth in 10 Asia Pacific countries.

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## Disclaimer

Any errors of fact or omissions in this document are the sole responsibility of the authors.

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## World Oil Price Changes and Inflation in Indonesia: A Nonparametric Regression Approach

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### Abstract

*This study aims to investigate the effect of world oil price changes on inflation in Indonesia. We used a nonparametric regression approach that never been employed in previous studies, both domestically and internationally. This study shows that the second-order Epanechnikov kernel function is statistically significant in explaining the effect of world oil price changes on Indonesia's inflation. We found that the world oil price changes had a lower effect on Indonesia's inflation when its price below USD 100 per barrel, and its effect became higher when its price above USD 100 per barrel. These results have important implications for Bank Indonesia and Indonesia's government in response to the world oil price changes. The policies that aimed at reducing the effect of world oil price changes on inflation in Indonesia should consider the world oil price level.*

### Keywords:

oil price changes, inflation, nonparametric approach, second-order Epanechnikov kernel function.

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## Introduction

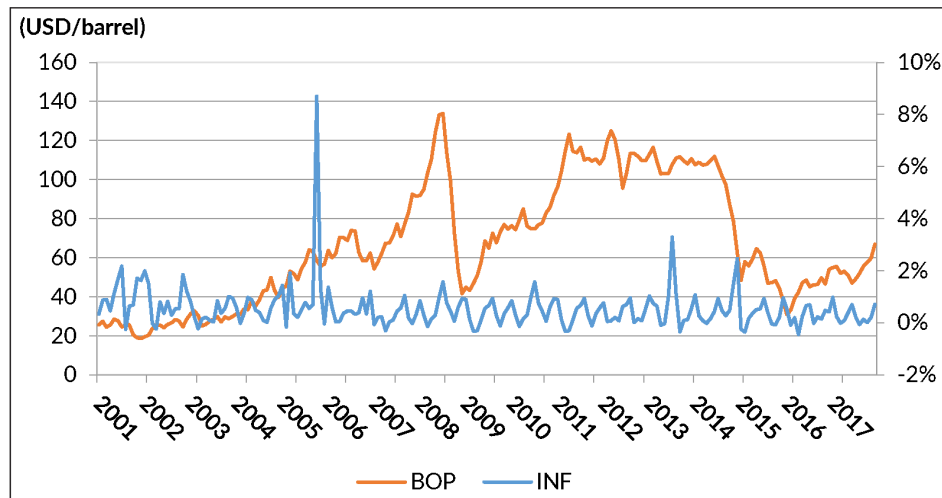
Since the discovery of a modern steam engine by James Watt, oil increase rapidly both for industry and transportation. Supported by the technological breakthrough in 20's century, oil has become an important energy source and plays an essential role in economies (Sek et al., 2015; Hesary et al., 2019). The essential role of oil prices in the economy occurs in the oil commodity market and financial markets. In other words, world oil price changes affect the economy through the oil commodity market and financial market.

From 2001 to 2017, world oil prices fluctuated in various volatility and trends. From January 2001 to March 2007, Brent oil prices fluctuated in low-range volatility. Its price increased by USD 36.50 per barrel, moving from USD 25.64 to USD 62.14. From April 2007 to July 2008, Brent oil prices fluctuated in high-range volatility and increased by USD 71.76 per barrel, moving up from USD 67.40 to USD 133.90. From August 2008 to February 2009, Brent oil prices fluctuated in high-range volatility and decreased by USD 27.56 per-barrel, moving down from USD 70.80 to USD 43.24. From March 2009 to April 2011, Brent oil prices fluctuated in high-range volatility and increased by 130 percent, becomes USD 123.07 per barrel at the end of its period. From May 2011 to July 2014, Brent oil price fluctuated in low-range volatility with a slight decrease by 9.73 percentage becomes USD 106.98 per barrel in July 2014. From August 2014 to December 2017, Brent oil price fluctuated in high-range volatility and decreased by 37.48%, becomes USD 66.87 per barrel at the end of its period.

In the same period, inflation in Indonesia fluctuated in single-digit percentages, except for 2002 (10.03%), 2005 (17.17%), and 2008 (11.06%). One of the fundamental reasons for higher inflation in Indonesia in those periods (2002, 2005, and 2008) compared to other periods was the increase of the domestic fuel price in significant percentages. In 2002, the domestic fuel price increased by 52.20%, while in 2005 it increased by 37.16%, and in 2007 increased by 47.88%. Apart from those periods, Indonesia's inflation fluctuated in single-digit percentage, where the lowest was in 2009 (2.78%), and the highest was in 2013 (8.38%). In the last three years, Indonesia's inflation was 3.35% in 2015, 3.02% in 2016, and 3.61% in 2017. The Brent oil price and inflation in Indonesia from 2001 to 2017 as presented in Figure 1.

Hamilton (1983) is the first researcher to investigate the effect of oil price changes on U.S. macroeconomic indicators. He used a six-variable, they are (1) real GNP, (2) unemployment, (3) domestic prices (as a proxy of inflation), (4) wages, (5) import-prices, and (5) money supply (M1). He concluded that the increases in oil prices induce recession in the U.S. economy. It occurs because the increase in oil price increased uncertainty and raised the operating costs. After Hamilton's study, many researchers investigated the effect of oil price changes on several macroeconomic indicators, especially inflation.

Figure 1. The Fluctuations of Brent Oil Price and Inflation in Indonesia.



Sources: BPS and St.Lois Federal Reserve Economic Data (FRED)

Qianqian (2011), using a vector error correction model (VECM), found a significant long-run relationship between oil price and China's macroeconomic. She concluded that an increase of 1% of oil price changes statistically significant pushing-up inflation in China by 0.017%. Dias (2013) finds that an increase in oil price pushed higher inflation in the first two years, by 0.25% and 0.05% in the Portuguese economy. However, its effect was temporary. Since the third year, oil price shocks on inflation have reduced slowly, without long-term effects.

Gokmenoglu et al. (2015) employed the Johansen cointegration approach and Granger causality tests to find that the Johansen cointegration test confirms a long-run relationship among variables, but the Granger causality test showed no causality relationship between oil prices and inflation. Mukhtarov et al. (2019), using a vector error correction model (VECM), shows that increasing 1% in oil prices increases inflation in Azerbaijan by 0.58%.

Many researchers investigated the effect of oil price changes on inflation in a group of countries. Sek et al. (2015) investigated the effects of oil price changes on inflation in the high and low oil dependency countries. They find that oil price changes have different effects for these two groups of countries. Oil price changes directly impact the domestic inflation in the low oil dependency countries, but its impact is indirect for the high oil dependency countries. Raghavan (2015) using a structural vector autoregressive model (SVAR) to observe the effect of oil price shocks on the domestic economy of ASEAN-5 (Thailand, Malaysia, Singapore, Philippines, and Indonesia). The research shows that oil supply shocks significantly affect inflation on four net-oil importing economies but insignificant for Malaysia as a net oil-exporting economy. However, the inflationary effects of oil price shocks vary among the four net-oil importing countries depend on their oil self-sufficiency.

Morana (2016) employed a semiparametric dynamic conditional correlation model

(SP-DCC), estimated using the quasi-maximum likelihood (QML) approach, which shows that recession in the European countries triggered by the oil price hikes and slumps in European countries. The research concluded that the conditional correlation is sizeable, particularly on inflation, which shows that inflation positively links to the oil price shocks.

Brini et al. (2016) analyzed the impact of oil price shocks on inflation and real exchange rate in MENA-6 countries (Tunisia, Morocco, Algeria, Bahrain, Saudi Arabia, and Iran) from January 2000 to July 2015. Using a structural vector autoregressive model (SVAR), they found that the impulse response function (IRF) of inflation to shock to oil price has a smaller impact and absorbed by subsidized product prices' rigidity. Forecast error variance decomposition (FEVD) shows that oil price shocks significantly affect inflation for MENA-6 countries, except for Algeria and Iran. Bala & Chin (2018) investigated the effect of oil price changes on inflation in African OPEC member countries: Algeria, Angola, Libya, and Nigeria. They used an autoregressive distributed lag (ARDL) and found that both positive and negative oil price changes positively affect inflation in those countries. However, the impact of oil price changes was more significant when the oil price dropped. It means inflation increased in African OPEC countries when the oil price dropped. Zivkov et al. (2019) observe the effect of oil price changes on inflation in Central and Eastern European (CEE) countries: the Czech Republic, Poland, Hungary, Slovak, Lithuania, Latvia, Estonia, Romania, Bulgaria, Slovenia, and Croatia, from January 1996 to June 2018. By using a wavelet-based Markov switching approach, they found that transmission of oil price changes to inflation was relatively low. However, the most substantial impact was the longer-time horizon for most CEE countries. Therefore, they concluded that the indirect spillover effect was more intensive than the direct one.

Several researchers had conducted the relationship between oil price changes and inflation in Indonesia. Nizar (2012), using a vector autoregressive model (VAR), found that the oil price shocks increased Indonesia's domestic inflation rate for a year and its response permanently since the second year. Artami & Hara (2010) conclude that both positive and negative oil price changes had a statistically insignificant effect on Indonesia's inflation. Rostin et al. (2019) conclude that there are no long-run and short-run effects of crude oil price shocks on Indonesia's inflation.

Several studies concluded that the effect of oil price changes on inflation is asymmetric. Nazarian & Amiri (2014) examined the effect of oil price shocks on Iran's inflation from March 2003 to March 2013. Using a pass-through model, they found that the model can demonstrate the effect of oil price shocks on inflation with a large magnitude in the long-run. They conclude that the relationship is asymmetrical, wherein in the short-run, the relationship showed the positive and negative effects of oil price shocks. Lorusso & Peironi (2015) assessed the effect of oil price changes on the U.K. macroeconomy measured by GDP growth and inflation. They used a structural vector autoregressive (SVAR) model to observe the data from 1976 to 2014. They found that oil supply shocks significantly affect the U.K.'s inflation, but shocks in oil demand have no significant effect. They concluded that the effect of oil supply shocks on the

U.K's inflation is significant, which occurs because of the position of the U.K. as an oil producer country.

Luthfi et al. (2017) investigated the impact of oil price changes on Indonesia's macroeconomic variables, measured by the inflation rate, real interest rate, GDP growth, and unemployment, on the pre and post-Asian financial crisis. By employing a vector autoregression model (VAR), they found there was an insignificant impact of oil price volatility, as net oil price decreased and increased to inflation for the period Q1.1984 to Q4.1997 (pre-crisis), but they were significant for the period 1998 to 2012 (post-crisis)

Khan & Malik (2016) investigated the pass-through of oil prices to the domestic price in Pakistan using Consumer Price Inflation (CPI) and Wholesales Price Inflation (WPI). By using the recursive vector autoregressive (VAR) model, their study showed that (1) the oil price has a moderate effect on inflation, (2) oil price pass-through is stronger in WPI than CPI, (3) the impact of oil pass-through is more pronounced in the period 2008 to 2015, and (4) oil prices have an asymmetric impact on domestic inflation in Iran.

Many studies conducted using various parametric approaches, both in Indonesia and outside Indonesia, the relationship between oil price and inflation had various conclusions. The different conclusion occurs because there are differences in the time horizon, source of oil price shocks, country's position in the oil market, and the model. Therefore, investigating the effect of oil price changes on Indonesia by using different approaches is still relevant.

Based on the fluctuation of Brent oil prices and inflation in Indonesia, this study investigates the effect of world oil price changes on inflation in Indonesia from January 2001 to December 2017, using a nonparametric approach. A nonparametric is used as an alternative approach if the variables used did not fulfill the parametric approach's requirement. However, a nonparametric approach based on general data assumptions, the validity of its procedure can be accountable (Daniel, 1989). Therefore, a nonparametric regression model used in this study can be a novelty to complete the literature that studied the behavior of inflation in Indonesia.

## Method

The world oil price that we used in this study is Brent oil price, based on the fact that it is the largest crude oil produced and the most frequently traded in European, Middle East, and African oil markets. Approximately two-thirds of the oil productions in the world are from Brent oil. Brent oil trades in the broadest commodity futures market in the world, such as International Petroleum Exchange (IPE) in London, Dubai Mercantile Exchange (DME) in Dubai, Multi Commodity Exchange (MCX) in India, and Tokyo Commodity Exchange (TOCOM) in Tokyo, Japan. The Brent oil price data taken from the Federal Reserve Bank of St. Louis Economic Data Research (FRED). The data of inflation in Indonesia taken from The Economic of Indonesia Monthly Report published by The Central Bureau of Statistic of Indonesia. We analyze 204 monthly

data from January 2001 to December 2017, and sufficient to be analyzed using the regression approach. We analyzed data using Eviews 9.0 for descriptive analysis, ADF unit root test, heteroscedasticity and stability test, and ARCH LM test. To select optimum bandwidth and analyze the nonparametric regression function, we used the R application program version 3.6.1.

The characteristics of inflation's data from January 2001 to December 2017 tended to follow a normal distribution and had no ARCH effect; therefore, when we used the parametric approach, the estimation would be biased and inconsistent (Handerson & Souto, 2018). A nonparametric regression provides an alternative method for a weak identification assumption and minimizes misspecification (Cizek & Sadikoglu, 2019). When we use a nonparametric regression function, the relationship between two or more variables cannot predict sooner. Therefore, we could not use a specific regression function before we had valid information on the relationship function (Hardle, 1994).

We observed the relationship between inflation in Indonesia and Brent oil price using three alternatives nonparametric regression functions: general additive model, second-order Gaussian Kernel, and second-order Epanechnikov Kernel. To observe the relationship using second-order Gaussian Kernel and second-order Epanechnikov Kernel approaches, we employed the Nadaraya-Watson (N-W) estimator due to its popularity, and it was easy to use. The regression function of the relationship between two variables should be assumed smooth and estimated based on the data given, which expressed by the following equation (1)

$$y_i = m(x_i) + \varepsilon_i, \text{ for } i = 1, 2, 3, \dots, n \quad (1)$$

Where:

- $y_i$  is inflation (INF) as a response variable
- $x_i$  is Brent oil price (BOP) as a predictor variable.
- $m$  is an unknown regression function

To select the best estimator, we estimate the optimum bandwidth using a smoothing regression technique, as De-Ulillarri (2015) suggested. This study used a *kernel* smoothing technique and an optimum bandwidth to control the bandwidth to ensure that the bandwidth is not under-smoothed or over-smoothed. It is important to control the bandwidth because an under smoothed bandwidth will cause the regression function to fluctuate and generate a rough estimation. Otherwise, an over-smoothed bandwidth will cause the regression function biased, and estimation cannot be accurate. Eubank (1988) defines a *kernel* regression function ( $K$ ) with an optimum bandwidth ( $h$ ) expressed in equation (2)

$$K_h(x) = \frac{1}{h} K\left(\frac{x}{h}\right); -\infty < x < \infty \text{ dan } h > 0 \quad (2)$$

Where:

- $K$  is the *kernel* regression function.
- $h$  is the optimum bandwidth
- $x$  is the predictor variable (Brent oil price)

There are several kernel regression functions that we can use to observe the relationship between the response variable and predictor variables, such as Uniform, Triangle, Triweight, Cosinus, Gaussian, and Epanechnikov kernel regression functions. This study used a second-order Epanechnikov kernel function because it is popular and frequently used by many researchers. A second-order Epanechnikov kernel function defined as in equation (3)

$$K(z) = \frac{3(1-\frac{z^2}{5})}{4\sqrt{5}}, \text{ where } z = (x_i - x)/h, \text{ for } h > 0 \quad (3)$$

The regression function of  $m(x_i)$  in equation (1) can be estimated using several estimator techniques, such as *Naradaya-Watson* (N-W), *Priestley*, and *Gesser-Müller* estimators. This study used *Naradaya-Watson* (N-W) estimator because many researchers more frequently use it. A *Naradaya-Watson* (N-W) estimator can be used to estimate the regression function of  $m(x_i)$  in equation (1) as a weighted *kernel* function, as presented in equation (4):

$$\hat{m}(x) = \frac{\sum_{i=1}^n K(\frac{x-X_i}{h}) Y_i}{\sum_{i=1}^n K(\frac{x-X_i}{h})} \quad (4)$$

Where:

- $\hat{m}(x)$  is an N-W estimator
- $K$  is the *Kernel* regression function
- $h$  optimum bandwidth

We analyzed the relationship between Brent oil price and inflation in Indonesia using descriptive analysis and inference analysis. The descriptive analysis observes the characteristics of data using general statistic descriptive parametric. Inference analysis is used to estimate the relationship between inflation in Indonesia as a response variable and Brent oil price as the predictor variable.

We conducted several steps to analyze the relationship between inflation and oil price. Firstly, plotting the pairing value of inflation in Indonesia and Brent oil price using a scatterplot diagram. Secondly, estimating the optimum bandwidth for each alternative nonparametric regression function. Thirdly, selecting the best alternative nonparametric regression function. Finally, assessing the relationship between inflation in Indonesia and Brent oil price using the best model that we chose at the 3rd step.

## Results and Discussion

The summary descriptive analysis of Brent oil price and inflation in Indonesia is present in Table 1. The maximum and minimum value of BOP show that Brent oil prices movement had a wide range but still in the expected range. On the other side, the minimum value of INF was negative, which indicates that there were several data set of inflation had negative values even the BOP value is positive. Based on the descriptive analysis, we could not use a parametric approach to analyze the relationship between inflation in Indonesia (INF) and Brent oil price (BOP).

**Table 1. Descriptive Statistics of Brent Oil Price and Inflation in Indonesia**

| Statistics   | BOP      | INF       |
|--------------|----------|-----------|
| Mean         | 66,46495 | 0,536422  |
| Maximum      | 133,9000 | 8,700000  |
| Minimum      | 18,60000 | -0,450000 |
| Std. Dev.    | 31,19502 | 0,794425  |
| Skewness     | 0,326080 | 5,735764  |
| Kurtosis     | 1,888461 | 56,59053  |
| Jarque-Bera  | 14,11708 | 25530,10  |
| Probability  | 0,000860 | 0,000000  |
| Observations | 204      | 204       |

Source: Data processed using Eviews

The probability of the Jarque-Berra statistics parameter can test a null hypothesis, where each variable consider to have a normal distribution. Table 1 shows that the p-value of BOP and INF was equal to 0.000, which means BOP and the INF data did not support a normal distribution. Therefore, we had to reject the null hypothesis of each variable that had a normal distribution. Based on the descriptive analysis, we could predict the relationship between Brent oil price and Indonesia's inflation using a parametric approach. If we still used the parametric approach to analyze the relationship, it could generate a spurious conclusion. Therefore, we used a nonparametric approach as an alternative approach to exploring the relationship between Brent oil price and inflation in Indonesia.

We conducted a preliminary test, such as a stationary test, heteroscedasticity test, and stability test, to analyze the relationship between inflation and the oil price. The results of the preliminary examination are as follow. The result of the stationary test using the Augmented Dickey-Fuller (ADF) unit root test for inflation in Indonesia (INF) and Brent oil price (BOP) is present in Table 2. Table 2 shows that inflation in Indonesia (INF) had  $\tau$  statistic less than 1% critical value ( $\alpha=0.01$ ) and p-value = 0.0000. It indicates that inflation in Indonesia was stationary in level(I/0). On the other side, the  $\tau$  statistic and p-value of Brent oil price (BOP) exceeded a 5% critical value ( $\alpha=0.05$ ), which indicates that Brent oil price was non-stationary in level, but stationary in a first different form (I/1).

**Table 2 ADF test for inflation in Indonesia (INF) and Brent oil price (BPO)**

| Variable | Critical Value |           | level      |         | 1st Difference |         |
|----------|----------------|-----------|------------|---------|----------------|---------|
|          | (1%)           | (5%)      | statistic  | p-value | statistics     | p-value |
| LnBOP    | -3,462737      | -2,875608 | -1,938644  | 0,3141  | -10,58025      | 0,0000  |
| INF      |                |           | -10,36141* | 0,0000* |                |         |

\*rejection of null hypothesis at 1% and 5%

Because INF and BOP had a different integration order, the relationship between these two variables model by using an autoregressive distributed lag (ARDL) model. This research conducted the heteroscedasticity and stability test for the ARDL model to ensure that the ARDL model was fit to analyze the relationship between inflation in Indonesia (INF) and Brent oil price (BPO).

We used the Breusch-Pagan-Godfrey test to observe heteroscedasticity and CUSUM and CUSUMSQ test to identify the ARDL model's stability. The results of the heteroscedasticity and stability test of the ARDL model as presented in Table 3. Table 3 shows that the ARDL model was unstable that caused by heteroscedasticity. Therefore, the ARDL model cannot analyze the relationship between inflation in Indonesia and the Brent oil price.

**Table 3 Heteroscedasticity and stability test for ARDL model**

| Model      | Heteroscedasticity | Stability test |         |
|------------|--------------------|----------------|---------|
|            |                    | CUSUM          | CUSUMSQ |
| ARDL Model | exist              | Yes            | No      |

Source: Data processed using Eviews

We use the ARCH effect test to observe the relationship between inflation in Indonesia and Brent oil price. It could be analyzed using the ARCH)/GARCH approach. The ARCH LM test result for inflation in Indonesia and Brent oil price (BOP) shows in Table 4. By observing the probability of Chi-square and 5% critical value ( $=0.05$ ), the ARCH LM test shows that Brent oil price (BOP) had an ARCH effect, while inflation in Indonesia (INF) had no ARCH effect. These results indicate that the ARCH/GARCH approach cannot analyze the relationship between inflation in Indonesia (INF) and Brent oil price (BOP).

**Table 4 ARCH LM test for inflation in Indonesia (INF) and Brent oil price (BPO)**

| Variable | Obs*R-squared | Prob.Chi-square | ARCH Effect |
|----------|---------------|-----------------|-------------|
| Ln.BOP   | 167,3117      | 0,0000          | Yes         |
| INF      | 0,003069      | 0,9558          | No          |

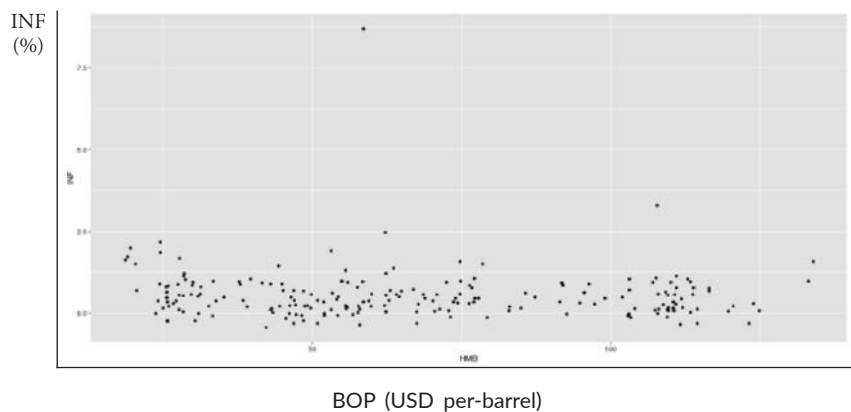
Source: Data processed using Eviews

The preliminary test shows that the relationship between inflation in Indonesia (INF) and Brent oil price (BOP) could not be analyzed using a parametric approach. Therefore, we employed a nonparametric regression approach to explore the relationship between these two variables. We used several steps to analyze a nonparametric regression approach: (1) plotting its relationship, (2) calculating the optimum bandwidth, (3) selecting the best alternative model, and (4) estimating its relationship.

The first step in analyzing the relationship between inflation in Indonesia as the response variable and the Brent oil price as the predictor variable was to predict these two

variables' relationship function. We used a scatterplot diagram to identify the relationship function between inflation in Indonesia as a response variable and Brent oil price as a predictor variable, as shown in Figure 3. Figure 3 shows that the relationship between inflation in Indonesia and Brent oil price from 2001 to 2017 did not offer a specific function. Therefore, we had no information to identify and model the relationship between inflation in Indonesia and Brent oil price using a particular regression function. Based on this fact, we analyzed the relationship between inflation in Indonesia and Brent oil price using a nonparametric regression approach.

**Figure 3. Scatterplot Diagram of BOP and INF for the Period of 2001 - 2017**



We used three alternatives nonparametric regression functions to analyze the relationship between inflation in Indonesia and Brent oil price; they are (1) general additive model, (2) second-order Gaussian kernel model, and (3) second-order Epanechnikov kernel model. The second-order Gaussian kernel and second-order Epanechnikov kernel model required optimum bandwidth information, while this information no need for the general additive model. The optimum bandwidth is selected automatically using an R-studio program, as shown in Table 5. The optimum bandwidth is 3.973047 for the second-order Gaussian kernel model and 3.009644 for the second-order Epanechnikov kernel model. This optimum bandwidth uses to regress the relationship between the response variable (inflation) and the predictor variable (Brent oil price) for each model.

**Table 5 Regression result of the nonparametric alternative model**

| Non-Parametric Regresi Model     | Bandwidth | R-squared | p-value |
|----------------------------------|-----------|-----------|---------|
| General additive model           | -         | 0,0204    | 0,346   |
| Second-order Gaussian kernel     | 3,973047  | 0,1007    | 0,088   |
| Second-order Epanenchikov kernel | 3,009644  | 0,1081    | 0,018   |

Source: Data processed using *R-studio*

To select the best nonparametric regression model, we observed three alternative models and selected using two criteria: R-squared and p-value, indicating the model's

explanatory power. Table 5 shows the R-squared and the p-value resulted from the regression process for each model. The R-squared criterion for the second-order Gaussian kernel model and second-order Epanechnikov kernel model was equal to 10 percent, indicates that the variation of Brent oil price can explain a 10 percent variation of inflation. The rest variation of inflation in Indonesia define by other factors that exclude the Brent oil price. Although the R-squared for these two models was low enough, it was better than the R-squared for the general additive model.

Table 5 also shows that the p-value of the General additive model (0.346) was higher than 10 percent, which means this model was statistically insignificant in 90% confidence level. The p-value of the second-order Gaussian Kernel model was 0.088, and the second-order Epanechnikov Kernel model was 0.018. It means that the second-order Epanechnikov Kernel model was statistically significant in a 95% confidence level. In comparison, the second-order Gaussian kernel model was statistically significant in a 90% confidence level. Using the p-value criteria, we employ the second-order Epanechnikov Kernel function model to analyze the relationship between inflation in Indonesia and Brent oil price.

The relationship between inflation in Indonesia (INF) and Brent oil price (BOP) is observed using the second-order Epanechnikov kernel model and estimated using a Naradaya-Watson's estimator. The Naradaya-Watson (N-W) estimator is used because it is frequently used to estimate a nonparametric regression function. By using sample size (n) = 204, the regression function of m(xi), as shown in equation (4), can be estimated using equation (5).

$$\hat{m}(x) = \frac{\sum_{i=1}^n K(\frac{x-X_i}{h}) Y_i}{\sum_{i=1}^n K(\frac{x-X_i}{h})} \quad (5)$$

which,

$$K(z) = \frac{3(1-\frac{z^2}{5})}{4\sqrt{5}}, \text{ where } z = (x_i - x)/h, h > 0 \quad (6)$$

By substituting the value of K(z) into the regression function of  $\hat{m}(x)$  in equation (5), the second-order Epanechnikov kernel function between inflation in Indonesia and Brent oil price formulated as equation (7)

$$\hat{m}(x) = \frac{5h^4 \sum_{i=1}^{204} Y_i - (h+1)^2 \sum_{i=1}^{204} X_i^2 Y_i + 2(h+1)x \sum_{i=1}^{204} X_i Y_i - x^2 \sum_{i=1}^{204} Y_i}{5h^4 - (h+1)^2 \sum_{i=1}^{204} X_i^2 + 2(h+1)x \sum_{i=1}^{204} X_i - x^2} \quad (7)$$

Where:

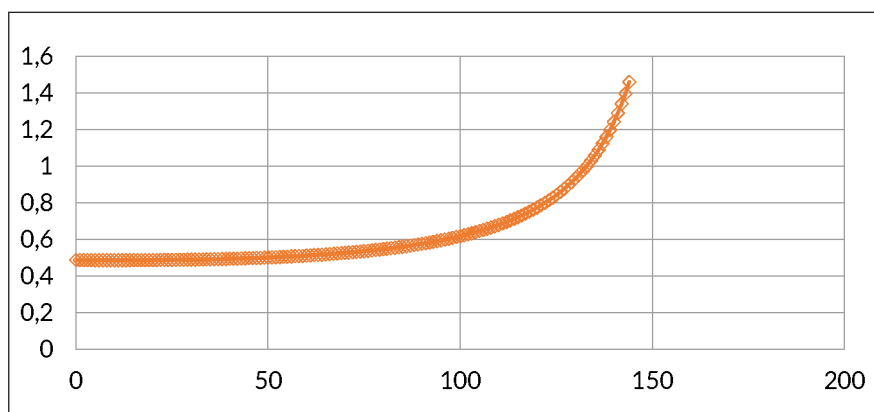
$$\sum_{i=1}^{204} Y_i = 109,43; \quad \sum_{i=1}^{204} X_i^2 Y_i = 538473,99; \quad \sum_{i=1}^{204} X_i^2 Y_i = 538473,99; \quad \sum_{i=1}^{204} X_i = 13558,84; \quad \sum_{i=1}^{204} X_i^2 = 1098733,39; \quad h = 3.009644,$$

By replacing the value of  $\sum_{i=1}^{204} Y_i$ ,  $\sum_{i=1}^{204} X_i$ ,  $\sum_{i=1}^{204} X_i^2$ ,  $\sum_{i=1}^{204} X_i^2 Y_i$ ,  $\sum_{i=1}^{204} X_i^2 Y_i$ , and  $h$  into equation (7), the relationship between inflation in Indonesia (INF) and Brent oil price could be estimated using the following equation (8).

$$INF = \frac{-8612286.5 + 55010.3 \text{ BOP} - 09.4 \text{ BOP}^2}{-17664195.6 + 108732.1 \text{ BOP} - 14630352 \text{ BOP}^2} + \varepsilon \quad (8)$$

To interpret the relationship between inflation and oil price, we drew this relationship into a two-dimensional diagram, where Indonesia's inflation mark on the vertical axis and Brent oil price draw on the horizontal axis. We calculated the value of inflation for each value of Brent oil price using equation (8), starting from the Brent oil price of USD 1 per barrel to USD 140 per barrel. The plotting of the value of inflation and Brent oil price shows in Figure 4.

Figure 4. Relationship between INF and BOP for the Period 2001-2017



Source: Data processed by R-studio

Figure 4 shows that the relationship between inflation in Indonesia and Brent oil prices tends to follow exponentially. An increase in Brent oil price forcing Indonesia's inflation to follow the exponential function in the second-order Epanechnikov kernel function, as shown in equation (8). The intercept of its function is 0.004875, which indicates that if the Brent oil price was equal to USD 0 per barrel, Indonesia's inflation rate per month is 0.4875 percent. Without considering the oil price, the inflation rate per month in Indonesia is 0.4785 percent. Figure 4 also informed us that Indonesia's inflation rate increases slowly when the oil price below USD 100 per-barrel and becomes high when the oil price above USD.100 per barrel.

When Brent oil price is below USD 100 per barrel, increasing USD 1 on Brent oil price will increase the inflation rate per month in Indonesia by 0.001289%. However, when the Brent oil price above USD 100 per-barrel, increasing USD 1 affects inflation rate increase by 0.1541%, higher than when the oil price below USD 100 per barrel. This result implies that when the oil price below USD 100 per barrel, increasing USD 10 on oil price will push up Indonesia's inflation by 0.01289%. Meanwhile, when the price is above USD 100 per barrel, an increase in the same amount on oil price will push up Indonesia's inflation by 1.541%. In other words, when the oil price below USD 100 per barrel, it affect Indonesia's inflation by a lower rate. On the other side, the oil price above USD 100 per-barrel affects Indonesia's inflation at a higher rate.

This study's result is in line with the result of the studies conducted by Nizar (2012) and Luthfi et al. (2017), although they used a parametric approach different from the

model used in this study. The nonparametric model also can be giving us information on the behavior of the relationship. By plotting the predictor and response variables' values into a diagram, as shown in Figure 3, a nonparametric model gives us more detailed information about the relationship between these variables. Therefore, we conclude that the nonparametric model used in this study can be considered an alternative approach to observe the relationship between oil price changes and inflation in Indonesia, and the result of this approach as good as a parametric approach.

This study is in line with almost all international studies conducted before, such as Qianqian (2011) in China, and Dias (2013) in Portuguese, although their studies used a parametric approach. The same conclusion between this study and those occurs because all these countries have the same oil market position as net-oil importing countries. This conclusion supports Raghavan (2015), which concluded that oil price shocks significantly affect inflation on net-oil importing economies.

This study's result is also in line with the previous study conducted in Indonesia by Nizar (2012) and Luthfi et al. (2017). Although this study uses a different approach from those, all of these studies conclude that oil price changes significantly affect inflation in Indonesia. Due to the resulting study conducted by Luthfi, Senevirathne & Kaneko (2017) and Khan & Malik (2016), this same conclusion occurs because all of these studies analyzed data on the same time horizon that is, in a post-financial crisis (1998). The effect of oil price changes on inflation could be occurred because of the asymmetric effect of oil price changes on the economy, caused by the position of a country in the oil market and the time horizon used to analyze (Khan & Malik, 2016). These two considerations are relevant to the result of this study, in which, from 2001 to 2017, Indonesia became a net oil importing country.

On the other side, this study's result differs from Gokmenoglu et al. (2015), which concluded that the Granger causality test confirms no causality relationship between oil price and Turkey's inflation. The different result occurs because the Granger causality test has limitations. One of the Granger causality test limitations is "all causal relationships remain constant in their direction over time". Therefore, only the strengths relations changes but never the general direction. This study's result is also different from Artami & Hara (2018) and Rostin et al. (2019) that oil price changes have no significant effect on inflation in Indonesia. The different results between this study and Artami & Hara (2018) exist because they employed a different proxy for the oil price, where they used actual oil prices in Indonesia as an independent variable that consisting of the price subsidy policy. Because the government employs the price's oil subsidy policy to reduce oil price changes' impact on the general price level, the effect of oil price changes on inflation is statistically insignificant. The different result between this study and Rostin et al. (2019) occurs because of the Aostin et al. (2019). As Sek et al. (2015) concluded, in ARDL format, oil price changes indirectly affect inflation in high oil dependency countries. Therefore, the ARDL model cannot observe the direct effect of oil price changes on Indonesia's inflation as a high oil dependency country.

## Conclusion

The second-order Epanechnikov kernel function as a nonparametric model can use as an alternative approach to estimating the relationship between the world oil price and inflation in Indonesia. The regression of the second-order Epanechnikov kernel function shows that the oil price changes on inflation in Indonesia tend to follow exponentially, with the critical level of oil price at USD 100 barrel. Our study shows that the effect of world oil price changes on Indonesia's inflation depends on the oil price level. If the oil price is below USD 100 per barrel, oil price changes will lower inflation in Indonesia. However, when its price is above USD 100 per barrel, its effect becomes higher.

This conclusion is giving important consequences on the implementation of the government and Bank Indonesia's policy. Because the oil price changes have a lower effect on inflation when its prices are below USD 100, as long as the oil price is at this price, the government and Bank Indonesia do not need to over-react to manage inflation due to oil price changes. Bank Indonesia and the government need to be concerned about managing inflation in response to the oil price changes when its price is above USD 100 per barrel.

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| Countries              | 2010       | 2015      |
|------------------------|------------|-----------|
| <b>ASEAN Countries</b> |            |           |
| Indonesia              | 5,814 (71) | 5,54 (71) |
| Malaysia               | 6,608 (36) | 6,62 (36) |
| Thailand               | 6,436 (42) | 5,96 (50) |
| Filipina               | 6,403(44)  | 5,71 (63) |
| Singapura              | 7,719 (11) | 8,00 (6)  |
| Vietnam                | 6,080 (61) | 5,64 (68) |

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