LESS INCLUSIVE GROWTH IN INDONESIA?
THE UNINTENDED CONSEQUENCES OF INTERNET PENETRATION

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ABSTRACT
Separate studies on the impact of internet penetration on growth and per capita income levels, inequality, and poverty levels are still being discussed. Using data from 33 Indonesian provinces between 2008 and 2020, this paper investigates whether internet penetration modulates economic growth by reducing inequality and poverty. The Two-Way Fixed Effect (TWFE) econometric model was used. Two findings can be concluded from this paper. First, Indonesia's economic growth remains less inclusive, as evidenced by rising per capita income, which tends to reduce poverty but not income inequality. Second, Indonesia's economic growth tends to be less inclusive as an unintended consequence of internet penetration. Although it strengthens the effect on poverty reduction, on the other hand, the interaction of economic growth with internet penetration tends to exacerbate income inequality. Based on these findings, the study suggests that the government should improve advanced ICT skills and lower barriers to internet adoption, particularly for the less fortunate. The internet is expected to become a tool to achieve inclusive growth through expanding a newly established middle class instead of simply the economic transformation of the poor into non-poor households under this policy.


Keywords: internet penetration, inclusive growth, poverty, inequality.

1. INTRODUCTION

The world is experiencing an unprecedented digital revolution. This era is identified by nearly two-thirds of the world's population online (Statista Research Department, 2022). This figure is expected to grow exponentially in line with the massiveness of digital devices. World Bank (2016) documents internet access is more prevalent in developing countries than clean water and sanitation. Only 3 in 10 households in the lowest group do not have a mobile phone connected to the internet (World Bank, 2016). Thus, the internet has the opportunity to become a game changer in achieving inclusive economic growth, where the most vulnerable groups are more involved.

Indonesia also benefits from widespread internet access. (Indonesia Central Statistics Agency, 2012 & 2021)—henceforth BPS—reported that 53.73% of the Indonesia population have access to the internet in 2020, a more than tenfold increase from 2008. Indonesia has the fourth highest internet users in the world, trailing only China, India, and the United States (Statista Research Department, 2021a). In Indonesia, internet users spend nearly 9 hours daily, which is relatively high compared to the average country (Statista Research Department, 2021b). In other words, the internet has become deeply embedded in daily life.

Regrettably, the rapid internet penetration in Indonesia has not been followed by more inclusive economic growth. The average economic growth rate during the reform era was around 5%, which was lower than the new order era (Jamil, 2017; Resosudarmo & Abdurohman, 2018). At the same time, despite the miraculous reduction in poverty, the level of income inequality
measured by the Gini ratio has not yet reached its lowest point since the reform era began (see Figure 1). This condition means that the poorest group's income growth is lagging behind that of the wealthiest group (Szcześniak, Geise & Bariyah, 2022; Hill, 2021; Hindun, Soejoto & Hariyati, 2019; Suryahadi & Izzati, 2018; Jamil, 2017; Miranti, Duncan & Cassells, 2014; Suryahadi, Hadividjaja & Sumarto, 2012). For this reason, inclusive growth is an inevitable agenda to prevent divergences during the digital revolution.

Source: Processed from BPS, various series

Figure 1. The Evolution of Inclusive Growth in Indonesia

This research aims to determine whether internet penetration causes inclusive growth based on this background. The estimated impact of the interaction term between internet penetration and per capita income growth on poverty and inequality is used to assess inclusive growth. This paper contributes to the literature by providing a more comprehensive analysis than previous studies that were relatively more partial in examining the impact of internet penetration on inclusive growth. The most recent study on the link of the internet to indicators of inclusive growth can be separated into three categories: i) the internet and changes in per capita income (Maurseth, 2018; Hussain, Batool, Akbar & Nazir, 2021; Abdulqadir & Asongu, 2022); ii) internet and income inequality (Bauer, 2018; Canh, Schinckus, Thanh & Hui Ling, 2020; Du, Zhou, Cao, Zhang, Chen & King, 2021); and iii) internet and poverty (Yang, Lu, Wang & Li, 2021; Lechman & Popowska, 2022). The next part of this paper will reconcile the theoretical framework scattered in previous studies to serve as the basis for formulating recommendations for inclusive economic growth during the digitalization era.

2. LITERATURE REVIEW

The definition of inclusive growth used in this paper is centered on Anand, Mishra & Peiris (2013) and Ramos, Ranieri & Lammens (2013). Inclusive growth is characterized as increased per capita income growth and a substantial decline in inequality and poverty. Economic growth is regarded as a pillar of inclusive growth because it reflects economic participation through increased productivity. Meanwhile, poverty and inequality reduction are regarded as pillars of inclusive growth because they lead to more equitable economic outcomes. In short, there is no
contradiction in the concept of inclusive growth between generating economic growth, reducing poverty, and improving income distribution. This section will discuss growth effects on inequality and poverty according to this definition. After that, this section will explain how digitalization shapes inclusive growth theoretically.

2.1. Inclusive Growth: Growth, Poverty, and Inequality

The literature on the effects of economic growth on income inequality continues to produce mixed results. The relationship was first described using the Kuznets hypothesis, which states that economic growth is accompanied by high inequality at first. The agricultural sector causes this inequality as the basis of the rural economy, which tends to produce a low average income per capita. At the same time, the industrial sector in urban areas with high productivity levels tends to generate high per capita income. Because of structural transformation, economic growth is followed by low-income inequality (Thorbecke & Ouyang, 2017). The labor movement from the agricultural to the industrial sectors reduces labor supply in the agricultural sector, causing agricultural labor wages to rise. Contemporaneously, workers who have moved to the manufacturing sector earn more than those who have remained in the previous sector. Meniago & Asongu (2018) in Africa, Thomas (2015) in South America, and Le, Nguyen, Su & Tran-Nam (2020) on a global scale all support the Kuznets hypothesis, which founds the relationship between growth and inequality as an inverted U-curve.

Chen, Karabarbounis & Neiman (2017), Shahbaz, Bhattacharya & Mahalik (2017), Jamil (2017), Piketty (2014), Pinney (2014), and Dartanto (2013) found no compelling evidence to support the Kuznets Hypothesis. Overall, the research confirms that economic growth has consistently exacerbated inequality in a variety of countries around the world. Since the spread of globalization, the digital revolution, and the 2008 global financial crisis, economic growth has been accompanied by income inequality, mainly due to the strengthening of the role of the capital-intensive sector, which has limited the inclusion of the poor in economic activities.

On the contrary, Perera & Lee (2013) find that inequality remains unchanged despite increased economic growth. The relatively constant income distribution during periods of high economic growth is due to a proportional increase in income for both the poor and rich (Deininger & Squire, 1998). Surprisingly, a study by Pinkovskiy & Sala-i-Martin (2014) observed that the laggard countries in Africa experienced rapid growth with a more even income distribution for the first time.

The poverty effect of economic growth is also being openly discussed. From an optimistic standpoint, poor household groups benefit from rapid economic growth, particularly in developing countries. This standpoint is supported by the research of Thorbecke & Ouyang (2022), Fosu (2018), and Dollar, Kleineberg & Kraay (2016). On the other hand, the pessimistic standpoint contends that pro-poor growth is incredibly challenging because the trickle-down effect is still a long way off (Harmáček, Syrovátková & Dušková, 2017; De Silva & Sumarto, 2014). Benfica & Henderson (2021), Ivanić & Martin (2018), and Dorosh & Thurlow (2018) underscore that poverty reduction is influenced not only by economic growth but also by the sectoral composition of growth. Currently, the growth engine relies more on the formation of labor-saving capital. It is not surprising that the non-tradable sector is more advanced than the tradable sector, despite its limited capacity for poverty alleviation (Christiaensen & Martin, 2018).
In addition, the correlation between economic growth and poverty may deviate from the pattern found in mainstream economic theory. Donaldson (2008) describes both relationships as two phenomena. First, a positive exception is a situation in which poor income growth exceeds economic growth. This case occurs in a Scandinavian country with a well-established social welfare program. Second, a negative exception occurs when high economic growth is accompanied by low-income growth for the poor. These trends are predicted in economic reforms that do not consider political stability, such as those implemented in Mali, Colombia, and El Salvador. Of course, the association between economic growth and poverty needs further to obtain empirical evidence that fits the context (Donaldson, 2008).

2.2. Linking Internet Penetration with Inclusive Growth

The effect of the internet in decreasing inequality and lowering poverty through promoting economic activity may be addressed further using three theoretical strands. First, there’s the creative destruction theory, which describes how digital disruption works. The advent of contemporary business models that make the market more efficient, such as an offline marketplace being replaced by an online marketplace, is a sign of disruption (Gerpott & Berends, 2022). Because incumbents are no longer reaping supernormal rates of profit, the rate of technological change and digital disruption is no exception, diminishing the concentration of wealth in nations with high levels of inequality (Antonelli & Gehringer, 2017). For example, World Bank (2021) demonstrates the presence of a ride-hailing digital service company, Gojek, disrupting the transportation and logistics, food, and beverage sectors in Indonesia.

Second, the theory of endogenous growth, based on the notion of creative destruction, describes how digitization is a necessary piece of the innovation capacity required to boost economic growth (see Romer, 1990). Internet penetration lowers the costs of discovery for innovators (Xu, Watts & Reed, 2019; Zhu, Li, Yang & Balezentis, 2021; Xiong, Zang & Gao, 2022; Kamga, Fokam & Nchofoung, 2022). For instance, high-speed internet will make it easier for innovators to explore previously registered patents. The innovator may evaluate whether the patent application revealed is unique and, if not, whether there is potential for learning-by-doing to improve the shortcomings of previous innovations. The creation of new products and the expansion of the internet ultimately improve economic well-being which is reflected in the increase in consumer surplus (Reed & Watts, 2018; Asongu & Le Roux, 2017; Asif & Lahiri, 2021).

Third, the new institutional economics (NIE) school of thought identified at least two factors that explain the synergistic relationship between internet expansion and inclusive growth. The first NIE characteristic describes how digitization reduces asymmetric information by lowering transaction costs. Internet facilitates farmers in developing countries to obtain cheaper production factors and market their products at reasonable prices (Deichmann, Goyal & Mishra, 2016; Duncombe, 2016). Meanwhile, the second NIE attribute explains how the internet increases the social capital needed to raise living standards (Kharisma, 2022). Members of social groups can share knowledge through digitization to improve skills and disseminate job information that meets their wage expectations (Louati & Hadoussa, 2021; Galperin & Viecens, 2017). Internet adoption also enables SMEs to gain market share during times of crisis (Wendt, Adam, Benlian & Kraus, 2021; Patma, Wardana, Wibowo, Narmaditya & Akbarina, 2021) and weak social ties (Rahayu & Day, 2017; Kozan & Akdeniz, 2014).
On the diametrical side, some scholars question the internet’s role in achieving an inclusive growth agenda. For a long time in developed countries, the rapid expansion of the internet has been accompanied by the emergence of a period of secular stagnation, declining total factor productivity (TFP), and increasing divergence (Acemoglu, Autor, Dorn, Hanson & Price, 2014; Salemink, Strijker & Bosworth, 2017; Benzell & Brynjolfsson, 2019; Callaghan, 2021; Cette, Devillard & Spiezia, 2022). This phenomenon is known as the “Productivity Paradox” (Brynjolfsson, 1993), and it serves as the foundation for subsequent research on the counterproductive association between digitization and well-being.

There are three main arguments why the internet is provoking less inclusive growth. First, the internet fails to generate digital dividends in society because of access gaps across regions and income groups (World Bank, 2016; Evans, 2019; Michaels, Natraj & Van Reenen, 2014). Urban residents, for example, are much more familiar with the internet compared to rural residents. Poor households consider the internet a luxury compared to wealthy households. Inadequate access to disadvantaged groups is primarily caused by a lack of digital literacy and the high cost of acquiring ICT.

Second, because of wage disparities, the internet fails to improve prosperity. During the digital economy, income growth favors high-skilled workers over low-skilled workers (Acemoglu, 1999; Autor & Dorn, 2013; Lee & Wie, 2015; World Bank, 2021). The internet, which inspired the development of artificial intelligence and automations, has the potential to displace humans as a factor of production in economic activity (Frey & Osborne, 2017; Acemoglu & Restrepo, 2018; Acemoglu & Restrepo, 2019; Acemoglu & Restrepo, 2020). It is not surprising that these circumstances aggravate economic polarization.

Third, the internet has not resulted in creative destruction. In the digital era, the incumbent position is relatively unaffected due to the industry’s lack of potential for newcomers. Incumbents can adjust to the advancement of digitalization so that income remains concentrated in the same hands (Arezki, Fan & Nguyen, 2021). Even if there are newcomers, there is a winner-takes-all dynamic in which superstar firms emerge to reap all of the market benefits, leaving disadvantaged groups out (Brynjolfsson & McAfee, 2014). As a result, ICT policies must level the playing field.

As per the aforementioned literature review, scholars have yet to reach a consensus on the relationship between internet penetration and inclusive growth. Many gaps in previous research can be attributed to differences in theoretical frameworks, country coverage, time observed, and research methods used in this topic. To that end, this study expands on previous research by investigating the internet’s inclusive growth effect. At the very least, this research will assist developing countries such as Indonesia in developing digitalization policies that will benefit all parts of society economically.

3. RESEARCH METHODS

This study uses a panel dataset obtained from BPS that includes cross-sections from 33 Indonesian provinces and a time series spanning 13 years from 2018 to 2020. North Kalimantan is an Indonesian province that we did not have in the analysis because it was only established in 2013, and the necessary data was only available in 2014. Because this province accounts for only 1.61% of the total sample, leaving it out of the analysis does not affect our generalization.
Furthermore, there are two analytical models developed to determine whether internet penetration supports or inhibits inclusive growth, which is modified based on the study of Tchamyou, Asongu & Odhiambo (2019), Miranti et al. (2014), and Suryahadi et al. (2012). First, an analytical model shows the effect of poverty due to the interaction of economic growth and internet penetration. Second, an analytical model highlights the impact of inequality due to economic growth and internet penetration. The form of the equations used in the respective research can be seen in Equations (1) and (2).

\[
\Delta \ln (POV)_{pt} = \alpha_{10} + \alpha_{11} \ln(G)_{pt} + \alpha_{12} \ln(G \ast INT)_{pt} + Z'_{pt} \gamma + \lambda_{p} + \nu_{t} + \varepsilon_{pt} \quad \ldots \quad (1)
\]

\[
\Delta \ln (INEQ)_{pt} = \alpha_{20} + \alpha_{21} \ln(G)_{pt} + \alpha_{22} \ln(G \ast INT)_{pt} + Z'_{pt} \gamma + \lambda_{p} + \nu_{t} + \varepsilon_{pt} \quad \ldots \quad (2)
\]

POV refers to the level of poverty, which is the independent variable in equation (1), and INEQ refers to inequality measured by the Gini ratio, the independent variable in equation (2).

Meanwhile, all independent and control variables used in both equations are identical. The independent variable used is G refers to the growth of GRDP per capita, and G \ast INT refers to the interaction of GRDP growth per capita with internet penetration. The control variable, Z' is a set of time-variant province characteristics consisting of the Covid-19 shock, mean year schooling, percentage of safe sanitation, trade openness, and government expenditure. Thus, all the variables used in this study can be seen in Table 1.

<table>
<thead>
<tr>
<th>Table 1. Variabel and Its Definition</th>
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<tbody>
<tr>
<td><strong>Variables</strong></td>
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<tr>
<td><strong>Dependent Variables</strong></td>
</tr>
<tr>
<td>Poverty Rate (POV)</td>
</tr>
<tr>
<td>Inequality (INEQ)</td>
</tr>
<tr>
<td><strong>Independent Variables</strong></td>
</tr>
<tr>
<td>Growth of GRDP per capita (G)</td>
</tr>
<tr>
<td>Internet Penetration (INT)</td>
</tr>
<tr>
<td><strong>Control Variables</strong></td>
</tr>
<tr>
<td>Covid-19 Shock (COV)</td>
</tr>
<tr>
<td>Mean Year Schooling (EDU)</td>
</tr>
<tr>
<td>Safe Sanitation (SANITATION)</td>
</tr>
<tr>
<td>Trade Openness (OPENNESS)</td>
</tr>
<tr>
<td>Government Expenditure (GOV)</td>
</tr>
</tbody>
</table>

The model in this study uses a two-way fixed effects (TWFE). The choice of this estimation method is intended to accommodate the impact of different provinces simultaneously (\(\lambda_{p}\)) and the systemic trend of outcome variables (poverty and inequality) over time (\(\nu_{t}\)). The assumption used in this method is that the characteristics between provinces are not correlated from time to time (see Miranti et al., 2014). With this assumption, the error component in this study is clustered at the provincial level.
To describe the TWFE estimator, define a row vector of province dummy variables for each \( p \) as \( \lambda_p = \lambda_1, \lambda_2, ..., \lambda_{33} \), where \( \lambda_h = 1 \) if \( h = p \), \( \lambda_h = 0 \) if \( h \neq p \). Therefore, for each row denoted by \( (p, t) \) pairs, precisely one element of \( \lambda_p \) is equal to unity. Also, the time dummies for year \( t \) are \{\( v_s t \): \( t = 2009, 2010, \ldots, 2020 \)\} with \( v_s t = 1 \) if \( s = t \), \( v_s t = 0 \) if \( s \neq t \) (see Arkhangelsky & Imbens, 2022; Sun & Abraham, 2021; Imai & Kim, 2021; de Chaisemartin & D’Haultfœuille, 2020). We excluded the first-year period dummy from this study because it is redundant.

This study looks at four coefficients to assess the inclusiveness of Indonesia’s economic growth. First, consider the \( \alpha_{11} \) coefficient, which depicts the magnitude of the effect of real per capita GRDP growth on poverty levels. Second, \( \alpha_{12} \) depicts the magnitude of the interaction effect on poverty of internet penetration and real GDP growth per capita. The third coefficient is \( \alpha_{21} \), which shows the magnitude of the impact of real GRDP growth per capita on income inequality. Fourth, \( \alpha_{22} \) depicts the magnitude of the interaction impact on income inequality between internet penetration and real GDP growth per capita. \( \alpha_{11} \) and \( \alpha_{21} \) values greater than zero indicate inclusive growth without the effect of internet penetration. \( \alpha_{21} \) and \( \alpha_{22} \) values that are greater than zero, in the meantime, indicate inclusive growth as a result of internet penetration.

### 4. RESULTS AND DISCUSSIONS

In line with the research objectives, this study examines inclusive growth by estimating the impact of economic growth on poverty and inequality levels, either without or with internet penetration scenarios. Table 2 shows two analytical models: i) Model 1, which shows the determinants of changes in poverty levels; and ii) Model 2, which shows the determinants of change in inequality. Both models were built without or by adding control variables to ensure robust estimation results. The determinants of changes in the level of poverty and inequality without control variables can be seen in Models 1(a) and 2(a), while the determinants of changes in the level of poverty and inequality without control variables can be seen in Model 1(b) and 2(b), respectively.

<table>
<thead>
<tr>
<th>Variables</th>
<th>( \Delta \ln (POV) )</th>
<th>( \Delta \ln (INEQ) )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1(a)</td>
<td>Model 1(b)</td>
</tr>
<tr>
<td>( \ln (G) )</td>
<td>-0.56354 ***</td>
<td>-0.48676 ***</td>
</tr>
<tr>
<td></td>
<td>(0.17308)</td>
<td>(0.12418)</td>
</tr>
<tr>
<td>( \ln (G * INT) )</td>
<td>-0.02650 ***</td>
<td>-0.02042 ***</td>
</tr>
<tr>
<td></td>
<td>(0.00618)</td>
<td>(0.00493)</td>
</tr>
<tr>
<td>Additional Controls</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Province Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.3571</td>
<td>0.3810</td>
</tr>
<tr>
<td>Number of Provinces</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>429</td>
<td>429</td>
</tr>
</tbody>
</table>

Notes: i) The level of significance in this study are: * \( p < 0.01 \); ** \( p < 0.05 \); *** \( p < 0.10 \); ii) The figure in parentheses is the robust standard error clustered at the provincial level; iii) Control variables consist of the Covid-19 shock, average length of schooling, safe sanitation, economic openness, and government expenditure.
For ease of interpretation, we look at the coefficients of $\alpha_{11}$ and $\alpha_{21}$ to see if inclusive growth is achieved without the effect of internet penetration. The estimation results show that per capita GRDP growth negatively correlates with changes in poverty levels in Model 1(a) and 1(b), with a consistent significance level of 1%. Meanwhile, the growth of GRDP per capita with changes in inequality has a positive relationship in both Model 2(a) and 2(b), with a significance level of 5%. Coefficient values that can be interpreted further are found in Models 1(b) and 2(b) because both have included control variables to avoid upward bias. The coefficient values of $\alpha_{11} = -0.48676$ in Model 1(b) and $\alpha_{21} = 0.30701$ in Model 2(b) can be interpreted that every 1% increase in real GDP growth per capita tends to be followed by a decrease in poverty of 0.49%, at the same time the same, accompanied by an increase in inequality of 0.31%, with other variables in the model held constant. Based on these results, economic growth in Indonesia with the assumption that without internet penetration can be said to be still less inclusive.

Indonesia's economic growth, which is still less inclusive, can be explained. Although the lowest income group can grow past the poverty line, the increase in income is not as fast as the top income group. In line with this argument, Miranti et al. (2014) add that the massive inequality trend has occurred since the era of decentralization. It provides limited opportunities for the lowest income groups to catch up. Dartanto (2013) and Jamil (2017) state that Indonesia's economic activity leads to capital-intensive sectors, such as services and trade. The growth of this sector makes it difficult for the lowest income group with limited skills to participate in economic activities. At the same time, the income of the lowest income group grows not as fast as expected.

The results of this study tend to contradict those of Deininger & Squire (1998), Pinkovskiy & Sala-i-Martin (2014), and Dollar et al. (2016). The income of the poor cannot grow faster than the rich in the case of Indonesia due to a sectoral shift from agriculture directly to the service and trade sectors without going through the manufacturing sector. Thus, low-income groups with low skills move to the service and trade sectors without experiencing an increase in productivity (Yusuf, Anglingkusumo & Sumner, 2021; Baymul & Sen, 2020).

Furthermore, the interaction effect of per capita GRDP growth and internet penetration can be seen from the magnitude $\alpha_{12}$ and $\alpha_{22}$. The estimation results show that GRDP per capita growth with internet penetration negatively correlates with the poverty level with a significance level of 1% in both Model 1(a) and 1(b). Meanwhile, the interaction of GRDP per capita growth with internet penetration has a positive relationship to inequality with a significance level that has decreased from 5% in Model 2(a) to 1% in Model 2(b). This significant decrease is presumably because the interaction of GRDP per capita growth with internet penetration has a reasonably strong correlation with the control variable. The interpreted coefficient values are in Model 1(b) and 2(b). The coefficient value of $\alpha_{12} = -0.02042$ in Model 1(b) and $\alpha_{22} = 0.09534$ in Model 2(b) means that a 1% increase in real GDP growth per capita with internet penetration will be accompanied by a decrease in poverty of 0.02%, but at the same time followed by an increase in inequality of 0.10%. In other words, internet penetration exacerbates inequality so inclusive growth is increasingly challenging to achieve.

We use Acemoglu's (1999) argument to back up this finding. The development of ICT, including the expansion of the internet, tends to be enjoyed by highly skilled workers, so wage increases occur disproportionately. Even though the internet disrupted old business models and included low-income groups in economic activity, equity holders enjoyed faster income growth.
For example, the LD FEB UI (2019) study confirmed that Gojek partners (drivers, talents, and merchants) enjoy higher incomes than the minimum wage, 25.64% in Greater Jakarta and 35.71% outside Greater Jakarta. A driver’s average income and expenses increased by 42% and 32% after joining Gojek. Unfortunately, the income received has indeed been able to lift them out of the poverty line, but the increase is not as fast as the owners of capital.

Internet expansion coupled with increasing inequality can be seen from the distribution of internet users by business field. Income inequality is worsening because the lowest income group with low wages working in the primary and secondary sectors has relatively lower internet access than the top income group with high wages working in the tertiary sector (see Lee & Wie, 2015; Autor & Dorn, 2013; Grossmann, 2001; Acemoglu, 1999). This fact can be seen in Figure 2, which depicts that the dominant share of internet users works in the tertiary sector, with a significant increasing trend over the last three years. The World Bank (2021) study also supported this fact, demonstrating that internet penetration disproportionately impacted low-skilled workers earning 80% less than high-skilled workers.

Notes: i) Primary Sector consists of Agriculture and Mining Sector; ii) Secondary Sector consists of Manufacturing, Utilities, and Construction Sector; iii) Trade and Services Sector.
Source: Processed from BPS, various series

Figure 2. The Distribution of Internet Users by Sector

The type of task is the source of inequality in internet penetration. In Indonesia, the Wicaksono & Mangunsong (2020) study categorizes tasks into four types: routine manual tasks, technological tasks, routine cognitive tasks, and non-routine interpersonal tasks. Routine manual tasks experience wage decreases ranging from 1.15 to 3.75%. Meanwhile, non-routine interpersonal, technological, and routine cognitive tasks all saw average wage increases of around 4.11%, 3.44%, and 2.50%, respectively. In line with their study, we hold that wage disparities between workers exposed to the internet (such as technological tasks, routine cognitive tasks, and non-routine interpersonal tasks) and types of workers not exposed to the internet (such as routine manual tasks) make Indonesia’s growth less inclusive.

The internet’s limited use also causes income inequality for productive purposes. According to a World Bank (2021) study, only 3% of people use the internet for buying and selling.
According to the same survey, poor households have lower internet adoption for business operations than wealthy households. In Indonesia, only 1% of households in the first quintile use the internet for productive purposes, while 24% of households in the fifth quintile do. This, of course, makes inclusive growth difficult to achieve once more.

In the Indonesian context, the viewpoint expressed by Antonelli & Gehringer (2017) regarding creative destruction cannot be entirely accepted. On a broader scale, creative destruction does replace the old business model. Still, only a tiny part can move into a high-income group; at the same time, most people enjoy a better income but not enough to make it move, at least be a middle-income group. In other words, income distribution is likely to deteriorate due to internet expansion.

We also suspect that the findings of this study do not provide empirical support for Yusuf's (2021) findings. Based on the simulation of Computable General Equilibrium (CGE), Yusuf (2021) claims that there is no need to be concerned about the impact of Industry 4.0 (including digitalization) on inequality. His study's findings are based on the assumption that increases in capital owners' income from land rent do not outpace increases in workers' wages. This study, on the other hand, does not fully accept this argument because capital in Industry 4.0 is not only related to land. Additionally, capital is complex and intangible, inherent in capital owners (see Bertani, Ponta, Raberto, Teglio & Cincotti, 2021; Birch, Cochrane & Ward, 2021; Barker, Lennard, Penman & Teixeira, 2021), and frequently not owned by the lowest income class. This attribute is constantly overlooked in analyses, although it has the potential to increase inequality.

5. CONCLUSION

The purpose of this paper is to investigate whether the interaction term of internet penetration and economic growth can reduce poverty and inequality in Indonesia during the period of massive internet expansion from 2008 to 2020. This study documents less inclusive economic growth using data at the provincial level. As a result of internet penetration and economic growth, Indonesia's economic growth is becoming less inclusive, as evidenced by a reduction in poverty but an increase in inequality. The TWFE estimation results confirm that these findings are robust whether additional control variables are included or not.

This paper concludes that growth in existing conditions is less inclusive, implying that Indonesia's economic growth is leading to more capital-intensive sectors or strengthening labor-saving capital. Meanwhile, internet penetration reduces the quality of inclusive growth because of unintended consequences of the creative destruction process, which do not always position low-income groups to grow faster than high-income groups. This circumstance arises as a result of income disparities between capital owners and workers, wage disparities between sectors that rely on the internet and those that do not, and low-income households' limited use of the internet for sophisticated purposes.

Comprehensive policy recommendations are required to address the unintended consequences of internet penetration. In the future, internet penetration in Indonesia must expand the newly established middle class rather than simply transforming the poor into the non-poor or aspiring middle class. Therefore, the government must improve advanced ICT skills and lower barriers to internet adoption, particularly for the less fortunate, to narrow the income gap (World Bank, 2021; World Bank, 2016). Simultaneously, to maintain the effect of reducing poverty during
the period of internet penetration, this policy must be supplemented by a social protection system that covers vulnerable and left behind groups as the digital economy develops (Jamil, 2021; Palier, 2019; Behrendt, Nguyen & Rani, 2019; Suryahadi & Izzati, 2018).

Besides, there remains room for researchers to address the limitations of this study in three ways. First, researchers should include more comprehensive measures such as digital literacy and internet adoption readiness rate instead of focusing on internet penetration. Second, research on the impact of internet penetration on inclusive growth must address the issue of endogeneity bias because internet penetration rates are not genuinely exogenous or influenced by a set of relevant ICT policies. Last but not least, researchers must ascertain whether the estimated impact of internet penetration is robust concerning various spatial characteristics in Indonesia, such as urban-rural areas, Java-Outside Java, and so on.

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