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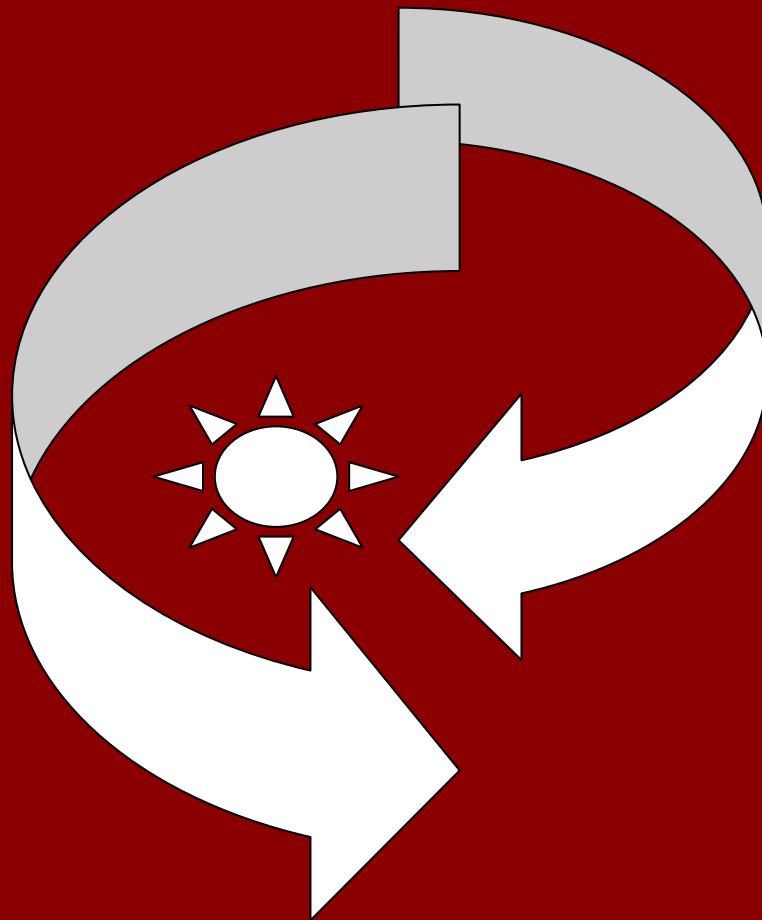
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# Jurnal Perspektif Pembiayaan dan Pembangunan Daerah

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Master Program in Economics  
Universitas Jambi



## Jurnal

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# Jurnal Perspektif Pembiayaan dan Pembangunan Daerah (Journal of Perspectives of Financing and Regional Development)

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## Editor's Note

Dear readers,

Welcome to Volume 10, Issue 6 of the Jurnal Perspektif Pembiayaan dan Pembangunan Daerah (JPPD). This edition brings you a rich and diverse range of papers examining various facets of socioeconomic growth and development from various perspectives.

The issue begins with Rasanjani et al. exploring the escalating threat of poverty and social welfare amid the COVID-19 pandemic, presenting a study on sustainable funding sources. This is followed by Gunanto et al.'s paper that applies a spatial econometric approach to analyze income convergence across regencies in Central Java, an important piece on regional economics.

Tijani et al. brings forward an interesting nexus between energy efficiency, carbon emissions, and economic growth, specifically in the context of Nigeria, offering valuable insights for policy planning and sustainable development. Octrina and Priatmojo examine Islamic bank efficiency by applying Stochastic Frontier Analysis (SFA), contributing to the discourse on financial efficiency.

Rahayu et al. tackle the concept of local government performance from a financial condition perspective, while Herawaty et al. focuses on factors affecting student entrepreneurial interests during the COVID-19 pandemic, such as income prospects, social media, and the environment. This paper provides invaluable insights for educators, policymakers, and students.

Closing this issue, Ibrahim et al. present a study on wage decomposition between manufacturing and non-manufacturing workers in Indonesia, contributing to our understanding of labor market dynamics in developing economies.

We trust that the analyses and findings presented in these articles will provide fresh perspectives, stimulate thoughtful discussions, and serve as a valuable resource for researchers, policymakers, and practitioners. We appreciate the significant contributions made by our authors, reviewers, and readers in advancing knowledge in public policy and development..

Sincerely,

Prof. Dr. Junaidi, S.E., M.Si  
Editor-in-Chief.

# Overcoming the threat of poverty and social welfare amid the COVID-19 pandemic through sustainable funding sources

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## Abstract

The COVID-19 outbreak is believed to have slowed economic acceleration in several countries, including Indonesia. Dramatic economic changes affect the country's performance in overcoming poverty and unemployment. This article aims to analyze the social and economic impact of the pandemic. It can be seen that the government, as the holder of the mandate of power, still and will continue to rely on social protection programs in dealing with the social and economic impacts that are currently being faced. The government can expand social security and assistance programs by strengthening collaboration between local authorities and non-state institutions. In addition to social protection, Indonesia, known as a country with a Muslim majority, has a religious instrument called zakat, which is believed to overcome the spike in poverty. Moreover, zakat is also considered a potential instrument to support some countries in achieving SDG goals as long as they are appropriately managed.

**Keywords:** COVID-19, Poverty, SDGs, Zakat

**JEL Classification:** F62, H12, I32, I38, Q01

## INTRODUCTION

COVID-19 disrupted the world economy's development; the intense turmoil caused by this pandemic forced many developing countries to postpone some of their economic acceleration programs in Indonesia. The World Bank (2019) stated that economic growth in developing countries is projected to slow from 6.3% in 2018 to 5.8% in 2019, followed by a slight decline of 5.7% and 5.6% in 2020 and 2021, respectively. With normal conditions, economic projections in developing countries continue to decline yearly, and now with the deadly virus threat, Indonesia inevitably has to prepare for this financial disaster.

The severity of the coronavirus has been able to paralyze various state activities. The crisis has caused various social and economic upheavals (Lawton et al., 2020; Nicola et al., 2020), from regional to global. Furthermore, the pandemic ultimately killed the economic cycle, resulting in temporary and even permanent layoffs as the worst conditions (Carlsson-Szlezak et al., 2020). As a result, those who lose their income source fall into a cycle of poverty (Whitehead et al., 2021). Amid this global

anxiety, a unique view is expressed by McGowan (2020), who views the corona pandemic as a form of examination to test a country's economic resilience and social structure. Therefore, handling a pandemic will depend on the government's social policies through comprehensive and in-depth studies involving various disciplines to produce sharper perspectives and more diverse solutions.

Providing protection and welfare to citizens is an obligation for the government of a country. Žofčínová (2017) argued that social welfare services provide a standard of living for individuals in stressful social situations who cannot handle them independently. Meanwhile, Sinayi and Rasti-Barzoki (2018) explained that every government must eventually move towards the sustainability phase if it wants to survive amid disruption. Joint global programs have been designed to realize prosperity together in the future; the program is the Sustainable Development Goals (SDGs), a continuation of the Millennium Development Goals (MDGs) program. Amid the program's progress, which is quite good, the world is currently hit by the COVID-19 virus, which has paralyzed all socio-economic aspects. The world still has to strive to realize the SDGs Program, which is targeted to be achieved by 2030, but on the other hand, the world is also expected to recover soon from the COVID-19 pandemic.

The economic downturn due to COVID-19 cannot be avoided by Indonesia; this emergency then affects the country's structure. Therefore, the authors are interested in discussing Indonesia's socio-economic capacity in dealing with this deadly virus and whether this pandemic threatens the development agenda and creates new poverty. This condition is undoubtedly a big challenge for a country as big as Indonesia. It wants to raise its dignity in the world's eyes by realizing the Sustainable Development Goals (SDGs), especially poverty alleviation, by 2030. The subject of the discussion will be divided into two parts to answer this big question. First, the Corona pandemic's impact spread on economic activities and employment, thus creating new poverty threats. Furthermore, the Second is the Solutions for Social Welfare in dealing with the COVID-19 epidemic in Indonesia to realize the SDGs program.

## METHODS

This study uses a qualitative approach emphasizing the study of literature (Creswell & Creswell, 2017). Many secondary data were collected from various sources from the internet in the form of books, journals, reports, news, and so on. Scientific journals published in the three years are the primary reference. The primary documents analyzed are related to COVID-19 and its development in the world and Indonesia. The references used in this study are up-to-date, most of which were published from 2020 to 2022. Most of the data were taken from Google Scholar, emphasizing some keywords: COVID-19; Poverty; SDGs; Zakat, and the selected data must be in English. More details can be seen in Figure 1.

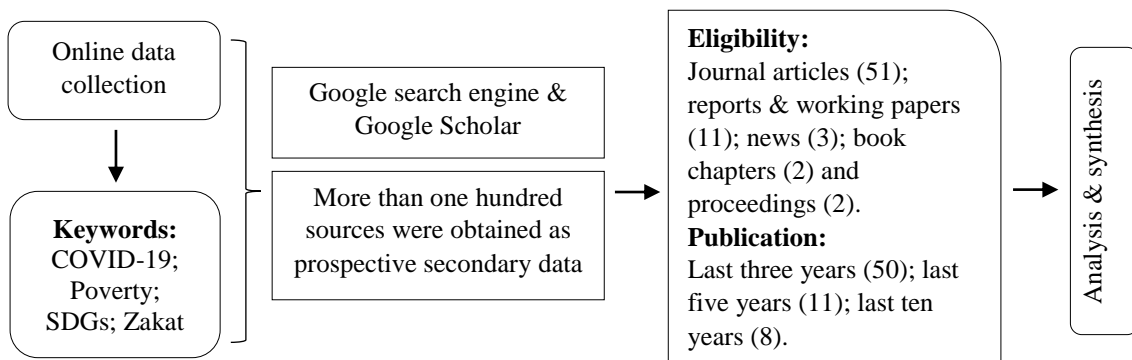


Figure 1. The flow of data collection and analysis

## RESULTS AND DISCUSSION

### Zero poverty x new poverty

The Sustainable Development Goals (SDGs) were born at the United Nations Conference on Sustainable Development in Rio de Janeiro in 2012. The objective was to produce a set of universal goals that meet our world's urgent environmental, social, and economic challenges. The SDGs replace the Millennium Development Goals (MDGs), which started a global effort in 2000 to tackle poverty's indignity. All United Nations Member States adopted these global goals in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity in 2030. Thus, at this point, we know that SDGs represent a significant advance over the MDGs (Stewart, 2015) and are more ambitious (Jacob, 2017).

Amid many countries' enthusiasm to achieve the SDGs, a stumbling block lies before the gate. The COVID-19 pandemic has devastated and paralyzed the economic sector and created a new threat of poverty, especially in developing countries (Buheji et al., 2020), including Indonesia, with a substantial human population and a reasonably complex poverty problem. Indonesia has experienced positive progress in achieving several indicators contained in the SDGs (Hudaeft et al., 2020; Rassanjani et al., 2019). However, after the COVID-19 pandemic hit that archipelago country, many problems emerged, especially in the socio-economic sector (Olivia et al., 2020). The number of poor people has increased during the pandemic, from the percentage of poverty 9,22 percent in September 2019 to 9,78 percent in March 2020, and will remain till the end of 2020 (Badan Pusat Statistik, 2020b; Suryahadi et al., 2020). The pandemic then impacted the progress of achieving the SDGs, and the previously well-designed programs targeted to be realized in 2030 will experience enormous obstacles.

The SDGs program will be increasingly difficult to achieve, especially in 2030, due to the conditions of the COVID-19 pandemic that plague the world, especially in placing the first goal in the SDGs, namely "end poverty in all its forms everywhere". Before the world met COVID-19, several countries were off track from their hopes of ending poverty in the next decade, and this is due to projections showing that 6% of the global population will still live in extreme poverty by 2030 (Editorial, 2020). Meanwhile, the threat of global economic recession after the pandemic is suspected to be the primary motivation for why millions of people will return to poverty (Valensisi, 2020).

Indonesia is one of the highest countries with confirmed COVID-19 cases in the ASEAN (Abdullah et al., 2021); this will undoubtedly be a projection of the failure to achieve the SDGs target in 2030. The increase in COVID-19 is undoubtedly affected by the rise in poor and vulnerable groups. The cases expected will be more severe than that in the global financial crisis in 2008. International commodity prices fell, and all income groups experienced a decline in welfare. Ministry of National Development Planning projected that without social protection, the decline in welfare would be varied from 8,6 % to 8,1 % from poor to the richest, respectively, creating poverty (Rudiyanto, 2020). By looking into the effect of COVID-19, it can be said that without the threat of a pandemic, creating a world without poverty would be extraordinary because of the complexity of the problems that continue to develop from time to time. Moreover, disruption due to COVID-19 is undoubtedly much more complicated to handle with an ordinary strategy. However, realizing zero poverty is still possible but quite challenging.

### **Unemployment and informal sector**

The widespread and rapid spread of the coronavirus caused the government to react by limiting people's mobility and interaction. All activities that made people gather were taboo, so factories and offices were closed, schools were closed, many businesses did not open, and other outdoor activities were abandoned. On the one hand, maintaining this distance has saved lives (Newbold et al., 2020), as seen in the decreasing trend of new cases of infected communities (Wong et al., 2020). Nevertheless, on the other hand, these preventive regulations have suspended the economy (Al-Mansour & Al-Ajmi, 2020); thus, millions lost their jobs and became victims of layoffs (von Wachter, 2020). Finally, the wave of layoffs has become a worrying specter apart from COVID-19.

The problem of unemployment is acute in developing countries (Alper, 2018; Sithole & Buchana, 2021; Suci & Ramdanyah, 2019), especially in Indonesia, which has long considered this as one of the main concerns, and now it is added to the pandemic conditions that follow to add the problems to the labor economy system in this country. The government's anticipatory measures to combat the COVID-19 outbreak by limiting activities outside the home have caused many breadwinners to lose their jobs. Just as many capital owners are forced to activate the layoff option due to stagnant economic activity, reduced profits, and income have resulted in their inability to provide salaries to employees. According to Goshu et al. (2020), contraction in sales and income from the business sector and negative growth in household income and expenditure has resulted in various economic consequences, including massive job losses that impact the population's welfare.

Chodorow-Reich & Coglianesi (2021) project that about 1.6 million workers laid off due to COVID-19 by April 2020 will remain unemployed for at least six months. The length of time someone is laid off from work also depends on the pandemic's length (Goshu et al., 2020). However, it does not rule out some workers experiencing permanent layoffs due to companies failing to anticipate the significant impact caused by the pandemic. Here we can assess that in addition to the company's ability to manage exit strategies against the pandemic's impact, the community, including workers, plays a role in the conditions they feel. Heeding government calls to stay home could reduce the virus's spread, although no one can guarantee how long the pandemic will last.

During 2015-2019, Indonesia's open unemployment rate fell from 6.18% to 5.28% (Badan Pusat Statistik, 2019); unfortunately, this percentage increased to 7.07% in 2020 (Badan Pusat Statistik, 2020a). The increasing number of unemployed is indicated by the pressure experienced by various business sectors. The COVID-19 pandemic has interrupted operational schedules, so workers have to be laid off. Apart from layoffs, the increasing number of unemployed was also contributed by several informal sector workers who also lost their income. The number of informal workers is large, reaching 80% of the total population, especially in developing countries (Narula, 2020).

Moreover, these informal sector workers are a group that is very vulnerable to the negative economic consequences of the pandemic caused by the related lockdown policy (Bassier et al., 2021; Rassanjani et al., 2022); unfortunately, this group often receives less government support than those working in the formal sector (Webb et al., 2020). Indonesia is a country that has a proportion of people whose jobs are mainly in the informal sector compared to formal jobs; Badan Pusat Statistik (2020a) noted that the number of informal workers reached 60.47% in August 2020. Pitoyo et al. (2020)



stated that COVID-19 could shock informal workers in Indonesia because the pandemic can affect their work mobility, ultimately affecting their income. The increase in Indonesia's unemployment rate could have a tremendous impact on economic development in the future. It is not easy for a country to quickly recover its economic condition coupled with a high unemployment rate.

If not handled properly, increased unemployment will create many bad possibilities for the victims. Hiswåls et al. (2017) revealed that job loss affects victims' social life and consumption patterns due to changes in financial situations; they even feel isolated, lose self-esteem, and feel hopeless, ultimately affecting their physical health. Furthermore, Blustein et al. (2020) saw the increase in global unemployment due to COVID-19 creating deep sadness and trauma for those laid off. Hence, the layoffs resulting from this pandemic present grim existential challenges for the country and its residents (Goshu et al., 2020). Meanwhile, the worst result of the inappropriate handling of this social problem is that it has resulted in a spike in poverty that is difficult to control. The bad news is that COVID-19 may be the first cause of increasing global poverty since 1998. Using thousands of scenarios, Jafino et al. (2020) estimate that 32 million to 132 million people will fall into extreme poverty by 2030 due to climate change; the results of this forecast also match available estimates for an increase in global poverty due to COVID-19.

With the absence of employment and increasing poverty, hunger becomes a more significant multidimensional problem. Poverty and hunger are closely related because hunger arises from poverty (Otekurin et al., 2019). One of the poverty alleviation programs is designed to provide food to eliminate hunger (Sakanko & David, 2018). Then, the aftermath of prolonged hunger, if not handled properly, can lead to a more serious problem, namely anarchism or crime. Previous research has observed that poverty and crime are interrelated. Papaioannou (2017) considers that income shocks lead to widespread poverty, becoming the main cause of crime. However, Iyer and Topalova (2014) state that absolute poverty is associated with a higher crime rate than relative poverty, which is also confirmed by Marxists, who see absolute deprivation as the root of crime (Kim et al., 2020). Thus, the duration of a pandemic will affect the potential for crimes that arise, but it must be remembered that crime will be the last resort if there is no other way to make ends meet. Therefore, for this lousy intention to be easily stopped, government roles, efforts, and policies are needed, which are expected to create a climate conducive to life amid this prolonged pandemic.

### **The threat of poverty and social welfare**

Indonesia has long struggled with welfare issues. Sure enough, the long efforts taken to reduce poverty have been tested, as the COVID-19 pandemic has the potential to give birth to a new number of poor people. It was indicated that 26.2 million people lived below the poverty before COVID-19 (Gibson & Olivia, 2020). A pandemic is predicted to put 5.5 and 8 million Indonesians into poverty (R. Ali & Tiwari, 2020). Without COVID-19, the shadow of poverty is relatively high. Given the economic recession that is certain to occur, it cannot be imagined how steep the long road is to bring down that astonishing number.

Power et al. (2020) state that millions of households were already impoverished before the pandemic. Millions more could follow unless the government protects household income by making policy adjustments. That way, the government will be

visible to the public, despite delays in determining policy direction. Long before COVID-19 hit and destroyed social resilience, the government had directed social protection policies as an instrument of poverty alleviation. Social protection systems have emerged as an additional policy tool to address poverty and hunger in developing countries in the last 20 years (Hidrobo et al., 2018). Social protection has become one of the most popular government policies for overcoming poverty (Rassanjani et al., 2019). Thus, social protection policies have a significant role in realizing equal distribution of social security for all parties, namely by reducing poverty and inequality and promoting inclusive growth by increasing human resources productivity and the structural transformation of the national economy.

In its report, the World Bank (2020) stated that around 106 countries had introduced social protection programs in response to the COVID-19 outbreak; this number increased by 26% (previously only 84 countries). From that figure, most governments still rely on social protection as a solution policy in addressing the vast impact caused by COVID-19. The Indonesian government has responded to the pandemic by allocating budgets through National Economic Recovery Program (PEN). Regarding social and economic responses, this program mainly focuses on social protection, followed by business incentives, corporate financing, and sectoral and regional government finance allocation (Sparrow et al., 2020). Therefore, focusing on a national economic recovery policy would minimize the number of vulnerable groups.

As the largest share of recovery packages, social protection is expected to assist the current poor people groups and prevent vulnerable individuals from falling into poverty due to covid attacks. However, even though the proportion of social protection is the largest, it should be underlined that the amount of budget allocation is still far from ideal (Sparrow et al., 2020). Sieber et al. (2022) argued that realizing social protection is a relatively easy problem for countries with large GDP per capita. However, on the other hand, social protection schemes are burdensome for countries with low GDP. Their GDP has decreased due to slowing economic activity during the pandemic. The same thing has also been explained earlier by Harris (2013) that an effective social protection system has long been seen as a problematic luxury to reach by many developing and low-income countries.

Another challenge of social protection distribution is the need for targeted and designed databases. The research showed that Indonesian social protection is designed for pre-COVID-19 cases only. The study has shown that the social protection program needs a targeted design because it was only designed against poverty before the pandemic. It focuses on poor people in the countryside and does not manage urban households, as the majority are impacted by the pandemic (Sparrow et al., 2020). Within the complexity of social protection allocation, it is understandable. The government has too many things to consider in budgeting its revenue for handling COVID-19, such as providing better health facilities, social protection for affected communities, etc. Given the many needs that must be resolved and the high budget required, a sustainable funding source outside of state revenue is needed, even outside loans or foreign debt.

As a country with one of the world's largest populations, and a majority Muslim population, Indonesia is quite fortunate. A rule has become a long tradition in efforts to improve social welfare for underprivileged people through zakat collection. This instrument is a religious obligation for all Muslims with minimum wealth to help those

in need. Zakat has a social protection function by targeting people vulnerable to the risk of poverty (Razak, 2020; Tajmazinani & Mahdavi Mazinani, 2021). The advantage of zakat is that it has a solid foundation of funding sources (Shaikh, 2016). Therefore, based on its goals and benefits, zakat is believed to have a sustainable source of funds to be an alternative source of funding for poverty alleviation and development programs (Miah, 2019). Even if it can be managed optimally, zakat will be able to have an impact on poverty alleviation so that it supports the achievement of the SDGs (Riyaldi et al., 2020). Thus, zakat seems to have the same vision as the SDGs, especially Goal 1, which is related to poverty alleviation.

As a country with the largest Muslim population, Indonesia has enormous potential in zakat. Several studies on the potential of zakat have been carried out, one of which is by Asfarina et al. (2019), which stated that Indonesia's Zakat potential is worth more than IDR 200 trillion. Furthermore, the results of a study from a non-structural government institution that manages zakat nationally called BAZNAS also received a similar value, namely above IDR 200 trillion or around USD 17 billion (Pusat Kajian Strategis BAZNAS, 2020). By that potential, the mission of poverty alleviation and economic equity will be more easily realized by remembering all the dynamics and obstacles blocking the road. Thus, it depends on the government to build a strong collaboration with outsiders such as religious organizations, as required in the SDGs 'Goal 17 Partnerships for the Goal' that building partnership is pivotal in promoting sustainable development.

The complexity of COVID-19 as a new threat in this fast-paced era requires more attention in public administration studies, particularly public policy, and collaborative governance needs to be done to create a fast and appropriate policy (Huang, 2020). Several government policy packages to restore uncertain economic conditions to prevent the emergence of new poor groups must be pursued even in emergencies. Gerard et al. (2020) argued that developing countries could provide a broad range of social protection if they use a more comprehensive range of patchwork solutions than high-income countries. This strategy could include expanding the social security system, expanding existing social assistance programs, and engaging local governments and non-state agencies. Optimizing zakat as a sustainable source of funds is one of the patchwork strategies in question, and several countries have practiced this initiation during COVID-19. In Morocco, for example, the acceleration of Zakat payments is carried out to help those affected by the pandemic (Ezziti, 2020).

Meanwhile, zakat is an effective short-term emergency system in Bangladesh that has succeeded in reducing the impact of COVID-19 on vulnerable communities (Alam, 2020). Hudaefi & Beik (2021) found that the Zakat collection during the pandemic in Indonesia has shown an increase. It is extraordinary, considering that the desire to do good and help others remains the main thing amid high anxiety. Amid the country's inability to recover from disasters, the vulnerability of the pandemic, closely related to poverty, can be overcome with zakat. Therefore, improving the distribution of wealth and providing insurance by optimizing Zakat funds needs to be the government's attention to minimize losses and increase resilience due to COVID-19, which is difficult to understand when it will end.

Without COVID-19, some governments have experienced obstacles in realizing the SDGs, especially in alleviating poverty, so it cannot be imagined how steep the long road to making it happen is, given the economic recession that is certain to occur. Apart

from the negative impact of COVID-19, which is considered by most people to have disrupted development, it turns out that, on the other hand, there are still groups who see the current situation as a transformative moment or opportunity that can change the world (Davies, 2020; Higgins-Desbiolles, 2020; Mair, 2020). Furthermore, many things will improve, such as economic development that will become more sustainable (Gössling et al., 2021; Kozul-Wright & Barbosa, 2020). Hopefully, COVID-19 will pass soon, and what humans aspire to live sustainably can be realized.

## CONCLUSION AND RECOMMENDATION

### Conclusion

The COVID-19 outbreak brings a new challenge for all countries worldwide, particularly for less developed countries. With the scenario preventing the spread, the Indonesian government faces disputes in performing economic activities and dealing with employment issues. Mobility restrictions during the pandemic had impacted an economic slowdown and increased layoffs; thus, poverty cannot be prevented. The increasing number of poor and vulnerable groups due to COVID-19 is more complicated within the complexity of the poverty problem beforehand. Moreover, the condition worsens because most Indonesian citizens are informal workers. Undeniably, the Sustainable Development Goals (SDGs) development agenda by 2030 is challenging.

### Recommendation

Social protection is one of the tools that could help address social issues; however, it should be underlined that a nation with low-level income per capita should consider the level of money that can cover all the costs of protection. Unlikely countries with advanced economies, third-world countries should carry out social protection cautiously. The nation could be enlarging social security and social assistance programs and strengthening collaboration between local authorities and non-state agencies. Apart from social protection, Indonesia also has to optimize zakat. As a majority of the Muslim population, zakat as a religious instrument is incredibly funded to support the government in assisting those who needed. Managing zakat properly will be an excellent tool for complementary social needs for poor and vulnerable groups.

This study only uses secondary data as an object of analysis. Hopefully, there will be further research with more robust methods through collecting empirical data from the field to cover the deficiencies in this paper.

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## Convergence of income across regencies in Central Java: spatial econometric approach

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### Abstract

The development of an economy is oriented towards not only growth but also equality. Furthermore, economic interaction across regions has to be captured in a development analysis to avoid the possibility of biased results. This study analyzes Central Java, Indonesia's economic development, by considering spatial interactions across regencies. The Spatial Durbin Model (SDM) is used for the analysis. The results show significant spatial interaction across regencies/cities in Central Java in the spatial model and economic convergence that occurs faster than in the non-spatial model. Then, the mismatch between the curriculum of education and industry needs is a presumption illustrated in the insignificant relationship of human capital to income. And an anomaly occurs where physical capital has a negative impact on income.

**Keywords:** *Economic convergence, Human capital, Per capita income, Physical capital, Spatial econometric, Spillover*

**JEL Classification:** D23, L83, M12

### INTRODUCTION

In essence, the concept of regional development cannot stand alone; there is a relationship with other regions and spatial dependence. This is due to the socioeconomic interaction across regions through trade, capital flows, migration, technological diffusion, and information exchange (Nijkamp & Poot, 1998). Neglecting the role of spatial dependence in the economic growth model will result in inefficient and even biased estimation of the parameters, which can be misleading in analyzing the economic growth of a region (Anselin, 2001). Socioeconomic interaction across regions resulting in spatial dependence must be considered in the economic growth model to avoid the possibility of variable omitted bias (Goetzke & Andrade, 2010).

The concept of development is not limited to economic growth but is also an effort to reduce inequality (Todaro & Smith, 2012), identical with the term convergence. Convergence is an economic inequality across regions that tends to shrink. Barro & Sala-I-Martin (1992) reveal economic convergence is how lower per capita income levels experience faster growth than higher levels of per capita income.

One of the neoclassical growth models is the Mankiw Romer Weil (MRW) model which has developed by Mankiw et al. (1992). The MRW model examines the augmented Solow growth model, which also analyzes convergence across countries. In

the model, the output is generated from physical capital and human capital accumulation. The MRW model provides an excellent description of cross-country data.

Ertur & Koch (2007) used the MRW model by including a variable of technological dependence, using data of 91 countries from 1960 to 1995. The results have several implications: first, the state cannot simply observe freely spatially but must explicitly consider spatial interactions due to technological interdependence. Second, the theoretical results show that the Solow model is less precise because the spillover effect variables are omitted. Then Fischer (2011) developed a spatial augmented MRW model by considering spatial dependence, using the Spatial Durbin Model, which considers technological dependence across regions in 198 regions in 22 European countries during the 1995-2004 period.

Several studies have considered spatial dependence in analyzing the determinants and convergence of economic growth across regions. At the regional/continental level, Andreano et al. (2017) and Cartone et al. (2021) analyze the determinants and convergence of economic growth in Europe by considering the iterated spatially weighted regression procedure and spatial quantile regression, respectively.

At the country level, Lima & Silveira Neto (2016) examined regional growth in Brazil using the spatial augmented MRW model, and explicitly considering physical and human capital, the parameters of the Spatial Durbin Model (SDM) with fixed effects were estimated. Cosci & Mirra (2018) analyzed economic growth using spatial econometrics and found that road investment in Italy since 1960 has significantly reduced travel time between northern and southern Italy.

In China, empirical findings by Li & Fang (2018) from cross-sectional data and spatial panel data show that significant absolute  $\beta$  and conditional  $\beta$  convergence are present in gross domestic product per capita after controlling for investment return rate, human capital, savings rate, population growth, technology advancement, capital depreciation rate, and initial technology level. Sun et al. (2017), following Ertur & Koch (2007), developed a spatially-extended neoclassical Solow growth model to explore the spatial characteristics of regional economic growth at the prefecture-level over the period 1992–2010.

The analysis of spatial convergence is also applied to archipelagic countries such as Indonesia. Affandi et al. (2019) analyzed the role of human capital on economic growth in both quantitative and qualitative contexts using a production function estimation approach and conditional convergence equation estimation. Kurniawan et al. (2019) discussed the dynamics of socioeconomic inequality in Indonesia over the past four decades by testing the convergence of clubs on provincial panel data against four indicators of gross regional product per capita, the Gini coefficient, school enrollment rate, and birth rate. There is a link between economic growth and spatial dependence.

The spatial econometric model underwent development, as Aspiansyah & Damayanti (2019), who developed the Fischer (2011) using the SDM, found the existence of spatial dependence on Indonesia's regional economic growth based on panel data from all provinces in Indonesia during 1990–2015. In addition, the existence of spatial spillover, except for physical capital investment and human capital investment. In narrower areas, such as islands or provinces, they are considered to have a tighter dependence because they are connected through land infrastructure. Hidayat et al. (2022) built an economic growth model using Spatial Autoregressive and Spatial Error Models across 154 regions on the island of Sumatra and found convergence from 2010 to 2020. However, research by Tombolotutu et al. (2019) gave different results; there was no convergence of economic growth in the regencies/cities in Central Sulawesi.

This study adopts the research model of Fischer (2011) and Aspiansyah & Damayanti (2019), which will later be compared between the non-spatial model and the spatial model through the means developed by LeSage & Kelley Pace (2009) and Elhorst (2010). The object of this research is Indonesia, especially in Central Java Province. In addition to the lack of spatial convergence research at the provincial/regency level in Indonesia, the governance at the regencies/city level in Indonesia is autonomous (Law No. 23 of 2014), including in the regional budget allocation (APBD). So that regencies/city and provincial policies become very strategic in efforts to develop the economy.

## METHODS

This study used secondary data. The data sources from the BPS report include per capita income, the ratio of Gross Fixed Capital Formation (GFCF) to Gross Regional Domestic Product (GRDP), the ratio of school participation, and population growth. The data is panel data with 35 regencies/cities in Central Java from 2011-2019.

The Spatial Durbin Model (SDM) is a general model that the effect of spatial lag takes into account on the independent and dependent variables (LeSage & Fischer, 2008). The SDM takes the following forms:

$$Y = WY_{\rho} + \alpha_{\iota_n} + X\beta + WX\theta + \varepsilon \dots\dots\dots (1)$$

where Y indicates the vector  $n \times 1$  of the observed per capita income growth rates (one observation for each spatial unit of the dependent variable); X is the matrix  $n \times k$  of the explanatory variable n is the number of regencies/cities in Central Java; and k is the sum of the explanatory variables. Intercept vector, represented by  $\iota$ . Matrix W is a matrix of non-stochastic and non-negative  $n \times n$  spatial weights. The W element is necessary to indicate the structure of spatial dependence across observations. A vector or matrix multiplied by W indicates the spatial values, i.e.,  $\rho$ ,  $\beta$  and  $\theta$  are the parameters of the response, and the  $\varepsilon$  is  $n \times 1$ , which is normally distributed.

In the analysis, variables in the form of spatial weights are added to capture spatial effects, which describe the relationship across regions. A spatial weight matrix based on contiguity is a spatial weighting matrix based on the intersection of regional boundaries. Anselin (2001) states interconnectedness across adjacent regions is depicted by binary code in a matrix to express the relationship across spatial units. If it is directly adjacent, it is given a value of 1 and 0 for others. According to Lesage (1999), there are various types of interactions of the contiguity matrix, namely:

1. Linear contiguity, this spatial weight matrix defines code 1 for a region on the left or right edge of the neighboring region and code 0 for another region.
2. Rook contiguity, this spatial weight matrix defines code 1 for a region side by side with neighboring regions and code 0 for other regions.
3. Bishop contiguity, this spatial weight matrix defines code 1 for regions whose corner points (common vertex) meet the angle of their neighboring region and code 0 for other regions.
4. Queen contiguity (angular side intersection), this spatial weight matrix defines code 1 for the region that is side by side or whose corner point meets the neighboring region and code 0 for the other region.

Due to the irregular border area across regencies/cities in Central Java, this study uses queen contiguity as the default for weights to deal with potential inaccuracies such as rounding errors (Anselin & Rey, 2014).

The neoclassical theory of growth underlies the theoretical framework of this study. The neoclassical model is based on the Cobb-Douglas production function. This research model adopts from Fischer (2011) and Aspiansyah & Damayanti (2019) as the

general model, which is compared with several alternative models through the means developed by LeSage & Pace (2009) and Elhorst (2010). The following is the SDM.

$$[\ln y_{it} - \ln y_{it-1}] = \beta_0 + \beta_1 \ln y_{it-1} + \beta_2 \ln s_{it}^K + \beta_3 \ln s_{it}^H + \beta_4 \ln(n_{it} + g + \delta) + \theta_1 \sum_{j=1}^N w_{ij} \ln y_{jt-T} + \theta_2 \sum_{j=1}^N w_{ij} \ln s_{jt}^K + \theta_3 \sum_{j=1}^N w_{ij} \ln s_{jt}^H + \theta_4 \sum_{j=1}^N w_{ij} \ln(n_{jt} + g + \delta) + \rho \sum_{j=1}^N w_{ij} [\ln y_{jt} - \ln y_{jt-1}] + \varepsilon_{it} \dots\dots (2)$$

The variables contained in the equation are defined operationally as follows:

- $y_{it}$  is a proxy income that we use as per capita income based on the constant price of the region (regency/city)  $i$  at the end of each period in the province of Central Java.
- $y_{it-1}$  is the initial income proxy that we use as the per capita income based on the constant price of the region (regency/city)  $i$  at the beginning of the period in the province of Central Java.
- $s_{it}^K$  is the level of physical capital investment in the region (regency/city)  $i$  of Central Java Province which is proxied using data on the ratio of Gross Fixed Capital Formation (GFCF) to Gross Regional Domestic Product (GRDP).
- $s_{it}^H$  is a regional human capital investment (regency/city)  $i$  in the province of Central Java, which is proxied using school participation rate data.
- $n_{it}$  is the region's population growth (regency/city)  $i$  in the province of Central Java. Meanwhile  $y_{jt}$ ,  $y_{jt-1}$ ,  $s_{jt}^K$ ,  $s_{jt}^H$ ,  $n_{jt}$  successively constitutes income, initial income, physical capital investment, human capital investment, and population growth of region  $j$  (neighboring).
- $g + \delta$  is a variable that represents the growth rate of technology and the depreciation rate of capital which is assumed to be of constant and equal value for the entire region (regency/city)  $i$  of Central Java Province, which is 0.05 (see Mankiw et al., 1992; and Islam, 1995)).
- $u_{it}$  is the error term
- $\beta_0$  is the intercept,  $\beta_{1...4}$  are the coefficient of exogenous variables  
 $\beta_1$  as the basis for calculating the implied  $\beta$  or convergence rate ( $\lambda$ ).  $\beta_1 = 1 - e^{-\lambda t}$  where  $t$  is time (Barro & Sala-I-Martin, 1992).
- $\theta_{1...4}$  is the coefficient of the spatial variable  $X$ ,  $\rho$  is the coefficient of the spatial variable  $Y$
- $w_{ij}$  is a spatial weight matrix.

## RESULT AND DISCUSSION

### Measurement model

Pesaran's Cross-Sectional Dependence (CD) test (Pesaran, 2004) is used to prove the presence or absence of spatial autocorrelation/dependence across regions; Table 1 showed that there is a spatial dependence across regencies/cities in the province of Central Java (p-value <0.05). The selection of the Spatial Econometric model used the Spatial Durbin Model (SDM) as an initial model compared to other alternative models (LeSage & Pace, 2009; Elhorst, 2010; Belloti et al., 2017). Model selection between SDM and SAR (Spatial Auto-Regressive) to test the value of  $\theta$  (if  $\theta \neq 0$  the SDM model was selected), then compared the SDM with SEM (Spatial Error Model) to test the value of  $\theta$  (if  $\theta = -\beta\rho$  SEM model was selected). Besides that, Belloti et al. (2017) suggested by looking at the smaller AIC (Akaike Information Criterion) and BIC (Bayesian Information Criterion) in choosing a model. Furthermore, the Robust Hausman test was carried out in the panel data case to choose between fixed effects or random effects.

**Table 1.** Pesaran's cross-sectional CD test

	Pesaran's test of cross-sectional independence	Probability	Spatial Dependence
Regencies/Cities in Central Java	14.841	0.0000	Yes

Table 2 showed that the probability chi-square value of the model test comparing SDM vs. SAR and SDM vs. SEM were 0.0007 and 0.0012, respectively. It indicates the existence of spatial dependence both in terms of dependent variables and independent neighboring regions (regencies/cities) in Central Java. The Robust Hausman test showed a probability chi-square value of 0.000, so the model chosen was a fixed effect SDM.

**Table 2.** Spatial model selection

	SDM vs. SAR	SDM vs. SEM	Robust Housman Test
Null Hypothesis	$\theta = 0$	$\theta = -\beta\rho$	
Chi-Square	19.17	18.09	
Prob> $\chi^2$	0.0007	0.0012	0.0000
The selected model	SDM	SDM	Fixed Effect

Then, this paper compared the spatial and no-spatial models (See Table 3). The MRW model emphasized that the initial per capita income had a significant influence, as well as population growth and technology to income growth. Meanwhile, physical capital investment and human capital investment were not significant.

**Table 3.** Regression analysis results

$[\ln y_{jt} - \ln y_{jt-1}]$	MRW Panel Fixed Effect	MRW Spatial Durbin Model (SDM) Fixed Effect
Constant	-1.548*** (0.4195)	
$\ln y_{it-1}$	-0.06*** (0.017)	-0.1006*** (0.0192)
$\ln s_{it}^K$	-0.0094 (0.0083)	-0.015** (0.0078)
$\ln s_{it}^H$	0.0011 (0.0293)	3.66E-05 (0.028)
$\ln(n_{it} + g + \delta)$	-0.616*** (0.166)	-0.112 (0.2121)
$w_{ij} \ln y_{it-1}$		0.0623** (0.029)
$w_{ij} \ln s_{it}^K$		0.0014 (0.0127)
$w_{ij} \ln s_{it}^H$		0.105* (0.0585)
$w_{ij} \ln(n_{it} + g + \delta)$		0.056 (0.369)
$w_{ij}[\ln y_{jt} - \ln y_{jt-1}]$		0.0504 (0.076)
AIC	-2005.006	-2012.653
Implied b (l)	0.647%	1.065%
Half-life convergence	107.1	65.1

\* significant by 10%; \*\* significant by 5%; \*\*\* significant by 1%. the standard error (). The implicated convergence ( $\lambda$ ) speed (implied  $\beta$ ) is calculated using the initial income formula where  $\beta_1 = 1 - e^{-\lambda t}$  is the number of periods.

In the Spatial MRW Model, initial per capita income and physical capital investment were significant to income growth. Other variables, investment in human capital, population, and technology growth were not significant. The spatial model was more fit than the no-spatial model because the AIC value was smaller (see table 1). AIC was a relative measurement of an econometric model for a given data set. The AIC worked to balancing the trade-offs between the complexity of a particular model and its suitability that illustrated how well the model "fits" the data (Belloti et al., 2017). Furthermore, implied  $\beta$  showed a speed of convergence ( $\lambda$ ) on the MRW Panel model (not a spatial model) of 0.65 % and the Spatial Durbin Model of 1.06%. This shows that the convergence speed is faster on the Spatial Durbin Model.

### Convergence analysis

The convergence of income growth in Central Java has occurred, which is indicated by the coefficient of initial per capita income ( $\ln y_{it-1}$ ) had significant and negative values in both spatial and non-spatial models. The speed of convergence (implied  $\beta$ ) was 0.647% for the non-spatial model and 1.065% for the spatial model. The time required to cover half the gap (half-life of convergence) shown by the non-spatial model was 107 years, while the spatial model was 65 years.

The spatial model had a higher coefficient of initial per capita income ( $\ln y_{it-1}$ ) than the non-spatial model. This showed that spatial dependence or interregional linkages in Central Java support the convergence of regional economic growth. Spatial dependence was shown from the significant positive coefficients of the per capita income in other regencies/cities ( $w_{ij} \ln y_{it-T}$ ) and the human capital investment in other regencies/cities ( $w_{ij} \ln s_{it}^H$ ). The convergence has implications where poor areas experience faster economic growth than rich areas (Barro & Sala-I-Martin, 1992).

These results align with the findings of Hidayat et al. (2022) and Sun et al. (2017), whereby controlling for spatial heterogeneity in the model, the convergence speed is faster. The convergence that occurs implies a reduction in inequality. This is very important because inequality will interfere with poverty alleviation and sub-optimal economic growth (Fosu, 2017).

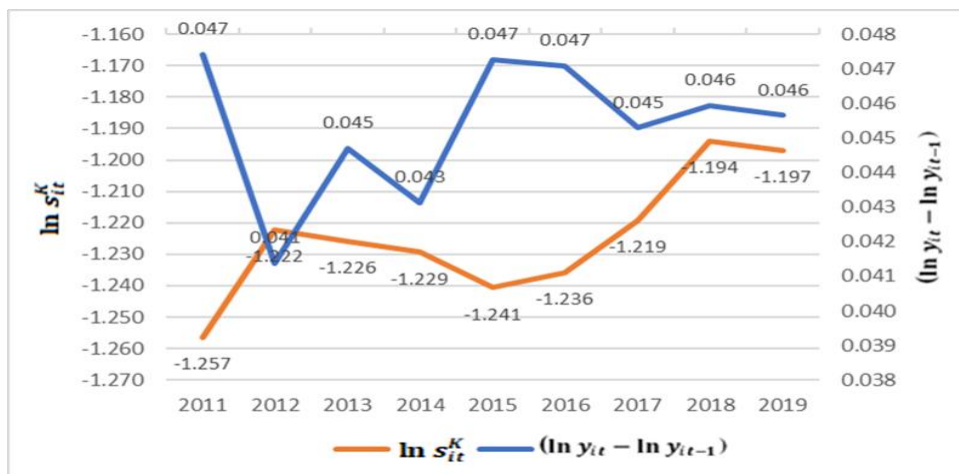
### Determinant of income growth and spatial analysis (direct and indirect effects)

#### *Physical capital investment*

The result showed that the physical capital investment in both spatial and non-spatial models had a significant effect on income growth, but was negative. This differs from Solow's growth model and MRW model that physical capital investment positively affects income (Solow, 1956; Mankiw et al., 1992). This might happen because the economic growth of a region will stagnate and even negatively when the amount of investment cannot cover the amount of depreciated capital (Aspiansyah & Damayanti, 2019).

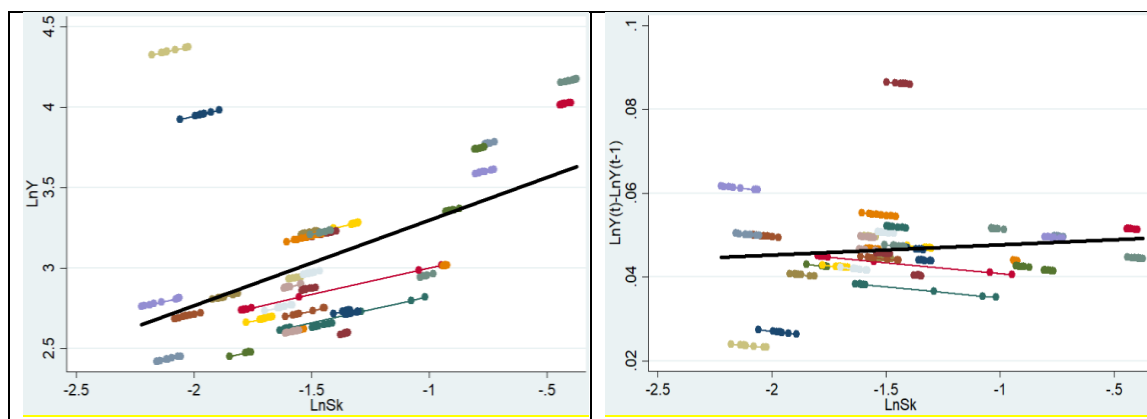
Figure 1. shows that the addition of physical capital in Central Java Province was volatile. It tends to increase, followed by adding per capita income every year. However, when physical capital was added at a higher point, the addition of per capita income at the same time tended to decrease and vice versa.





**Figure 1.** Growth per capita income ( $\ln y_{it} - \ln y_{it-1}$ ) and physical capital investment ( $\ln s_{it}^K$ )

The negative effect of physical investment on income growth ( $\ln y_{it} - \ln y_{it-1}$ ) is supported by figure 2b, where the regression line for each regencies/city is decreasing. However, the relationship between physical capital investment and income ( $\ln y_{it}$ ) was positive (figure 2a). This suggests an alleged diminishing return due to physical capital investment being positive for total income but negative for income growth.



**Figure 2a.** Regression line physical investment ( $\ln s_{it}^K$ ) to per capita income ( $\ln y_{it}$ )

**Figure 2b.** Regression line physical investment ( $\ln s_{it}^K$ ) to the growth of per capita income ( $\ln y_{it} - \ln y_{it-1}$ )

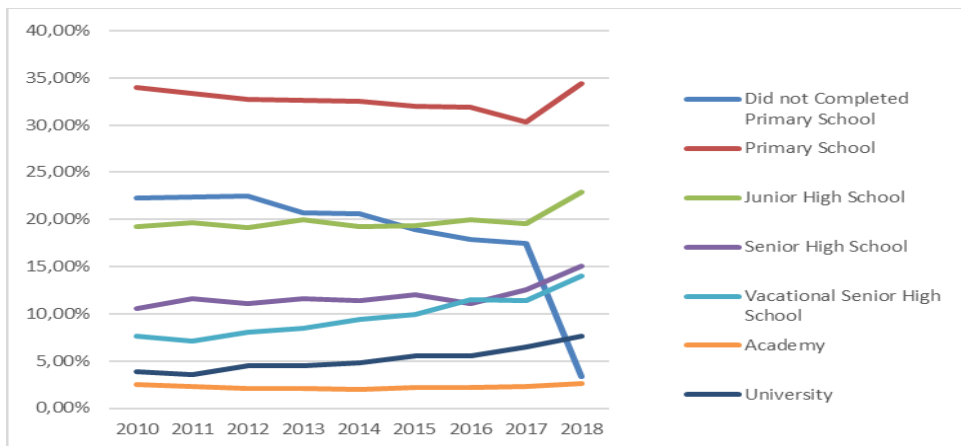
Another conjecture is that there is a lag effect from physical capital investment, meaning that the physical capital investment carried out at this time does not directly impact increasing output but takes time. However, the cost of capital adjustment itself is less flexible when compared to others (such as labor) (Bar-Ilan & Strange, 1996).

This is reinforced by the problem of ease of doing business in Indonesia, which ranks 73 out of 190 countries and below other ASEAN countries (Singapore, Malaysia, Thailand, Brunei, Vietnam) (World Bank, 2020). Special attention must be paid to technical (such as technology) and non-technical (such as institutional) factors in creating an efficient business environment, which will also attract a lot of incoming investment.

**Human capital investment**

Human capital investment in the model was not significant, both when aspects of interregional linkages were ignored or incorporated. This was different from other

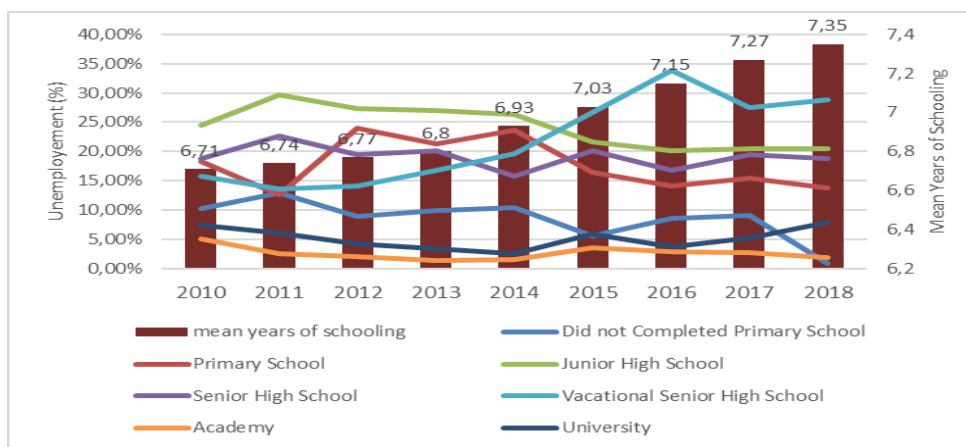
studies that stated the strong positive influence of human capital investment on economic growth conducted by Lima & Silveira Neto (2016) on Brazil, Li & Fang (2018) on China, Affandi et al. (2019) on Indonesia and Fischer (2011) and Cartone et al. (2021) in European countries. However, it is the same as the findings of Hidayat et al. (2022) where human capital is not significant to economic growth on Sumatra Island.



Source: Statistics of Central Java Province (jateng.bps.go.id)

Figure 3. The percentage of the workforce according to Central Java Province education

This is possible because unskilled laborers dominate the labor force in Indonesia. Figure 3. shows that the Labor Force in the province of Central Java, on average from 2010-2018, is still dominated by the education level of unfinished primary schools (19%), primary schools (33%), and junior high schools around (20%).



Source: Statistics of Central Java Province (jateng.bps.go.id)

Figure 4. Percentage of unemployment based on education and the average study length of Central Java Province

In addition, this might happen because of the mismatch between the outcome of education in Indonesia and the needs of the industry in the field, so educated unemployment arises, which should be productive to improve the economy. Figure 4 shows precisely that the highest percentage of unemployment in 2018 is in vocational education at 28.85%, followed by junior high schools at 20.41% and senior high schools at 18.88%. The trend of the average length of schooling in Central Java province continues to increase from 2010-2018. Hasibuan & Handayani (2021) state that field of

study mismatch occurs in 68.4% of the workforce in Indonesia and results in a wage penalty of around 6%.

### ***Spillover effect***

The initial per capita income of other regencies/cities ( $w_{ij} \ln y_{it-1}$ ) positively affected to the income growth. This indicates that there is a spatial spillover of per capita income from regencies/cities to the income growth of other regencies/cities in Central Java. In line with research conducted by Basile (2008) in European countries, Sun et al. (2017) in China, and Aspriansyah & Damayanti (2019) in Indonesia. The interaction initial per capita income of other regions to income growth suggests that regions surrounded by wealth regions have a higher expected growth rate than regions surrounded by poor regions (Basile, 2008). When a region's income increases, it will increase demand and become an opportunity for other regions to fulfill it through trade (Capello, 2009).

The spillover effect also occurred from human capital investment. Human capital investment by regencies/cities will impact the regional economic growth of other regencies/cities in Central Java. This shows that human capital investment in one regencies/cities This shows that human capital investment in one area is also enjoyed by other regencies/cities in Central Java is also enjoyed by others. It is suspected that there are transmission channels, so educated workers migrate to other regions. In contrast, Olejnik (2008) says that the increase in human capital that is only enjoyed by its region is due to an educated workforce that does not migrate to other regions. Physical capital investment, economic growth, and population growth had no significant spillover effect to income growth of other regencies/cities in Central Java.

## **CONCLUSION AND RECOMMENDATION**

### **Conclusion**

This research uses the foundation of Solow growth theory in the Mankiw Romer Weil (MRW) model, plus the development of a model by Fischer that emphasizes dependence across regencies/cities in Central Java. In this case, the use of the Spatial Durbin Model was selected with the following findings:

- a) Factors derived from one's territory that affected the income growth were the initial per capita income and physical capital investment. Interestingly, the anomaly that occurs from physical capital investment was detrimental to income growth.
- b) The occurrence of spillover effects across regencies/cities on initial per capita income and human capital investment. A region's increased per capita income will increase the demand, which will be an opportunity for other regions, thereby increasing trade. Increased human model investment in one region will affect other regions when educated workers migrate to other regions.
- c) Spatial dependence supported the convergence process of growth of per capita income in the Central Java.

### **Recommendation**

Based on the results of this study, the findings of a positive spillover effect on per capita income growth in Central Java need to be utilized, especially in the field of increasing human capital investment. The increase in human capital investment will improve the way of production which will improve the economy. Meanwhile, the insignificant human investment in per capita income growth needs to be reviewed by

the curriculum or education and training system so that it is in sync/match with the needs of industry or the economy in increasing output. The importance of human investment is not only limited to education but also other aspects such as health.

The negative findings of physical capital investment on per capita income growth need to be studied in more depth, if the cause is an investment that cannot cover depreciation, it needs to be reviewed projects, especially the government, to produce products that have a longer economic life. If the problem is that there is a lag of investment on income growth, then policies are needed to increase certainty in investing because uncertainty will cause investment delays. Efforts that have been made through the issuance of Law Number 11 of 2020 concerning Job Creation and development of the Special Economic Zone (KEK) Kendal are expected to boost the economy.

And to take advantage of the spillover effect, infrastructure is needed to improve connectivity across regions, thereby facilitating the mobility of production factors and reducing transportation costs. The construction of toll roads and railway routes in Central Java is expected to accelerate spillover, resulting in equal distribution, and on the other hand, will also improve the economy.

The limitations of this study include not properly capturing the role of technology and the time lag assumptions in the model. It is hoped that future research can incorporate digitalization within the framework of an economic growth model.

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## Nexus of energy efficiency, carbon emission and economic growth in Nigeria

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### Abstract

Given rising temperatures, climate change, the alarming increase in energy demand, and the importance of energy efficiency, there is a need for an increasing review subject matter. In this sense, policymakers develop various measures, including renewable adoption and energy efficiency. This study examined the causal effect of oil production and carbon emission from gas flaring on the economic growth rate in Nigeria from 1980-2021. The findings revealed that economic growth and energy consumption significantly increases energy-related emissions. An increase in income level influences investors and industrialists to invest in the industrial sector, increasing production, diversification, and expansion. However, increased production and expansion of industries increase energy demand. Energy demand met by consuming fossil fuel increases energy-related emissions in Nigeria and negatively affects environmental quality. More importantly, carbon emission impedes environmental sustainability and sustainable economic growth in Nigeria. The study is relevant to the post-2015 Sustainable Development Goals agendas for two fundamental reasons: the world needs Sustainable Development Goal 7 – ensuring access to affordable, reliable, sustainable, and modern energy by 2030. (b) Large extractive industries primarily drive growth in Nigeria, and the country's population is expected to double in about 30 years. Energy efficiency for inclusive development is very welcome. This is essential because studies have shown that the increase in unemployment (resulting from the underlying demographic change) would be accommodated by only the private sector, not the public sector.

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**Keywords:** *Carbon emission, Economic growth, Electricity, Energy demand, Environment.*

**JEL Classification:** O44, Q31, Q34. Q43

### INTRODUCTION

Nigeria faces a similar challenge as we move into the coming election year. The ultimate challenge follows the big question of “who to vote for” in our view, it depends on not only the political ideology of the party but often their plans and policies on

relevant issues that will affect our lives in the short and long run. This is usually considered how to improve the economic condition of society. Still, another prominent challenge faced in the world generally is the issue of reduction of carbon emissions and zero carbon policies.

Energy efficiency has several environmental benefits and helps to reduce GHG emissions, both direct emissions from fossil fuel combustion or consumption and indirect emissions reductions from electricity generation. Energy efficiency is important in tackling climate change. It helps limited time to achieve mitigation targets, stated by the recent Intergovernmental Panel on Climate Change (IPCC) special report on Global Warming of 1.5oC. Energy efficiency is an important tool the world can use to meet energy service demand with lower energy use. It is important in the pathways of IPCC GHG emissions limiting global warming to 1.5oC (IPCC, 2018).

International Energy Agency (IEA) states energy efficiency can help global energy demand and energy-related CO<sub>2</sub> emissions reduce steadily until 2050. “Efficiency” is the ratio of output to input. World Energy Council (WEC 2006) states energy efficiency is the ratio of energy service output to energy input. Rationing of the target consumption quantity and the actual consumption quantity. The closer the ratio is to one, the more efficient it is. Improving energy efficiency is using as few inputs as possible to gain the largest quantity of service outputs. Energy efficiency is not an isolated measurement. It closely relates to the economy, society, environment, technology, and many other domains. Therefore, Energy efficiency refers to the effective and efficient utilization of energy resources.

With each incoming administration to power promising adequate energy supply, Nigeria's major energy challenges are securing energy supply to meet growing demand, providing everybody with access to energy services, and tackling the causes and impacts of CO<sub>2</sub> emission. Specifically, priorities on energy may vary from nation to nation. Developed and rapidly growing economies focus on energy efficiency, energy security of supply, and reducing the CO<sub>2</sub> emission impacts of energy use, particularly climate change and air pollution. For developing nations, Nigeria included, securing access to reliable, sustainable, and affordable energy remains a key challenge. Energy poverty, coupled with rapid growth in the human population, has often been identified as one of the main factors of environmental degradation.

Politicians are paying much more attention to climate change and environmental protection due to the dangerous effects of global warming. The political parties now included energy and environmental policies in their agenda, with different ways of improving energy efficiency, reducing energy poverty, and controlling climate change. For instance, the Labour party's agenda is on energy poverty, reducing energy bills, and reducing carbon emissions to zero by 2030. Other parties also include affordable energy supply and insulation and energy efficiency measures in their agenda and better funding system for energy efficiency programs, like, proper building insulation and investment in renewable energy sources. Thus, the question is, how important are energy efficiency and reducing carbon emissions for the population?

Energy is needed to stimulate production, generate income and social development, as well as to reduce the serious health problems caused by the use of fuel wood and other solid fuels. Providing energy supply, securing energy supply, tackling climate change, avoiding air pollution, and reaching sustainable development globally offer opportunities and synergies. Sustainable development Goals 7 and 13 initiatives are vital to curbing energy poverty, deforestation, and forest degradation and increasing energy efficiency.



Currently, over 40% of people in Nigeria do not have access to electricity and rely on traditional biomass - wood, agricultural residues, and dung - for cooking and heating. Better access to a sustainable energy supply is necessary for economic growth, business development, and income-generating activities. Homes, schools, and health centers need adequate lighting, communication, water supply, and heating and cooling energy. Streetlights improve safety at night. Better fuels and cooking stoves are necessary to end the exposure of women and children to indoor air pollution and reduce the daily work of collecting wood. Added to it is the increasing high population with a series of barriers to energy access. The increasing high population can become more challenging.

Nigeria, whose overall electrification rate is about 60%, expects an additional 20% to 30% of its population to have assessed electricity by 2030. However, in Nigeria's housing, with the population's expected growth by 2030, the housing infrastructure needs gap will be 50% higher, correlating to higher energy demand. By 2030 the overall energy demand in Nigeria is expected to more than double. The National Population Commission reports 200.2 million people in the country, and an electricity supply of 5,000 MW is grossly inadequate for many Nigerians. The nation's socio-economic growth requires much more than 5,000 MW of electricity. Energy planning experts using modern energy modeling tools estimate that for the Nigerian economy to grow 10 percent, the country's electricity requirement by 2020 will be 30,000 MW by 2030. it will be 78,000 MW (Chika Izuora 2018). With the increasing need for energy and reliance on imports, an unbalanced mix of energy sources, there is a need to slow down energy consumption and increase energy efficiency.

Nigeria spends an increasing share of its GDP on energy imports, with devastating effects on economic growth and levels of indebtedness (subsidies). Energy efficiency and greater use of renewable sources can thus reduce dependence on imported energy and contribute to economic stability and environmental sustainability. Nigeria has been an energy importer and exporter, importing finished products and exporting raw products.

Nigeria's challenges include globalization, urbanization, technological innovation, fundamental economic and political power shifts, global environmental impacts, climate change, and potentially explosive social conflicts. Where any of the challenges have been net negative, energy's role has come into focus. These negative challenges encompass concerns about water security, food shortages, climate change, and the country's slower-than-expected performance of the SDGs. Adequate, available, and sustainable energy supply can provide a positive outcome for development and human well-being (portable water, food, health, and reduce other developmental challenges). Again, it could reduce the adverse effects that Nigeria has been experiencing (climate change, air pollution, lack of competitiveness, and inequality). The paradox of energy use is that it can simultaneously alleviate or aggravate all challenges. Energy is important for delivering health services but also causes health problems; it is necessary for delivering water and improving its quality, but it is also an important consumer and polluter of water. In most cases, if one was to drill down, energy aggravates the inequities in the world through the costs and benefits of its use (Tahir & Kanwal 2017).

The energy shortage in Nigeria has grown over the years to about 75% (International Energy Agency, 2020). Overdependence on fuel wood has led to deforestation, attendant degradation of the environment, and worsening desertification (Olure-Bank et al., 2019). An average annual deforestation rate of 2.38% between 2000 and 2020 in Nigeria is due in part to hikes in kerosene and cooking gas prices. Other alternative energy sources, including solar, wind, and wave, are largely underdeveloped

in the country. Furthermore, as a result, domestic fuel prices have gone up several times with an attendant upsurge in transport fares and prices of goods and services. Nigeria, a developing country, has had a major focus on the GDP growth rate since its independence. But in recent years, the country has experienced one of its worst recessions, one of the reasons being a severe crisis in the energy sector. Nigeria's energy shortage is led by several reasons: isolated technology and 80% dependency on oil and gas income. Nigeria, developmental take-off should be based on its readiness to ensure an adequate and regular energy supply, which represents a crucial factor that supports industry and, thus, economic growth.

With the above challenges in mind, we need to re-examine the causal relationship between energy efficiency, CO<sub>2</sub> emission, and GDP growth in the short and long run to better understand economic development's sustainability in the wake of unsustainable energy supply. It is also of note that Nigeria's economy has changed its structure during the past few decades. In particular, the share of agriculture to GDP has declined from about 56% in 1959-60 to 25% in 2015-16, and the share of services has increased from 38% to 58% during the same period. It would be interesting also to draw implications of this changing structure of the economy for energy efficiency

Therefore, the study's main objective is to answer three questions. First, is there a causal relationship between energy intensity (efficiency), CO<sub>2</sub> emission, and GDP? If there is, what is the direction of the causal relationship between energy intensity and GDP in the short and long run? Finally, how is energy intensity expected to change in light of changing shares of the major economic sectors to GDP? This study uses energy intensity as a proxy for energy efficiency. Energy intensity is often used as a proxy for the energy efficiency of an economy (Poveda & Martinez, 2011), cited in Olure-Bank et al., 2019. High energy intensity implies low energy efficiency. This study, therefore, becomes imperative in analyzing the challenges of energy supply and examining the level of energy-induced growth in the Nigerian economy.

Most study uses energy intensity as a proxy for the energy efficiency of an economy. Energy intensity is energy use per unit of GDP, the total energy used for economic and social activity (Olure-Bank et al., 2019). The more intense the energy use, the higher the cost of converting raw material into the final product, resulting in meager economic performance, deteriorated environment, and low living standards. Energy consumption and economic growth have four hypotheses: growth hypothesis, feedback hypothesis, conservation hypothesis, and neutrality hypothesis (Yildirim et al., 2014).

Previous studies identify four different approaches to abstain if energy consumption reduces or increases with energy efficiency. (Reinhard & Alcot 2006) cited Olure-Bank et al., 2019. Firstly, Jevons (1865) states that without the efficiency increases in steam engines and metal smelting, the demand for coal could never have reached mid-19th-century high levels. Rosenberg sums up this argument for the backfire as follows: The Bessemer process was one of the most fuel-saving innovations in the history of metallurgy. Since innovation made it possible to use steel in various uses that were not feasible before Bessemer, and large increases in the steel demand. The Bessemer process reduces fuel requirements per unit of output (ratio). Still, its ultimate effect (from an economic view, not just an engineering perspective) was to increase, not reduce, demand for fuel. Notably, the efficiency improvements in finding energy are known as the energy return on investment (EROI). The increases come with the law of diminishing returns – deep mines and drill holes would have rendered energy more expensive rather than cheaper. Related to the gradual improvement of technology

over time are the two phenomena ‘lock-in’ and ‘path-dependency’ (David 1986, Arthur 1989). Both explain, in part, the general issue of inertia imposed on the turnover of the capital stock. Note, however, that the replacement rate is usually not part of the discussion about the size of rebound effects since the two relevant measures for the assessment change in the technical efficiency with which particular goods and/or services are provided and total consumption levels.

Secondly, in the microeconomic approach of prices, substitution, and income effects, studies investigated direct rebound (additional demand for a good or service that can be more efficiently produced with the new technology). That is, buying an energy-efficient automobile, do people either buy or keep additional cars and does the weight of the household’s entire car fleet perhaps increase (de Haan et al. 2006)? One could also ask whether a more energy-efficient car is driven more than non-energy-efficient cars (Greene 1992). Studies in the U.K. attest, for instance, that after a house is insulated or obtains a more efficient space heating system, people tend to heat more (Defra 2002). A useful survey of such direct rebound studies can be found in Greening et al. (2000). Of note, a reduction in the cost of energy service from energy efficiency can increase important bearing on the marginal consumer by making unaffordable energy service now affordable.

The workability of the microeconomic approach needs to meet two conditions: First, the system boundaries of empirical studies must be expanded to a world scale; since many energy markets and emissions are international, and embedded energy and material are increasingly traded globally, country or OECD studies alone are insufficient (Greenhalgh 1990; Dahlström & Ekins 2006; Rhee & Chung 2006). Secondly, the measure of total rebound must be the goal, i.e., indirect and direct effects: the increased purchasing power can be used to purchase anything and be shared by people, not in the market. The rebound from more efficient automobiles cars can be demand for air travel. However, tracing indirect effects with the tools of microeconomics proves to be extremely difficult (Howarth 1997; Roy 2000). Moreover, estimates of total rebound vary wildly. For instance, U.K. 4CMR (2006) arrives at 26%, and Allan et al. (2006) is closer to 40%. For others, it is inverted (Jevons 1865; Giampietro & Mayumi 1998; Brookes 2000) whether a rebound is greater or less than unity and is not concluded.

Thirdly, statistically, it can be tested on an aggregate and over time that technological efficiency increases and influences the size of energy consumption and its growth. The long-term increase in energy consumption needs no documentation (Reijnders 1998). Jevons (1865) was the first writer to show that consumption increases accompanied large and obvious efficiency increases. He traced efficiency increases in steam engines and steel (or pig-iron) production and then compiled statistics on coal consumption. Greenhalgh (1990) shows engineering efficiency gains of over 20% for household appliances in Denmark between 1977 and 1986, alongside rising electricity consumption. Rudin (2000) also study U.S. energy use in commercial buildings (8% more efficient from 1979 to 1995) and cars (30% from 1967 to 1997). Smil (2003) likewise covers changes in energy efficiency and consumption (Clapp 1994). Herring (2006) maintains a causal relationship between lighting efficiency and electricity consumption.

Since correlation is not causality, an ideal metric for energy efficiency levels valid in different periods and countries is needed for rigorous hypothesis testing. However, the global nature of environmental problems (climate change) and the global nature of the market for fossil fuels, for rigorous assessment of rebound effects, world statistics

are needed. Or the metrics defined by products, industries, or sectors whose efficiency change can be measured in percentages and averages for the whole world economy evaluated. One must decide between financial, utility or welfare, and physical metrics to measure both economic growth and output as the denominator in input-output efficiency. Using GDP as the metric means economic output divided by energy input, which has disadvantages. GDP does not measure all economic activities (unpaid work to bartered goods), resource depletion, and so-called ‘eco services’ where the true costs are not reflected in the price. Moreover, the prices of the goods that influence GDP also count not on changes in efficiency and production costs but rather on consumer tastes, quality changes, and even politics (Schipper & Meyers 1992; Saunders 2000; Smil 2003).

For human utility, the measure of energy inputs also has problems. When a second person rides in a car, utility is doubled while energy input is the same, which is not technological efficiency change, but economy-wide energy efficiency. Welfare, too, is subject to many influences. The energy efficiency policies accessed involved energy inputs relating to physical and environmental relevant output. Finding a physical metric has proven difficult. Ayres & Warr (2005) state an exergy/energy ratio, i.e., Using useful energy for useful work, and work is defined by energy. How can one distinguish between an input and an output Joule of exergy? And since exergy is the energy of higher quality or greater availability to do work, what are the inputs into the process increasing this ‘quality’, or is it meant to describe, for instance, low-entropy coal and gas as opposed to dispersed energy closer to equilibrium?

Instead of energy or work, can the weight (or mass) of consumable and durable goods, including the (energy-using) stock of capital goods doing the work, serve as an aggregate metric? Radetzki & Tilton (2021) consider this, but qualitative product differences make it necessary to ‘weigh’ these weights. Dahlström & Ekins (2006) attempt to weigh physical characteristics – e.g., chemical elements, weight, waste, shape, and recycled tonnage – by economic value, attempting to integrate traditional material flow analysis with ‘value chain analysis. But here, the danger of conflating physical and subjective economic characteristics is great (Weisz et al. 2006). The quest for an all-encompassing, purely physical efficiency measure is a precondition for rigorous statistical analysis.

Another element ignored in studies is the size of energy rebound effects in time. Very well, there is an economic value when goods or services are produced in less time. Producing goods with the same amount of energy in a shorter time has additional value. Most rebound assessments remain silent about this time value of energy (work overtime equals power) and only address work over energy. The same argument can be put forward for energy considerations.

Lastly, early economic growth theories add technical change as an exogenous factor (Solow 1956). As a driver of economic growth, energy efficiency is part of the technological progress in neo-classical growth theory. With the increasing use of energy and other resources, environmental degradation is not seen as a significant barrier to economic growth. There will be more abundant substitutes (natural resources or human-made capital). In the 1990s, endogenous growth includes concerns about environmental and resource factors limiting growth in standard growth models (André & Smulders, 2006; Smulders & de Nooij, 2004). Endogenous growth theory gives new relationships between resource scarcity, technical change, and economic growth, and hence improvement compares to standard neoclassical growth theory. Endogenous growth includes rebound effects and diminishing returns to the ability of technology to reduce

the amount of human-made and natural capital needed to produce resources. Technical change can offset diminishing returns by more productive and less resource-dependent technologies or by using less scarce resources. Microeconomics ignores substitution's macroeconomic and global effects. Thus underestimating thermodynamic limits, complementarity, irreversibility, waste, and scale (impact of trade) (Stern & Cleveland 2004).

Therefore, studies have no established relationship between energy efficiency and economic growth. Their development, methods used, and time frame analyzed differ. But, studies reveal four hypotheses tested and the result obtained. The first, non-causal hypothesis states no significant relationship exists between energy efficiency CO<sub>2</sub> and economic growth, with real GDP growth from the service sector (low energy consumption). Therefore, proving the hypothesis means reducing energy consumption to decrease input cost and CO<sub>2</sub> emission, negatively affecting domestic output. The second, unidirectional causal hypothesis states real GDP growth is a function of energy consumption. If energy consumption is reduced, it will only lead to a marginal impact on economic growth. The conservation hypothesis is analyzed in the context of economic activity leading to more energy consumption. Economic activity leads to reduced energy consumption with a policy on the use of resources and reduced demand for products with low energy efficiency.

The third, unidirectional growth hypothesis states that energy efficiency significantly impacts economic growth. Meaning the relationship between these variables will negatively impact domestic output. But, the economic reality is that sometimes a negative relationship between energy efficiency and real GDP growth can differ depending on the exogenous variable change. Thus, energy efficiency increases output if an economy is more of a service sector with reduced energy consumption. On the other hand, low energy efficiency has a negative impact on the GDP if an economy relies on manufacturing with high energy intensity and low energy efficiency. The fourth, feedback hypothesis state that energy efficiency and economic growth dependent on each other. When energy efficiency increases, it leads to an increase in real GDP, thus, positively impacting energy consumption nationwide. Environmental policies will generate both energy consumption and a GDP decrease, and energy efficiency will lead to GDP growth and an increase in energy consumption.

The first strand of works on the nexus between energy efficiency, carbon emission, and economic growth focused on environmental pollutants and economic growth nexus and related to the validity of the Environmental Kuznets Curve (EKC) hypothesis of the U-shaped relationship between per capita income and environmental degradation in the long run (Akboostanci, Turut-Asik & Tunc, 2009; Xinshen et al., 2009 and He & Richard, 2010). Another strand relates to energy consumption and economic growth nexus (Mehrara, 2007; Olusegun, 2008; Akinlo, 2009; Ezzo, 2010; Fatai, et al. 2004; Sa'ad, 2010; Apergis & Danuletu, 2012; Kemisola, et al. 2014; Olure-Bank, et al. 2019).

So, to ensure appropriate recovery of the socio-economic process of Nigeria within the framework of the effective economic system, development, enhancing structures, patterns, and evolution of production, allocation, and utilization of its vast resources, similarly ensuring optimal development and efficient management of available resources, equitable allocation of such resources and effective utilization to achieve economic development ultimately, the issue oil production, carbon emission to gas flaring on economic growth in Nigeria. This study takes the first strand of works on the nexus between energy efficiency, carbon emission, and economic growth focused on

environmental pollutants and economic growth nexus and related to the validity of the Environmental Kuznets Curve (EKC) hypothesis of the U-shaped relationship. Methodology of the form of Granger causality and regression model to examine the dynamic effect of oil production. Carbon emission from gas flaring on economic growth in Nigeria, again, interdependence variance auto-regression (VAR) is used to establish the economic growth response of external and internal carbon emission.

**METHODS**

This study combines the two methods within the Autoregressive Distributed Lag (ARDL) bounds testing framework and the Granger causality test. The central issue in the causal relationship between economic growth and energy consumption has been whether economic growth stimulates energy consumption or is a stimulus for economic growth via indirect channels of effective aggregate demand, improved overall efficiency, and technological progress (Ghosh & Basu, 2006). There are two related hypotheses on the nexus between energy consumption and economic growth: the energy-led growth and growth-led-energy hypotheses. The two hypotheses are established in development studies, with inconsistent and controversial outcomes due to various structural frameworks and policies from countries, periods, methodology, various energy consumption and growth proxies, omitted variables, and varying energy consumption patterns. To capture the causality relationship between oil price, energy consumption, investment, and real economic growth and to account for possible feedback effects from the short-run fluctuations to the long-run steady state of the relationship between the key variables. The model is expressed in the form that allows for testing both unit root and co-integration. Mathematically:

$$RGDP = f(OLP, CEGF, OLC, INVEST) \dots\dots\dots(1)$$

Mathematically log expressed for hypothesis formulation:

$$lnRGDP_t = \alpha_0 + \beta_4 OLP_t + \mu \dots\dots\dots(2)$$

$$lnRGDP_t = \alpha_0 + \beta_1 lnCEGF_t + \mu \dots\dots\dots (3)$$

$$lnRGDP_t = \alpha_0 + \beta_1 OLP_t + \beta_2 lnCEGF_t + \beta_3 OLC_t + \beta_4 INVEST_t + \mu \dots\dots\dots (4)$$

Where; RGDP = Real gross domestic product proxy by Oil production; CEGF = Carbon emission from gas flaring proxy by Oil consumption; INVEST = Investment; OLC = Crude oil production growth rate  $\alpha_0$  = Intercept;  $\beta_{1-4}$  = Slope or regression parameters; and  $\mu$  = Stochastic term.

The model revealed that the first and second lag of RGDP growth rate [DRG(-1) & DRG(-2)]; change in crude oil production growth rate (DOLPG), first and second lag of crude oil production growth rate [DOLPG(-1) & DOLPG(-2)]; change in crude oil consumption growth rate (DOLCG), first lag of crude oil consumption growth rate DOLCG(-1), change in the growth rate of carbon monoxide emission from gas flaring (DCO2G), first and second lag of growth rate of carbon monoxide emission from gas flaring [DCO2G(-1) & DCO2(- 2)] and change in investment growth rate (DINVTG), first and second lag of investment growth rate [DINVTG(-1) & DINVTG(-2)] are the only significant factors influencing economic growth proxy by the change in RGDP growth rate (DRG). Therefore, this study rejects the null hypotheses and concludes a causal relationship between oil production, carbon emission from gas flaring, and economic growth in Nigeria during the study period.

The econometric analysis of the relationship among energy consumption, carbon emission, and growth rate in Nigeria uses data from 1980 to 2021. The period for the

analysis is chosen based on the availability of data from various sources. The data sourced are from Central Bank of Nigeria Statistical Bulletin, Volume 22, 2021; World Development Index, 2022 and International Energy Agency (IEA) publications for 42 years (1980 – 2021). The model designed for the study is a multiple regression equation. The model predicts the relationship between the dependent variable (RGDP) and independent variables (“OLP”, “CEGF”, “OLC” and “INVEST”). The study adopts a dynamic methodology of Granger causality and dynamic regression model to examine the dynamic effect of oil production and carbon emission from gas flaring on economic growth in Nigeria and further use the two-step granger co-integration test framework to establish the economic growth response of external and internal carbon emission which serves as the methodological rationale for the study

**RESULT AND DISCUSSION**

Table 1 reveals descriptive statistics of the variables. The average values of the variables are close to their median values denoting the balancing point of the data. The volatility is represented by the standard deviation values and how the information is spread around its mean. In agreement with Dantama et al. (2012). the skewness ranges from 2 to  $\beta$ 2, while the values of Kurtosis come in between 7 to  $\beta$ 7. The statistical values of skewness and Kurtosis depict the data as symmetrical and normally skewed with normal distribution. Additionally, the Jarque-Bera test also affirms the normal distribution. The probability values of all the variables further prove that the information's significance is proportional and symmetrical.

**Table 1.** Descriptive statistics and normality check.

	RGDP	OLP	CEGF	OLC	INVEST
Mean	11.47679	1.196004	11.37112	11.48075	11.70743
Median	11.47722	1.44857	11.37501	11.47334	11.74016
Maximum	12.21427	1.948165	12.02514	12.19126	12.80323
Minimum	10.56636	0.35714	10.60202	10.68293	10.08623
Std. Dev.	0.365443	0.647826	0.341628	0.358035	0.529208
Skewness	-0.033495	-0.913301	-0.02021	0.00077	-0.31749
Kurtosis	2.367933	2.638812	2.267537	2.285484	3.196525
Jarque-Bera	5.740122	49.25928	7.646017	7.253849	6.277666
Probability	0.056695	0.000000	0.021862	0.026598	0.043333

The first step is to know the order integration of the variables as time series data are not stable and to know the best integration method to use test. The ADF unit-root test is used, and variables are not stationary at level. The log difference of the variables is then examined, and the estimated results are revealed in Table 2. The test result reveals the time series variables; change of real gross domestic product growth rate ( $\Delta$ rg), change of crude oil production growth rate ( $\Delta$ olpg), change of crude oil consumption ( $\Delta$ olcg), change in the growth rate of Carbon Monoxide Emission from Gas Flaring ( $\Delta$  02gC), and change in investment growth rate ( $\Delta$ invtg) are all stationary at order one (I(I). In contrast to the Ogundipe et al., (2019) unit root analysis results, the variables are stationary at their levels. In this study, all the variables become stationary at their first difference a common order of integration I(1). These findings imply that the variables converge to their mean values. Thus, the stationarity properties of the variables nullify the possibility of estimating spurious estimates from the regression analysis

**Table 2:** Unit root test

Variables	ADF Tau Statistics		Order of Integration
	Intercept	Linear Trend	
$\Delta$ rg	-7.7438*(1) [-3.6156]	-7.6760*(1) [-4.2191]	1
$\Delta$ olpg	-5.7002*(3) [-3.6268]	-5.6156*(3) [-4.2350]	1
$\Delta$ olcg	-5.1342*(4) [-5.1342]	-4.9951*(4) [-4.2436]	1
$\Delta$ CO2g	-8.6359*(0) [-3.6105]	-8.5399*(0) [-4.2119]	1
$\Delta$ invtg	-9.7901*(0) [-3.6145]	-9.6422*(0) [-4.2119]	1

Note: \* significant at 1%; Mackinnon critical values are shown in parenthesis. The lagged numbers shown in brackets are selected using the minimum Schwarz and Akaike Information criteria

Next, the co-integration test and the results of the long-run OLS model are in Table 3 and Table 4.

**Table 3.** Co-integration test results

Null Hypothesis: No Co-integration (Intercept Model)			
Exogenous: Constant and Lag Length: 0 (Automatic - based on SIC, maxlag=9)			
	t-statistic	Prob*	
Augmented Dickey-Fuller test statistic	-5.802866	0	
Test critical values:	1% level	-3.62678	
	5% level	-2.94584	
	10% level	-2.611531	
*MacKinnon one-sided p-values			
Pairwise Granger Causality Tests			
Null Hypothesis:	Obs	F-Statistic	Prob
DOLPG does not Granger Cause DRG	39	0.58844	0.448
DRG does not Granger Cause DOLPG		0.03927	0.844
DOLCG does not Granger Cause DRG	39	0.75605	0.3903
DRG does not Granger Cause DOLCG		0.21198	0.648
DOLCG does not Granger Cause DRG	39	0.75605	0.3903
DRG does not Granger Cause DOLCG		0.21198	0.648
DINVTG does not Granger Cause DRG	39	3.55365	0.0675
DRG does not Granger Cause DINVTG		1.76833	0.192
DOLCG does not Granger Cause DOLPG	39	2.57916	0.117
DOLPG does not Granger Cause DOLCG		0.065	0.8002
DCO2G does not Granger Cause DOLPG	39	3.11579	0.086
DOLPG does not Granger Cause DCO2G		6.5036	0.0152
DINVTG does not Granger Cause DOLPG	39	0.20215	0.6557
DOLPG does not Granger Cause DINVTG		0.03696	0.8486
DCO2G does not Granger Cause DOLCG	39	0.9185	0.3443
DOLCG does not Granger Cause DCO2G		0.01032	0.9197
DINVTG does not Granger Cause DOLCG	39	3.29949	0.0776
DOLCG does not Granger Cause DINVTG		0.79254	0.3792
DINVTG does not Granger Cause DCO2G	39	0.75206	0.3916
DCO2G does not Granger Cause DINVTG		1.39954	0.2446



**Table 4:** Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	-0.036	0.046	-0.789	0.439
DRG(-1)	-0.691	0.164	-4.216**	0
DRG(-2)	-0.436	0.179	-2.431*	0.024
DRG(-3)	-0.252	0.165	-1.524	0.143
DOLPG	-0.16	0.077	-2.086*	0.034
DOLPG(-1)	-0.617	0.297	-2.077*	0.04
DOLPG(-2)	-0.628	0.08	-7.801**	0
DOLCG	-0.114	0.053	-2.151	0.033
DOLCG(-1)	0.076	0.027	2.822*	0.016
DOLCG(-2)	0.326	0.68	-0.48	0.636
DCO2G	0.75	0.313	2.400*	0.025
DCO2G(-1)	0.443	0.157	2.822*	0.016
DCO2G(-2)	0.251	0.116	2.168	0.031
DINVTG	-0.006	0.003	-1.963*	0.05
DINVTG(-1)	-0.121	0.036	-3.332*	0.004
DINVTG(-2)	0.189	0.031	6.034**	0
R-squared	0.86251	S.D. dependent var		0.278124
Adjusted R-squared	0.818589	F-statistic		22.1221
Durbin-Watson stat	1.824953	Prob(F-statistic)		0.005569

The estimated long-run model rejects the null hypothesis “no stationary, ” implying that “no co-integration” is rejected for intercept and linear deterministic models at 1% McKinnon critical value as revealed in Table 3. This implies that there is a long-run relationship between a change in real gross domestic product growth rate ( $\Delta \text{rg}$ ), a 1% increase in the real growth of GDP will decrease the growth of energy intensity by 0.19% in the long run, and a change of crude oil production growth rate ( $\Delta \text{olpg}$ ), change of crude oil consumption ( $\Delta \text{olcg}$ ), change in the growth rate of Carbon Monoxide Emission from Gas Flaring ( $\Delta \text{O}_2\text{gC}$ ), and change in investment growth rate ( $\Delta \text{invtg}$ ) in Nigeria between 1980 and 2021. This suggests that economic growth has a negative influence on environmental quality. Co-integration shows that causality exists at least in one direction. These results are consistent with those obtained in an earlier study by Opeyemi (2017) for Africa. This supports the conservation hypothesis focusing mainly on electricity consumption rather than all forms of energy. The results also agree with the findings of Huang et al. (2008) for poor countries. In long-run dynamics, the coefficient of the EC term is statistically significant with a negative sign in equations 2(a) and 2(b). This implies that a change in GDP is expected to affect the energy intensity through feedback in agreement with Olure-Bank et al. (2019).

The findings of this study also support the findings of other previous studies such as Zhihui et al. (2022), Akadiri & Adebayo (2021), Hu et al. (2021), He et al. (2021), Dantama et al. (2012), Petrovic-Randelovic et al. (2020), and Muhammad & Jelilov (2015). Zhihui et al. (2022) investigate the influence of economic growth, energy consumption, renewable electricity output, and energy efficiency on energy-related emissions. The results reveal economic growth and energy consumption significantly increase energy-related emissions. Conversely, renewable electricity and energy efficiency are significant tools for lowering energy-related emissions in the region. Again, a unidirectional causality is revealed from energy consumption and renewable

electricity output to energy-driven emissions. However, an inverse effect is revealed between economic growth, energy efficiency, and energy-driven emissions. From findings, this study states the increasing need for renewable electricity output and the adoption of energy-efficient technologies to reduce environmental degradation and emission level.

Akadiri & Adebayo (2021) also analyzed the asymmetric association between economic growth and other energy, economic growth, and financial indicators in the case of India. The non-linear autoregressive distributed lags model demonstrates that economic growth, financial development, and non-renewable energy consumption promote environmental quality degradation, as renewable energy consumption promotes environmental quality.

Hu et al. (2021) reveal the existence of bidirectional causal nexus between renewable energy use and CO<sub>2</sub> emissions and a unidirectional causal nexus between CO<sub>2</sub> emissions and economic growth. The study of Petrovic-Randelovic et al. (2020) asserted the existence of bidirectional causal nexus between energy consumption and CO<sub>2</sub> emissions while a unidirectional causal association between CO<sub>2</sub> emissions and economic growth. Energy consumption and technical innovation lead to higher economic growth at the cost of environmental degradation.

He et al. (2021) explore the path of carbon emissions reduction in China's industrial sector through energy efficiency enhancement induced by R&D investment. The increasing incidence of power shortages has been identified as responsible for increased CO<sub>2</sub> emissions and dwindling economic development in most underdeveloped countries. This is not unconnected with the inability to develop new generating capacity as hydropower has been the only power source, thereby diminishing electricity supply severely during droughts.

Dantama et al. (2012) examine the impact of energy consumption and economic growth in Nigeria from 1980-2010. The results indicate a long-run relationship between economic growth and energy consumption variables exists. Petroleum and electricity consumption is statistically significant on economic growth, but coal consumption is statistically insignificant. Also, the speed of adjustment in the estimated model is relatively high and contains the expected significant and negative signs. In a recent study, Muhammad & Jelilov (2015) revealed that there exists a co-integration relationship between energy consumption and economic growth. Though they have fluctuating relationships in the short term, in the long run, energy consumption and economic growth have a long-term stable equilibrium relationship. The Granger causality test shows that GDP is the Granger cause of energy consumption, and an increase in Nigeria's GDP directly leads to an increase in energy consumption. Therefore, a decline in GDP has had an adverse effect on energy consumption in Nigeria.

## **CONCLUSIONS AND RECOMMENDATIONS**

### **Conclusions**

This study examines the causal effect of oil production and carbon emission from gas flaring on the economic growth of Nigeria from 1980-2021. The results reveal that economic growth and energy consumption significantly increase energy-related emissions. Increased income level influences investors and industrialists to invest in the industrial sector, enhancing production, diversification, and expansion. Of note, increased production and expansion of industries increase energy demand. Energy demand met by consuming fossil fuel increases energy-related emissions in Nigeria and

negatively affects environmental quality. More importantly, carbon emission impedes environmental sustainability and sustainable economic growth in Nigeria.

Again, oil production and carbon emissions negatively affect Nigerian economic growth. Theoretically, high energy consumption by the industrial sector is an important economic growth driver, increasing energy-related CO<sub>2</sub> emissions. The significance of the income from oil production is yet to impact citizens in the case of Nigeria. Since Nigeria's economies focus on developing its economy, the industrial sector is considered key for diversification, high-income level, and economic growth. There is a need for more energy consumption from the industrial sector to increase productivity and, thus, income. The increased income level will further promote non-renewable energy use, which is not harmful to environmental quality. On the other hand, the study reveals that renewable electricity output and energy efficiency could be measured for reducing harmful environmental quality. But, energy-related emissions are increasing, meaning renewable energy electricity output and energy efficiency are not up to the mark level in Nigeria.

### **Recommendations**

Based on the findings, this study recommends that renewable energy electricity output and energy efficiency could be used for environmental recovery and sustainability. Since the industrial sector is the key sector that helps the economy to stabilize and achieve higher economic growth levels, policies must be made to accommodate the structural transformation of the industrial sector towards renewable energy resources. Such can include subsidies and tax benefits for industries using renewable energy to make renewable energy resources more attractive and feasible for the economy.

In addition, policies that target renewable electricity need more attention to attain a low-carbon economy in the future. Moreover, energy-efficient resources must be adopted and promoted to save energy, lower energy demand, and reduce energy-related emissions. Importantly, there is a need for increased investment in technologies and research and development to promote renewable energy and energy-efficient products and services usages.

The ultimate goal is to supply adequate energy to support the growth and development of the economy from viable sources and to have a one-stop shop that assesses what infrastructure is necessary for such to happen that can lead to industrial development. Note the country does not need to sacrifice economic growth for low emission levels. CO<sub>2</sub> emissions reduction can be achieved via energy conservation without negative long-run effects on economic growth. So, the government needs to integrate emissions regulation with economic development policies.

This study's scope is limited to CO<sub>2</sub> emissions from the industrial sector, oil production, and gas flaring. It does not account for electrification, fuel switching within the building sector, or transportation-related CO<sub>2</sub> emissions.

The recommendations for future studies, keeping in view the future growths in various sectors of the economy, the economic policies maker of the country need studies for future projections on energy needs and use. This is important information for the timely development of the energy sector as there is a need to conduct a more detailed study to project for future energy requirements to be better informed for making credible plans for the energy sector's timely development of energy sector. There is a need to conduct a more detailed study to project future energy requirements to be better informed for making credible plans for the energy sector.

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## Islamic bank efficiency: an efficiency method with SFA

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### Abstract

Judging from the financial ratios, the performance of Islamic banking in Indonesia was remarkably stable both before and during the Covid-19 pandemic. However, another thing is whether this condition could make Islamic banks continue to work effectively. This study aimed to measure the cost efficiency of Islamic commercial banks in Indonesia quarter I of 2019 – quarter IV of 2020 and analyze the influencing factors in cost efficiency. The study used a saturated sampling technique with a total sample of 14 Islamic commercial banks, while the efficiency level was determined using the Stochastic Frontier Analysis (SFA) method. It turns out that PT. Bank Muamalat Indonesia Tbk. has the highest efficiency value of 0.9284. Several banks with an efficiency value of more than 0.5 are PT. Bank Aceh Syariah, PT. Bank BNI Syariah, and PT. Bank Mega Syariah. In this study, only inflation variables affect efficiency. In contrast, bank size, Return on Assets (ROA), Net Operating Margin (NOM), Non-Performing Financing (NPF), Financing to Deposit Ratio (FDR) variables, Capital Adequacy Ratio (CAR), Gross Domestic Product (GDP), and the rupiah exchange rate don't affect the efficiency. Overall, all the company's internal variables and environmental variables affect efficiency.

**Keywords:** Cost efficiency, Islamic bank, Stochastic Frontier Analysis

**JEL Classification:** [D24, E58, G21]

### INTRODUCTION

Islamic finance is becoming increasingly important today because of its significant benefits (Diallo & Gundogdu, 2021; Shah et al., 2021). Especially the Islamic banking industry, which is growing rapidly. Bitar et al. (2017) stated that the Islamic financial industry worldwide had experienced significant growth since 25 years ago compared to conventional banking. At the same time, the S&P Global Ratings estimates that the financial industry will grow 10% -12% in 2021-2022 (S&P Global Ratings, 2021). The increasing growth of Islamic Banking has generated debate among policymakers and economists about the sustainability and performance of Islamic Banking (Majeed, 2021).

The first Islamic banking in Southeast Asia was formed in 1983 in Malaysia by Bank Islam Malaysia Berhad (Ghozali et al., 2019). Meanwhile, in Indonesia, the existence of Islamic banks was initiated in the 1980s through various discussions with the theme "Islamic Banks as Pillars of Islamic Economics," which was later supported

through the 1988 Banking Deregulation Policy Package (Pakto 88). Finally, in 1992 the Indonesian Ulema Council (MUI) established the first Indonesian sharia bank, PT. Bank Muamalat Indonesia (BMI). Since its first inception, there have been many changes. A series of policies were carried out to improve the performance of Islamic banks, with the enactment of several laws such as (i) Law No. 21 of 2008 concerning Islamic Banking, (ii) Law No. 19 of 2008 concerning Securities, State sharia certificate (Sukuk). This series of policies provided a legal umbrella and indirectly increased Islamic financial market activities (OJK, 2017).

Islamic banking in Indonesia has continued to grow since the enactment of Law No. 21 of 2008 concerning Islamic Banking. To date, the number of Sharia banks has increased to 11 entities. Islamic banking in Indonesia is one of the leading indicators of developing the Islamic financial economy. As an intermediary institution, banking operations are highly dependent on the community's economic conditions, especially amid the current Covid-19 pandemic, which has caused the government to issue several policies that impact the community's economy, indirectly affecting the Islamic banking's economic condition.

Economic conditions can be viewed from macroeconomic factors, such as Gross Domestic Product (GDP), inflation rates, and exchange rates. In 2019, Indonesia's GDP was deemed stable at 5.06 at the beginning of 2019 and fell at the end of the year to 4.96. It continued to decline until the 2nd quarter of 2020 to -5.32 and rose 3.13 points at the end of 2020 to -2.19 due to the impact of the Covid-19 pandemic. Not much different from GDP, inflation in Indonesia also fluctuated. In early 2019, inflation was recorded at 2.48 and continued to decline to 0.8 points at the end of 2020. Meanwhile, the Rupiah's exchange rate against the Dollar was not much different. In the middle of 2020, the Rupiah was recorded to depreciate up to Rp deeply. 16.6367,-/USD, hampering all economic activities.

The Covid pandemic has impacted financial stability and bank resilience, which depend on the bank's performance (Demir & Danisman, 2021). Even according to Elnahass et al. (2021), this pandemic has had a global impact on banking. Regarding banking performance, the pandemic affects some aspects of banking activities, such as savings. People will use existing funds for consumption rather than saving in banks. Apart from financing, people tend to have difficulty returning their loans to the bank. Of course, this situation has affected the growth of Return on Assets (ROA), Net Operating Margin (NOM) income, financing such as Financing to Deposit Ratio (FDR), Non-Performing Financing (NPF), and asset quality of Capital Adequacy Ratio (CAR). However, the research results of Shamsur and Weill (2019) state that increasing bank efficiency can encourage access to credit because the efficiency of large banks is significantly related to lower credit costs.

The Islamic financial system can increase bank financial stability and resilience to financial crises' effects (Rashid et al. (2017). In addition, the Global Financial Crisis (GFC) has focused attention on Islamic banking as an alternative business model for banking (Asmild et al., 2019). During a crisis, the research results by Parisi et al. (2021) show that the efficiency of Islamic banks is higher than conventional banks. Likewise, Yusuf et al. (2021) state that the efficiency of Islamic banks tends to be higher. This result is not in line with Miah & Sharmeen (2015), which shows that conventional banks are more efficient in managing costs than Islamic banks. Based on statistics, the growth of total financing and third-party funds (TPF), Islamic banking is still sound, where financing growth is at 7.15% with TPF growth of 9.74%. Although the growth of Islamic banks is considered quite good, this condition certainly causes banks to be more



careful in extending credit to the public, especially with limited inputs. Islamic banking is expected to be able to reduce the number of non-performing financing amid policies related to restructuring to ease creditors in settling their obligations.

The concept of the 'efficient frontier' is a central concept in the production economy, where the measurement is more stringent when compared to the measurement of financial ratios (Emrouznejad & Yang, 2018). According to Rabbaniyah & Afandi (2019), the efficiency performance parameters can show the company's entire performance. Efficiency is crucial for the proper functioning of the banking system (Martens et al., 2021; Rashid et al., 2020c). Meanwhile, Mohamed et al. (2020) confirm a gap between a bank's actual level of technical efficiency and its potential level.

We can use two methods to calculate the efficiency of Islamic banks: parametric and non-parametric. One of the parametric methods that can be used is the Stochastic Frontier Approach (SFA), while the non-parametric method that can be used is Data Envelopment Analysis (DEA) (Sun et al., 2023; Miah & Sharmeen, 2015). The SFA method has advantages over other methods because it first involves a disturbance term representing measurement error, disturbance, and exogenous shock. In addition, it allows hypothesis testing using statistics because environmental variables are easy to treat and identify outliers (Coelli, 2005). The statement is supported by Nguyen & Pham (2020), which aimed to examine the differences between parametric and non-parametric methods in measuring bank efficiency. They used the methods of Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA). This study shows that the cost efficiency obtained with the Stochastic Frontier Analysis (SFA) model is more consistent than the cost efficiency with the Data Envelopment Analysis (DEA) model. So in this study, the Stochastic Frontier Analysis (SFA) model is used to measure efficiency. Sakouvogui (2020) compared DEA and SFA in banking in America. The results show that the cost efficiency measures of homogeneous SFA and DEA are substantially higher on average over time than heterogeneous US banks.

Research on efficiency using the SFA method can be used to examine banking performance, among others was done by Tri & Anh (2020) on 26 Vietnamese domestic banks through intermediation and a production approach. The study aimed to determine input and output variables, the results of which showed an efficiency value of 0.8. These results are not much different from the research by Wang et al. (2019). The latter showed that the efficiency of Vietnam's banking sector was between 0.8 to 0.9, and bank loans have a significantly negative effect on cost efficiency.

Another study related to efficiency by Chaity et al. (2021) found a relationship between bank efficiency regarding corporate governance guidelines and the extent of earnings management practices in the banking industry. The study results show that the efficiency level of banks in Bangladesh has an average of 80.84%. Besides that, the research results also show that bank efficiency is not affected by asset growth, bank size, or economic conditions.

Octrina & Mariam (2021) revealed that only two of eleven Islamic banks have an efficiency value close to 1. Besides, based on the influence test, the factors affecting Islamic banking's efficiency in Indonesia comprised bank size, Financing to Deposit Ratio (FDR), Capital Adequacy Ratio (CAR), and Non-Performing Finance (NPF), while other variables had no effect. The bank efficiency level can be enhanced by increasing competition in the banking industry.

Hadhek et al. (2018) conducted a study on profit efficiency in 37 Islamic banks in 15 countries during 2005-2014, aiming to compare the efficiency level among various Islamic banks using input variables, such as labor, funds, physical capital, price of

labor, fund, and physical capital. Meanwhile, the output variables in the study were net loans and other earnings assets. In addition, another objective of their research was to determine explanative factors causing inefficiency and reducing profit efficiency by using variables such as macroeconomic variables (GDP per capita, inflation rate, population density) and efficiency determinants (size, capital adequacy, profitability, credit risk, operational costs). The results of this study indicated that the average level of profit efficiency was 25.7%, meaning that inefficient use of the bank's input would reduce profits by 74.3%, and only credit risk did not affect the Islamic banks' profit efficiency.

Furthermore, the hypothesis testing panel results showed that total savings significantly and positively affected financing and operational costs. In contrast, other operational costs had a positive and insignificant effect. By using a different t-test, it showed that there was no difference in the efficiency level comparison between Islamic banks and SBUs. This result aligns with Rabbaniyah & Afandi (2019), which showed no significant difference between the average efficiency value of Islamic banks' foreign exchange and non-foreign exchange during 2010-2016.

Kustanti & Indriani (2016) conducted a comparative analysis of 10 Islamic banks' efficiency and 5 SBUs during 2010-2014 using the SFA method. The study results indicated that total assets positively and significantly affected total financing. Meanwhile, operating costs nor labor costs did not affect total financing. The results showed no significant difference between the Islamic banks' and SBUs' efficiency, which was 0.43994 and 0.47654 for Islamic banks and SBUs, respectively. This value indicated the inefficient Islamic banking in Indonesia. These results do not align with Chowdhury's research (2022), which shows that Islamic banks are better in terms of overall technical efficiency when compared to commercial banks.

Sufian & Kamarudin (2015) examined the Islamic banks' efficiency in Southeast Asian countries operating in Malaysia, Indonesia, and Brunei Darussalam. This study investigated the potential internal (bank-specific) and external (macroeconomic and industry-specific) factors affecting Islamic banks' income efficiency. Empirical findings revealed that income efficiency had a more significant influence on profit efficiency. It revealed that bank size, asset quality, capital, liquidity, and management quality significantly affected the domestic Islamic banks' income efficiency operating in Malaysia, Indonesia, and Brunei Darussalam during the study period.

Another study by Khalifaturafi'ah (2021) showed that the bank's cost efficiency in Indonesia has a negative effect on bank's financial performance. The Capital Adequacy Ratio (CAR) and Loan to Deposit Ratio (LDR) have a positive effect on Return on Assets (ROA) and Net Interest Margin (NIM). Meanwhile, financial ratios proxied by Non-Performing Loans and Equity to Total Assets have a negative effect on Return on Assets and Return on Equity. Another research by Khalifaturafi'ah (2018) states that there is no effect of profit and cost efficiency on the level of profitability of Islamic banks.

Recently, there has been a multitude of studies related to banking efficiency. Based on Ikra et al. (2021), the efficiency literature on Islamic banking has increased since 2008. However, no further research has yet discussed how Islamic banking efficiency is amid the current pandemic and the factors affecting its efficiency. Based on this rationale, it is necessary to conduct a study related to Islamic banks' performance conditions, which can be viewed from how efficiently Islamic banks manage inputs to produce some outputs. It is crucial since research on the cost efficiency of Islamic banks during the pandemic has not been carried out. Therefore, the study's primary purpose

was to determine the Islamic banks' efficiency in Indonesia during the pandemic by using the Stochastic Frontier Analysis (SFA) test and analyzing its influential factors.

Microeconomic theory (consumer and producer theory) initiates the concept of efficiency theory (Monica et al. 2020). The producer theory tends to minimize costs and maximize profits. In this theory, the term production frontier line shows the relationship between the company's input line (representing the use of technology) and output (representing the maximum output level). Analysis of financial institutions can use a frontier approach, in which the frontier efficiency of a financial institution is measured based on the financial institution's performance relative to the estimated performance of the "best" financial institution in the industry, provided that the financial institution faces the same market conditions. According to Octrina & Mariam (2021), a company is considered efficient if it can maximize the output of its inputs.

There are three concepts to measure the financial institution's efficiency which are (Berger & Mester, 1997): 1) Cost efficiency calculates how close bank fees are to the "best practice" of the fees to produce the same number of outputs under the same conditions; 2) Standard profit efficiency measures how close a bank is to generate the maximum possible profit by considering a certain level of input and output prices 3) Alternative profit efficiency is measured by how close the bank is to obtain the maximum profit based on its output level rather than its output price.

Economic performance is an economic condition with limited resources but can obtain optimal production, considering the resulting costs and benefits of different decisions (Allothman, Al-Mahish, 2020). Cost efficiency consists of two components, i.e., allocative and technical efficiency (Anwar, 2019). According to Coelli et al. (2005:263), allocative efficiency measures a company's ability to use inputs at a certain price. In contrast, technical efficiency measures its ability to obtain a maximum output with a certain input level. The combination of these two components forms economic efficiency.

Furthermore, non-parametric methods include Total Factor Productivity (TFP) and Data Envelopment Analysis (DEA). According to Rabbaniyah & Afandi (2019), one of the differences between these two methods is that the parametric method includes random errors while the non-parametric method does not. Based on the explanation above, the SFA method is used in this study.

The determination of cost efficiency ranges from 0 to 1, where one indicates a bank is the most efficient, while 0 indicates the least efficient (Silva et al. 2018; Apriyana et al. 2015). The components of inefficiency and random error of the composite error are described by assuming their distribution. Inefficiency is assumed to be one-sided (generally half-normally distributed), while random error is assumed to be two-sided (generally normally distributed) (Berger and Mester (1997). Based on Wang et al.(2019), to calculate the cost function, one can use the formula:  $\ln TC_{it} = \ln C(y_{it}, w_{it}) + \varepsilon_{it}$ .  $\ln TC_{it}$  refers to the total cost,  $\ln C(y_{it}, w_{it})$  denotes the cost function,  $y_{it}$  is the output variable, and  $w_{it}$  describes the input variable.

There are two approaches used to identify the relationship between output and input variables in calculating efficiency, i.e., the intermediation approach (introduced by Sealey and Lindley in 1977) and the production approach (introduced by Cobb and Douglas in 1928) (Apriyana et al. 2015). The intermediation approach sees banks as intermediary institutions for financial services. It assumes banks are intermediaries by hiring workers and capital to collect deposit funds to be used as loans and other earnings assets. Then, the production approach assumes the banks' activities produce services and see them as workers and capital users to provide savings and loans.

Most studies state that choice variables influence efficiency measures (Zaabouti et al., 2016). Therefore, various input-output variables are used, including variables that affect efficiency. But in this study, the variables will refer to Anwar's research. The cost components used in this study are total costs. According to Anwar (2014), total costs are operational and non-operational.

Furthermore, the intermediation approach determines this study's output and input variables because it considers the bank's primary role as an intermediary institution. The input variables used are: 1) The cost of funds is the total cost of the deposit divided by the total deposit; 2) The price of labor is the total cost of labor divided by total assets; 3) The price of capital, which is non-profit sharing cost divided by fixed assets. Meanwhile, the output variables in this study consist of 1) total financing, which is the total financing in all sectors of each Islamic commercial bank at the end of the month; 2) Securities and investment is the total investment in securities and all placements of each Islamic commercial bank at the end of the month; 3) Each Islamic commercial bank earns other revenue at the end of the month.

The bank size variable is used to describe the size of a bank (Hadhek et al. (2018). In this study, the bank size is determined using core capital. According to Octrina and Mariam (2021), the use of core capital to determine the bank size is due to the minimum limit of core capital in Bank Indonesia Regulation No. 14/26/PBI/2012. Based on the Financial Services Authority (POJK) Regulation Number 21/POJK.03 2014, core capital consists of two types, i.e., primary and additional core capital. The primary core capital includes paid-in capital and additional reserve capital. Islamic banks must provide a core capital of at least 6% of the Risk-Weighted Assets (RWA) and a minimum of 4.5% of the RWA.

Profitability ratios determine a company's ability to generate profits concerning revenues, operating costs, assets, and equity (Uddin et al., 2022). Melicher & Norton (2016) define Return on Assets (ROA) as a ratio describing how a company earns profits on its assets. A company can generate a return on its assets by two basic strategies: offering low prices and low-profit margins to seek high sales volume. The second one sells high-quality goods and relies on high-profit margins but low sales volume. According to Mahardika (2015), ROA is the ratio between net income and total assets.

Net Operating Margin (NOM) is the ratio between net profit and total bank income. The higher this ratio, the better the bank's performance in utilizing its resources for optimum profit (Mahardika, 2015). NOM constitutes the bank's profitability ratio. The stability of NOM value must be maintained to remain stable. A low NOM value indicates a low profitability value or low profits obtained. On the other hand, a high NOM value indicates a high profitability value, which means large profits are earned (Suryanto & Susanti (2020).

Mahardika (2015) defines Non-Performing Financing (NPF) as the ratio Islamic banks use to calculate non-performing financing and total financing. NPF is divided into two, which are NPF Net and NPF Gross. The difference lies in the Allowance for Earning Assets Losses (PPAP). The Gross NPF does not include PPAP in the calculation, while the net NPF does. The higher the ratio indicates the poorer performance of Islamic banks in channeling their financing. According to Suryanto & Susanti (2020), NPF can be used to see the financing risks Islamic banks face since they finance customers. The greater this risk, the greater the financing risk the Islamic bank bears, and vice versa.

The Financing to Deposit Ratio (FDR) measures Islamic banks' ability to meet short-term obligations (Suryanto & Susanti, 2020). In other words, FDR indicates a bank's ability to repay withdrawals made by depositors by relying on financing it has carried out as a source of liquidity. In addition, the Financing to Deposit Ratio (FDR) is a ratio used to compare the number of funds a bank has collected from customers and channeled to financing to customers in need (Mahardika, 2015). If this ratio reaches 100%, it means that 100% of the bank's funds are used to finance needy customers.

The Capital Adequacy Ratio (CAR) is also known as the Minimum Capital Adequacy Ratio (MCAR) (Wardiyah, 2019). The amount of bank's CAR is determined based on the amount of capital it owns and the amount of Risk-Weighted Assets (RWA) managed by the respective bank.

The study of overall economic behavior is called macroeconomics (Hasyim, 2017). It encompasses currency exchange rates, recessions, the economy's output of goods and services, the balance of payments, output growth rates, inflation, and unemployment rates. Macroeconomics explains the demand and supply (aggregates) that determine economic activity, the main economic problems, policies, and government intervention in overcoming economy-related problems. Macroeconomic policy is divided into three domains, which are fiscal policy (taxes and government spending), monetary policy (interest rates), and supply-side policies (income policy).

Macroeconomics studies the aggregate activities of households, firms, and markets (Piros & Pinto, 2013). Macroeconomics is focused on national aggregates, such as total investment, total consumption, aggregate consumption of household goods and services, and interest rates. The nation's aggregate output and income, labor productivity, price levels, and inflation rates are examples of macroeconomic analysis. Mankiw (2017) states that macroeconomics studies the economy as a whole. The purpose of macroeconomics is to explain the economic changes that occur in households, firms, and markets simultaneously.

The gross domestic product is the most visible macroeconomics, which measures a country's total income. Based on the explanation above, macroeconomics is the study of economic behavior. This study considers GDP, inflation, and exchange macroeconomic variables.

The healthy or bad of a nation's economy can be seen through the Gross Domestic Product (GDP) (Mankiw, 2017). It calculates two variables at a time, i.e., total income per capita in the economic system and total spending on the economy's output of goods and services. GDP is the market value of all final goods and services produced in a country in a given period. According to Melicher & Norton (2016), GDP is a country's output of goods and services achieved over a certain period, usually one year. An increase in GDP over time measures the economic growth in a country.

Piros & Pinto (2013) propose that inflation is a continuous increase in prices at the overall price level in an economic system. The inflation rate is the percentage change in the price index. Investors follow a country's inflation rate closely because it can help infer the state of its economy and that unexpected changes in inflation can result in changes in monetary policy with a significant and direct impact on prices.

The difference between nominal Gross Domestic Product (GDP) and real GDP is caused by increased goods prices, as so-called inflation (Hasyim, 2017). The inflation rate is the percentage increase in prices over a certain period. The higher the inflation rate, the higher the price of goods in the market. Therefore, inflation is less desirable for each individual; even when prices rise, income increases. Inflation can be influenced by economic and political instability in a country, unreasonable public demand, excessive

money supply, and increased production costs. According to Mankiw (2017), inflation is a condition where prices increase at all economic price levels. Over time, inflation is regarded as an economic problem because it causes an increase in various kinds of costs in society. Thus, maintaining inflation as low as possible is the goal of various economic regulators worldwide. Based on the explanation above, inflation is an economic condition with an increase in the overall price level in an economic system.

The exchange rate has two meanings, i.e., nominal and real exchange rates (Mankiw, 2017). The former refers to the exchange rate at which a person can trade a country's currency with the currency of another, while the latter refers to the rate at which a person can trade goods and services from one country with goods and services from other countries. Meanwhile, Melicher & Norton (2016) state that the exchange rate is the price of one currency against the value of other currencies. An increase or decrease in exchange rates can affect the cash flows of multinational companies. Based on the explanation above, the exchange rate has two meanings: nominal and real exchange rates. The nominal exchange rate is the price of a country's currency against other countries' currencies. In contrast, the real exchange rate is the price of goods and services in one country against that of others.

## METHODS

This study is descriptive and causal research. This study uses a purposive sampling technique to select the data with the criteria: Islamic commercial banks that consistently publish financial reports during the period and Islamic commercial banks that are not in the merger acquisition or liquidation process. The data in this study is a combination of time series and cross-section data with a total sample of 11 banks. The research period extended from the 1st quarter of 2019 to the 4th quarter of 2020. The research model is as follows:

$$CE_{it} = \alpha_0 + \beta_1 LNSIZE_{it} + \beta_2 ROA_{it} + \beta_3 NOM_{it} + \beta_4 NPF_{it} + \ln \beta_5 FDR_{it} + \ln \beta_6 CAR_{it} + \beta_7 GDP_t + \beta_8 INFL_t + \beta_9 RATE_t + \varepsilon_{it}$$

Note:

$CE_{it}$  = efficiency estimation of cost-I at period-t.

$\beta_1 LNSIZE_{it}$  = core capital logarithm

$\beta_2 ROA_{it}$  = Return on Asset

$\beta_3 NOM_{it}$  = Net Operating Margin (NOM)

$\beta_4 NPF_{it}$  = Non Performing Financing (NPF)

$\ln \beta_5 FDR_{it}$  = Financing to Deposit Ratio (FDR)

$\ln \beta_6 CAR_{it}$  = Capital Adequacy Ratio (CAR)

$\beta_7 GDP$  = Gross Domestic Product (GDP)

$\beta_8 INFL_t$  = inflation

$\beta_9 RATE_t$  = exchange rate

$\varepsilon_{it}$  = error

## RESULT AND DISCUSSION

### Result

In the descriptive statistical analysis, the total cost was used as a component variable for the cost efficiency assessment using the SFA method. Later, the Price of Funds (POF), Price of Labor (POL), and Price of Capital (POC) were processed as input variables. The total financing, securities investment, and other revenue as output variables of the efficiency test. Table 1 describes the descriptive statistical results using efficiency input and output variables.

**Table 1.** Description of efficiency

	Mean	Std. Dev.	Maximum	Minimum
Total cost (million Rupiah)	1,327,478	1,679,456	9,272,387	10,203
Total financing (million Rupiah)	6,574,974	7,910,635	30,150,027	0.0000
Securities investment (million Rupiah)	16,655,861	20,717,001	83,787,968	0.0000
Other revenue (million Rupiah)	40,759,98	111,231,5	799,886	0.0000
Price of funds (PoF)	6.476846	10.66152	69.4901	0.0000
Price of labor (PoL)	0.012959	0.011112	0.068	0.0022
Price of capital (PoC)	0.995067	1.833874	8.074	0.0000

Source: data processing, 2021

The variable of total cost indicates the operational scale of Islamic commercial banks. The total cost has an average value of Rp1,327,478 billion, with the lowest value of IDR 10.203 billion, attributed to PT. Bank Aladin Syariah Tbk. In the first quarter of 2019, the bank did not issue a profit-sharing distribution. Meanwhile, the highest total cost value was obtained by PT. Bank Syariah Mandiri, accounting for Rp. 9,272,387 billion in the fourth quarter of 2019, which breaks down to Rp. 6,220.194 billion for other operating expenses and Rp. 3,052.193 billion used for profit-sharing distribution. It shows that PT. Bank Syariah Mandiri has large operating expenses, while the total financing variable has an average value of IDR 6,574,974 billion. The lowest value is 0, owned by PT. Bank Aladin Syariah Tbk. in the first quarter of 2019 due to a halt in financing activities. The highest total financing value was IDR 30,150,027 billion, carried out in the fourth quarter of 2020 by PT. Bank Syariah Mandiri.

The variable of securities investment has an average value of Rp. 16,655.861 billion. In this variable, the highest value is at Rp. 83,787.968 billion was attributed to PT. Bank Mandiri Syariah in the fourth quarter of 2020. It shows that the bank had the largest investment in current accounts, savings, and deposits during this period compared to other Islamic commercial banks.

Furthermore, the lowest value of this variable is owned by PT. Bank Aladin Syariah Tbk. with a value of 0 in the third quarter of 2019. The other revenue variable has an average value of IDR 40,759.98 million. PT. Bank Syariah Mandiri owned the highest value of IDR 799.886 billion in the fourth quarter of 2020, indicating the excellent bank's capability to obtain other profits. The lowest value of this variable is owned by PT. Bank Aladin Syariah Tbk., i.e., 0 in the first quarter of 2019, which shows that the bank has difficulty earning other income.

The variable of fund price has a mean of 6.476846, with the highest value of 69.4901 attributed to PT. Bank Victoria Syariah in the second quarter of 2020. It shows that the bank has a much higher total cost of deposits than the deposits it owned, indicating its poor performance in obtaining deposits from customers. Furthermore, the lowest value of this variable is owned by PT. Bank Aladin Syariah Tbk. in the first quarter of 2020, with a value of 0. It shows that the bank did not perform deposit activities, leading to no deposit costs incurred. The price of labor variable has a mean of 0.012959 and a standard deviation of 0.011112, with the smallest value of 0.0022 obtained by PT. Bank Panin Dubai Syariah Tbk. in the first quarter of 2020. It is because very low total labor costs it incurred compared to the total assets it owned.

Furthermore, the largest value of 0.068 was obtained by PT. Bank BTPN Syariah Tbk. in the fourth quarter of 2019. It shows pretty high labor costs the bank incurred compared to others. The variable of the price of capital has a mean value of 0.995067 and a standard deviation of 1.833874. The maximum value of this variable is 8.074, owned by PT. Bank BRI Syariah Tbk. in the second quarter of 2019. Meanwhile, the

lowest value is 0, owned by PT. Bank BTPN Syariah, Tbk. and PT. Bank Aladin Syariah Tbk. since it did not finance other than share the lease financing results.

Using Frontier 4.1., if the value of the SFA result is close to 1, it indicates that a bank is more efficient in using inputs to produce some outputs. On the other hand, the closer the value to 0 indicates that the Islamic commercial bank is inefficient. Table 2 presents the assessment result of Islamic commercial banks' efficiency.

**Table 2.** Islamic banks' efficiency assessment results

No	Bank name	Assessment result
1	PT. Bank Aceh Syariah	0.5861
2	PT. BPD NTB Syariah	0.3004
3	PT. Bank Muamalat Indonesia Tbk.	0.9284
4	PT. Bank Victoria Syariah Tbk.	0.1180
5	PT. Bank BRI Syariah Tbk.	0.1328
6	PT. Bank BJB Syariah	0.2499
7	PT. Bank BNI Syariah	0.7840
8	PT. Bank Mega Syariah	0.5337
9	PT. Bank Panin Dubai Syariah Tbk.	0.3368
10	PT. Bank Syariah Bukopin	0.2010
11	PT. Bank BCA Syariah Tbk.	0.3061
12	PT. Bank BTPN Syariah Tbk.	0.3498
13	PT. Bank Aladin Syariah Tbk.	0.1125
14	PT. Bank Syariah Mandiri	0.2065
Mean efficiency		0.5858

Source: data processing, 2021

Table 2 presents the results of the efficiency assessment of Islamic commercial banks for the quarter I of 2019 – quarter IV of 2020. It shows that PT. Bank Muamalat Indonesia Tbk. had the highest efficiency value of 0.9284. It indicates that it used inputs (price of funds, price of labor, and price of capital) to produce outputs (total financing, securities investment, and other revenue) very well compared to other Islamic commercial banks in the same period. Several banks had a higher efficiency value of more than the average of 0.5858, such as PT. Bank Aceh Syariah with a value of 0.5861, PT. Bank BNI Syariah had a value of 0.7840, while 11 other banks were below the average.

The multicollinearity test was used to determine a linear relationship between independent variables in the regression.

**Table 3.** Lagrange Multiplier test results

	LNSIZE	ROA	NOM	NPF	FDR	CAR	GDP	Inflation	Exchange Rate
<b>LNSIZE</b>	1								
<b>ROA</b>	0.009857	1							
<b>NOM</b>	0.172529	0.727887	1						
<b>NPF</b>	-0.14322	-0.5447	-0.39811	1					
<b>FDR</b>	-0.12316	0.216453	-0.02114	-0.11032	1				
<b>CAR</b>	-0.19727	0.209008	0.021248	-0.02556	0.118979	1			
<b>GDP</b>	-0.05726	0.057845	0.07615	0.012313	0.079401	0.056075	1		
<b>Inflation</b>	-0.05465	0.062013	0.051902	0.028994	0.032298	0.017657	0.850294	1	
<b>Exchange Rate</b>	0.011416	-0.05837	-0.08416	0.018782	-0.07813	-0.06165	-0.10671	0.026099	1

Source: data processing, 2021



Generally, the multicollinearity test hypothesizes that  $H_1$  indicates multicollinearity exists while  $H_0$  does not. If it has a correlation coefficient value less than 0.9,  $H_0$  is accepted. Based on Table 3, each independent variable used in this study has a correlation coefficient value of  $<0.9$ . Therefore,  $H_0$  is accepted, and we can conclude no multicollinearity in this study.

**Table 4.** t-test results

Variable	Coefficient	Prob.
C	-0.000739	0.9982
Bank size	0.0017	0.5840
ROA	-0.000392	0.6597
NOM	0.001039	0.1208
NPF	0.002626	0.1590
FDR	0.0819+e7	0.8257
CAR	-0.00000340	0.7757
GDP	0.000743	0.3451
Inflation	-0.019314	0.0001*
Exchange rate	0.013072	0.7009
Adj R-squared	0.244949	
F-statistic	5.001101	
Prob(F-statistic)	0.000014	

Source: data processing, 2021

Note: \*significance level = 5%

Table 4 shows the effect of each independent variable on the dependent variable. Based on the table, only inflation affects the efficiency of Islamic banks with a value of 0.0001 or less than 0.05. Inflation has a significant effect, and the coefficient is negative on efficiency. It indicates that Islamic commercial banks' inflation and efficiency values inversely correlate. High inflation will affect economic conditions, reducing people's demand for saving and financing. The increase in inflation also affects the increase in the prices of goods and services, which indirectly increases the operational costs of Islamic banking and reduces its cost-efficiency

Furthermore, the probability value (F-statistic) of 0.000014, which is less than 0.05, indicates that all independent variables, i.e., bank size, ROA, CAR, NOM, NPF, FDR, inflation, GDP, and the exchange rate simultaneously have a significant effect on efficiency.

## Discussions

Based on the efficiency test results with the SFA method using the Frontier 4.1 application, during the first quarter of 2019 to the fourth quarter of 2020, the value of PT. Bank Muamalat Indonesia Tbk. is close to 1 with a value of 0.9284. This result indicates the bank, as the first Islamic commercial bank in Indonesia, can use its inputs and outputs very well. Furthermore, several banks with an efficiency value of more than 0.5 are PT. Bank Aceh Syariah, PT. Bank BNI Syariah, and PT. Bank Mega Syariah with 0.5861; 0.7840; and 0.5337, respectively. This result shows that the three Islamic commercial banks are pretty good at using their inputs and outputs but need to optimize the management of their inputs and outputs to produce better efficiency values. Meanwhile, ten other Islamic commercial banks in Indonesia almost fell into inefficiency and have increased and optimized their inputs or outputs to enhance efficiency values. The research result aligns with Octrina & Mariam's (2021) for 2011 – 2019.

Based on the hypothesis test results, the bank size, ROA, NOM, NPF, FDR, and CAR variables do not partially affect efficiency since the probability values are 0.5840; 0.6597; 0.1208; 0.1590; 0.8257; and 0.7757, respectively, or greater than 0.05. Therefore, those variables have no significant effect on efficiency. The study results align with research conducted by Muttaqin et al. (2020), which revealed that CAR and NPF had no significant effect on efficiency. Similarly, the research by Octrina and Mariam (2021) found that ROA and NOM had no significant effect on efficiency. However, the results of this study are not in line with those study results since, based on these research results, NPF, FDR, and CAR variables affect efficiency.

Based on the results of hypothesis testing, the probability value of the GDP and exchange variables have values of 0.3451 and 0.7009, respectively, or greater than 0.05. It explains that the GDP environmental variables GDP and exchange rate have no partially significant effect on efficiency. Meanwhile, inflation has a value of 0.0001 or less than 0.05, meaning that the inflation variable has a partially significant impact on efficiency. Inflation significantly affects efficiency, and the negative coefficient indicates that inflation and the efficiency value of Islamic commercial banks have an inverse correlation. Inflation is one of the benchmarks the Bank Indonesia refers to whether to incline or decline the BI-rate (credit interest rate). If inflation is high, Bank Indonesia will lower the BI rate to reduce money circulation in the community and vice versa. The decrease/increase in the BI rate indirectly causes Islamic commercial banks to adjust the price of financing and other products that may affect their efficiency. These study results align with those of Octrina & Mariam (2021), which revealed that GDP and the exchange rate did not affect efficiency. However, this research does not align with their study because they revealed that inflation did not affect efficiency. The results of this study are also in line with the research conducted by Hadhek et al. (2018), which found that inflation had a partial effect on efficiency.

The hypothesis test results show that bank-specific variables, such as bank size, ROA, NOM, NPF, FDR, CAR, and variables of the economic environment, i.e., GDP, inflation, exchange rate, have probability values (F-statistic) of  $0.000014 < 0.05$ , indicating that all independent variables (bank-specific variables and variables of economic environment) affect efficiency simultaneously.

These study results align with the research by Octrina & Mariam (2021), which showed that independent variables (bank-specific variables and variables of the economic environment) simultaneously affect cost efficiency. Furthermore, this research is also in line with Hadhek et al. (2018) findings, stating that variables of the economic environment (GDP and inflation) affected efficiency.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusion

Based on the results of analysis discussions on the Indonesian Islamic banks' efficiency assessment during the first quarter of 2019 – fourth quarter of 2020 using the Stochastic Frontier Analysis of Frontier 4.1. Before and during the Covid-19 pandemic, it shows that Bank Muamalat Indonesia has the highest efficiency level, almost reaching a value of 1. It is an efficient Islamic commercial bank, while the others still need improvement in input optimization to generate outputs. Inflation is the only variable significantly affecting Indonesia's Islamic banks' efficiency. Overall, the specific variables of bank size (bank size, ROA, NOM, NPF, FDR, CAR) and variables of economic environment (GDP, inflation, exchange rate) have a significant effect on the

Sharia/Islamic banks' efficiency in Indonesia for the first quarter of 2019 – fourth quarter of 2020.

### Recommendation

Based on these findings, it is expected that the Indonesian government sustains to encourage Islamic commercial banks through various regulations to develop. Islamic banks must consider efficiency matter in managing their inputs and outputs. Banks with a small operational scale should merge to enhance their core capital and operational scale. Islamic banks can also improve their Net Operating Margin (NOM) to amplify their profitability value and increase Financing to Deposit Ratio (FDR) to meet short-term obligations. Hence, they can survive and continue to grow in the future. This research has limitations in the diversity of data, the research period, and the number of research objects. It is hoped that further research can increase the research period and analyze the efficiency of Islamic banks after the pandemic.

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## Local government performance: financial condition perspective

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### Abstract

The government performance measurement is essential to assess target achievement and public services, one of which is measured from the perspective of financial conditions. This study aimed to measure the performance of the regency and municipal in Jambi Province. The measurement used eight ratios of the basic factors of local governments' finance to analyze financial conditions. Furthermore, Jambi municipal and Sungai Penuh municipal are the regions with the best financial condition viewed from regional income factors. At the same time, Tanjabbar has the best financial condition from regional expenditure factors. From operational factors, the best position was held by three regions: Kerinci, Tanjabbar, and Sarolangun Regencies. Additionally, Muaro Jambi Regency has the best financial condition viewed from the debt structure factor. Overall, the regencies and municipalities in Jambi Province are in good financial condition. Four regions are averagely good, six regions have better financial conditions, and one region is in the best financial condition compared to those included in the assessment process.

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*Keywords: Financial condition, Liability, Regional income*

**JEL Classification:** G31, O16, R51

### INTRODUCTION

The implementation of New Public Management (NPM) makes the government must work and provide services for consumers such as private organizations (Tarofder et al., 2017; Thomas & Nadiyah, 2017). Good NPM practices in Indonesia, such as performance appraisal, local financial management accountability, public service improvement, innovation, civic engagement in the planning process, and one-stop service, are outstanding examples of NPM practices in local governments in Indonesia (Rosyadi & Dharma, 2014). Local governments are increasingly aware of the importance of conducting periodic performance evaluations (Iacuzzi, 2022).

Performance measurement is important for local governments to assess their ability to achieve their goals. One way to measure the performance of government organizations is to assess the financial condition of the region (Maulina & Rhea, 2019; Pundissing & Pagiu, 2021). Financial conditions are evaluated to be able to provide an early warning so that the regions can immediately anticipate them.

The regional government must manage all funds from any sources to provide services to the community, and the results of financial accountability are shared with the stakeholders. Ritonga (2016) stated that the studies conducted in Indonesia and internationally to assess the financial condition of local governments were very limited. In contrast, local stakeholders in Indonesia certainly need information regarding the financial condition of local governments.

The financial condition assessment results will inform whether the region is experiencing financial difficulties. Accounting research has been conducted to evaluate the financial health of companies/ private and banking. For local governments, the results can be used to help detect signs of financial difficulty so that it can be prevented to improve community services (Skica et al., 2020; Padovani et al., 2018). For the legislature and public, the results of the assessment are used to evaluate and supervise the financial management of local government, which has yet to be done (van Helden & Reichard, 2019)

The indicators often used to measure the financial performance of local governments are the acquisition of Own-source Revenue (in Indonesia, it's called *Pendapatan Asli Daerah* or abbreviated as PAD), expenditure, and financial independence ratio. The development of the three indicators for regency/municipality in Jambi Province from 2019 to 2021 is presented in Table 1.

**Table 1.** PAD (in billion), expenditure (in billion), and financial independence ratio regency/ municipal in Jambi Province in 2019-2021

R/M	2019			2020			2021			Average
	OI	Exp	F.I. Ratio	OI	Exp	F.I. Ratio	OI	Exp	F.I. Ratio	
Batanghari	91.57	1,341.86	7%	104.23	1,196.95	9%	148.44	1,253.60	12%	9%
Bungo	140.33	1,386.88	10%	126.13	1,294.68	10%	126.13	1,294.68	10%	10%
Kerinci	85.90	1,330.74	6%	81.67	1,229.59	7%	100.78	1,143.50	9%	7%
Merangin	106.16	1,448.97	7%	100.32	1,422.30	7%	107.88	1,495.15	7%	7%
Muaro Jambi	93.79	1,148.46	8%	92.80	1,391.58	7%	110.75	1,326.75	8%	8%
Sarolangun	66.05	1,031.83	6%	70.10	1,221.82	6%	44.65	1,093.05	4%	5%
Tanjabbar	120.22	1,702.41	7%	115.56	1,390.38	8%	118.53	1,443.09	8%	8%
Tanjabtim	53.92	1,188.86	5%	49.65	1,095.36	5%	81.60	1,049.21	8%	6%
Tebo	83.24	1,119.84	7%	78.46	1,021.78	8%	92.92	1,145.76	8%	8%
Kota Jambi	393.43	1,661.36	24%	355.67	1,667.72	21%	384.73	1,057.41	36%	27%
Sungai Penuh	27.25	809.31	3%	59.11	803.62	7%	99.14	803.62	12%	8%
Average	114.71	1,288.23	8%	12.15	1,248.71	9%	128.69	1,191.44	11%	9%

Source: Processed Data

The independence ratio illustrates the ability of local governments to finance their government activities, development, and services to the people who have paid taxes and retribution as a source of income needed by the region (Basri & Nabiha, 2014; Tama, 2015; Mulyani et al. 2021). Local governments are considered independent if they can finance their activities (Zelmiyanti, 2016), shown by the high ratio of regional independence. Jambi municipal is the only local government with an independence ratio above 15%. The low independence ratio proves that the regencies and cities in Jambi Province are still very dependent on funds from the central government.

Local governments deal with some conditions, programs, and activities that must be performed along with the limitations, including financial problems. Therefore, it is required that local governments can streamline their financial management. Regrettably, the apparatus still have limited ability to assess the health of local governments as to whether they are at risk (McDonald, 2018)

In addition, the regional government is required to apply the pattern of entrepreneurship in community service as an effort to utilize resources to increase



productivity and effectiveness. Government officials must be prudent and prioritize opportunities to do work and structure to achieve value for money (efficient, effective, and economical) (Sama et al., 2014; Vela-Barguws et al., 2018).

Financial condition is a major concern for the government. They need to make the public sure that their regional finances are in good health. This can promote the community's support and legitimacy. Legitimacy aims to form a general view (Gaus, 2011). A government organization needs legitimacy to be more accepted by the community (Rahayu, 2016). Therefore, they must be positive and open to the public in delivering information about their performance (Halim & Kusufi, 2014; Anggadini, 2023). The community will participate if the local government has won the trust. Nevertheless, even though government organizations adhere to the principles of entrepreneurship, they don't work on a profit-oriented basis. Services to the community remain a top priority.

Many studies have been conducted on measuring the financial condition of local governments, both in Indonesia (Nirwana, 2020; Ritonga et al., 2019; Winarna, 2017 and Ritonga & Buanaputra, 2022) and other countries (Czupich, M., 2020; López-Hernández et al., 2018 and Cuadrado-Ballesteros & Bisogno, 2019). Likewise, the assessment of financial conditions for private companies has also been widely studied by accounting researchers. Research on the local government's financial condition is later than the private sector.

The assessment of financial conditions can refer to the Fiscal Trend Monitoring System Model (FTMS). FTMS is an early warning system to predict financial conditions (Ritonga, 2016). Local governments can also detect fiscal difficulties early if they do not meet standards in operations, debt, and community needs for several years using the Kloha Model (Kloha, Weissert, & Kleine, 2005). The Brown Model measures local government's financial condition, assessed from income, expenditure, operating position, and debt structure, but from a different perspective. Some indicators include income, expenditure, operational position, and debt structure (Maher & Nollenberger, 2009; Maher et al., 2020). Brown's model is used in this study. In addition, Ritonga et al. (2012) also developed indicators and other models for evaluating financial conditions.

This study aims to assess the financial condition of districts and cities in Jambi Province. However, research related to the financial condition of local governments is highly required. Leaders must continuously evaluate and monitor financial conditions in their jurisdiction (Maher & Nollenberger, 2009).

## **METHODS**

This study used the data from audited financial statements of the regency (R) and municipality (M) in Jambi Province. Data is sourced from each official website of the local government and the official website of the Director General of Regional Government Fiscal Balance of the Republic of Indonesia. A quantitative descriptive approach was employed to analyze the results of data processing. We did not consider obtaining an audit opinion; accordingly, all financial statements in 2013-2021 were used in this study. Ratios connect the components in the financial statements that were mostly used to assess the financial condition of private companies, for instance, to predict a company's bankruptcy (Altman, 1968). These ratios were also developed for local governments, such as those proposed by Brown (1993).

The application of the accrual basis by local governments referring to

Government Regulation No. 71 of 2010 concerning Government Accounting Standards makes government financial reports more informative. The new financial reporting model allows regions to comprehensively inform operational activities and financial positions (Kioko, 2013). Financial conditions can be evaluated by using financial statement data. The local government's financial condition was evaluated using four basic factors of local government finances by Brown (1993). The income factor consists of three ratios: the expenditure factor with one ratio, the operational position factor of three ratios, and the debt structure factor of ratios.

Data analyzed referring to the stages of financial condition assessment suggested by Brown (1993) as follows:

1. Calculating key financial ratios that consist of four main aspect ratios.
2. Comparing the ratios between local governments. Local government ratios were divided into quartiles-1 (25% of local governments having the lowest ratio score -1); quartile-2 (25% of local governments having a ratio above the lowest score of 0); quartile-3 (25% of local governments having a ratio above the quartile-2 ratio obtained a score of 1) and quartile-4 (25% of the local governments having the highest ratio obtained a score of 2).
3. Assess the condition score by adding all the ratio scores obtained from the second stage. It was performed to determine the comprehensive value of the local government's financial condition. The local governments whose total condition score was 0 or more were considered to have the best financial conditions. A score of 5 to 9 was considered better than most local governments. A total score of 1 to 4 was considered average. A score of 0 to -4 was considered worse than most other regional governments, and a score of -5 or less was considered one of the worst financial conditions among the analyzed local governments.

## RESULTS AND DISCUSSION

Brown (1993) developed ten indicators divided into four basic factors of local government finance to measure financial conditions. In this study, the regency and municipal governments' performance in Jambi Province was measured using financial conditions as a perspective divided into eight ratios. The long-term direct debt ratio was not used because most of the regencies and municipalities in Jambi Province did not have a balance in this account. The discussion is grouped into four basic financial factors:

### Regional revenue factors

One of the authorities granted to the regional government after implementing regional autonomy is to provide flexibility and optimization to explore sources of regional income, although they still have to pay attention to the community's economic, social, and cultural conditions and do not conflict with relevant regulations (Tanjung et al., 2021; Kis-Katos. & Sjahrir, 2017; Iek & Blesia, 2019; Musviyanti et al., 2022)

The financial condition can be assessed from income factors using three ratios: the ratio of total income to population, the comparison of total income from own sources with total revenue of general funds, and the comparison of general funds from other sources with the total sources of general funds. These ratios reflect whether the region can increase income sources and regional revenue to finance each population.

Local governments have good financial conditions if the ratio of total income to the population is high. Brown (1993) asserted that a high ratio indicates the ability of regions to obtain additional income. The higher the indicator ratio, the healthier the condition. It is because local governments can provide services to their communities. It

aligns with Kloha et al. (2005), stating that fiscal distress occurs when the government cannot provide services to the public and cannot pay bills.

**Table 2.** Income to population ratio, regency/municipal in Jambi Province, 2013-2021

R/M	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average
Sungai Penuh	6.53	6.94	7.19	8.04	7.72	7.99	8.97	8.09	7.96	7.71
Kerinci	3.44	3.71	4.14	4.49	5.07	5.06	5.44	5.02	4.71	4.57
Tanjabt看	4.37	0.23	4.31	5.07	4.99	5.01	5.44	4.75	5.02	4.35
Batanghari	3.74	3.69	3.51	4.08	4.39	4.44	4.84	4.35	4.38	4.16
Tanjabbar	3.69	3.61	2.98	3.92	3.99	4.21	4.92	4.19	4.80	4.03
Sarolangun	3.09	3.28	3.56	3.87	4.07	4.14	4.29	3.76	3.83	3.77
Merangin	2.61	2.88	3.16	3.47	3.54	3.48	3.88	3.48	3.87	3.38
Bungo	2.87	3.08	3.07	3.30	3.56	3.44	3.60	3.33	3.56	3.31
Tebo	2.49	2.72	2.67	2.94	2.96	3.15	3.26	3.01	3.42	2.96
Muaro Jambi	2.54	2.56	2.69	2.89	2.88	3.05	3.16	2.91	3.41	2.90
Kota Jambi	2.08	2.32	2.41	2.69	5.20	2.72	2.81	2.65	2.66	2.84
Average	3.40	3.18	3.61	4.07	4.40	4.24	4.60	4.14	4.33	4.00

Notes: Tanjabbar = Tanjung Jabung Barat; Tanjabtim = Tanjung Jabung Timur

Source: Processed data

Table 2 shows that Sungai Penuh municipality, an area of division from Kerinci regency, had the best income and population ratio. In contrast, Jambi municipality had the lowest ratio. This is due to the higher population of Jambi municipality than other regencies and municipalities in Jambi Province. This municipality has nominally higher regional income than other regions; however, this ratio is low since it has the highest population density.

Moreover, the financial condition of the regional income can be seen from the high and low amount of revenue coming from own funds compared to total revenue (Table 3).

**Table 3.** Own funds income to revenues ratio, regency/municipal in Jambi Province, 2013-2021

R/M	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average
Kota Jambi	0.13	0.19	0.19	0.18	0.13	0.21	0.23	0.22	0.23	0.19
Tanjabt看	0.03	0.72	0.04	0.04	0.07	0.05	0.05	0.05	0.07	0.12
Bungo	0.09	0.10	0.10	0.10	0.14	0.11	0.10	0.10	0.15	0.11
Batanghari	0.05	0.07	0.08	0.07	0.08	0.08	0.07	0.09	0.11	0.08
Tanjabbar	0.05	0.07	0.07	0.07	0.08	0.07	0.07	0.08	0.08	0.07
Kerinci	0.05	0.06	0.07	0.08	0.07	0.07	0.07	0.07	0.08	0.07
Tebo	0.04	0.06	0.07	0.06	0.07	0.07	0.07	0.07	0.08	0.07
Sarolangun	0.04	0.07	0.09	0.08	0.07	0.10	0.05	0.06	0.04	0.07
Merangin	0.05	0.06	0.07	0.04	0.06	0.07	0.07	0.07	0.08	0.06
Muaro Jambi	0.05	0.06	0.06	0.05	0.06	0.07	0.07	0.07	0.08	0.06
Sungai Penuh	0.04	0.06	0.06	0.05	0.05	0.04	0.03	0.03	0.08	0.05
Average	0.06	0.14	0.08	0.08	0.08	0.08	0.08	0.08	0.10	0.09

Source: Processed data

Sources of public own regional funds were from local revenue, including regional taxes, regional levies, and other legal revenues. The high ratio achievement for this indicator indicates the good condition of regional financial health. The closer the ratio to 1, the healthier the regional financial position.

Table 3 shows that only Jambi municipality, Muaro Jambi regency, Merangin regency, and Sungai Penuh municipality had an average ratio below 0.07. however,

these were still considered low because no region reached an average ratio of 25%. Jambi municipality continued to experience an increase in 2019 and 2021, and the ratio reached 0.23.

The region's financial condition can also be seen from its ability to extract sources of income from other public funds, which is presented in Table 4.

**Table 4.** Revenues from other general funding to total general funding ratio, regency/municipal in Jambi Province, 2013-2021

R/M	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average
Kota Jambi	0.87	0.81	0.81	0.82	0.87	0.79	0.77	0.78	0.77	0.81
Tanjabt看	0.97	0.28	0.96	0.96	0.93	0.95	0.95	0.95	0.93	0.88
Bungo	0.91	0.90	0.90	0.90	0.86	0.89	0.90	0.90	0.85	0.89
Batanghari	0.95	0.93	0.92	0.93	0.92	0.92	0.93	0.91	0.89	0.92
Tanjabbar	0.95	0.93	0.93	0.93	0.92	0.93	0.93	0.92	0.92	0.93
Kerinci	0.95	0.94	0.93	0.92	0.93	0.93	0.93	0.93	0.92	0.93
Tebo	0.96	0.94	0.93	0.94	0.93	0.93	0.93	0.93	0.92	0.93
Sarolangun	0.96	0.93	0.91	0.92	0.93	0.90	0.95	0.94	0.96	0.93
Merangin	0.95	0.94	0.93	0.96	0.94	0.93	0.93	0.93	0.92	0.94
Muaro Jambi	0.95	0.94	0.94	0.95	0.94	0.93	0.93	0.93	0.92	0.94
Sungai Penuh	0.96	0.94	0.94	0.95	0.95	0.96	0.97	0.97	0.92	0.95
Average	0.94	0.86	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.91

Source: Processed data

Overall, the regencies and municipalities in Jambi province in 2013-2021 had a relatively high ratio of other revenue sources compared to the total amount of general funds. It demonstrates that the regions still depend on the sources of revenue from the central. A low ratio indicates the good financial condition. Sungai Penuh municipality had the lowest ratio of other regions, although it reached 95% on average.

### Local expenditure factors

The expenditure aspect used in this study views the financial condition regarding expenditure on infrastructure spending. Ritonga (2014) asserted that the ratio of operational expenditure and low total expenditure shows the region's potential to allocate more budgets to capital expenditure. An overview of the Jambi regency and municipalities' achievement can be seen in Table 5.

**Table 5.** Operating expenditures to total expenditures ratio, regency/municipal in Jambi Province, 2013-2021

R/M	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average
Tanjabbar	0.59	0.55	0.74	0.78	0.67	0.69	0.59	0.75	1.00	0.70
Tanjabt看	0.61	0.65	0.70	0.66	0.74	0.72	0.72	0.79	0.78	0.71
Kota Jambi	0.76	0.77	0.73	0.72	0.72	0.72	0.74	0.73	0.53	0.71
Muaro Jambi	0.59	0.67	0.70	0.76	0.70	0.76	0.72	0.81	0.80	0.72
Sungai Penuh	0.65	0.72	0.73	0.71	0.75	0.74	0.78	0.77	0.79	0.74
Tebo	0.65	0.60	0.73	0.77	0.76	0.75	0.76	0.86	0.83	0.75
Sarolangun	0.74	0.73	0.73	0.79	0.78	0.81	0.60	0.80	0.85	0.76
Merangin	0.76	0.76	0.75	0.74	0.78	0.84	0.84	0.81	0.77	0.78
Batanghari	0.73	0.75	0.84	0.83	0.50	0.87	0.81	0.87	0.86	0.79
Kerinci	0.75	0.76	0.81	0.77	0.81	0.83	0.78	0.82	0.86	0.80
Bungo	0.75	0.81	0.84	0.90	0.87	0.84	0.83	0.88	0.91	0.85
Average	0.69	0.70	0.75	0.77	0.73	0.78	0.74	0.81	0.82	0.76

Source: Processed data

According to Ritonga (2016), a low ratio indicates well-maintained infrastructure. Bungo regency had the highest operational expenditure ratio; on average, 85% of regional expenditure was spent on operational expenses such as salary, goods, and services. One of the highest regional burdens was employee salary expenditure. The regencies and cities that became the parent before the division received a high ratio; this could indicate the high personnel expenditure that had to be spent each year.

### Operational position factors

The operational position aspect can be seen from the three ratios presented in Table 6 – 8. The three regions with the best performance comparison of total income with the best total expenditure are the Jambi Municipality (average ratio of 1.19), Sarolangun Regency, whose ratio was 1.05; and Muaro Jambi Regency, whose ratio was 1.03; Tanjabtim Regency had the lowest ratio which was 0.90.

**Table 6.** Total revenue to total expenditures ratio, regency/municipal in Jambi Province, 2013-2021

R/M	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average
Kota Jambi	1.01	1.03	0.97	1.03	2.05	1.03	1.02	0.97	1.56	1.19
Sarolangun	1.06	1.06	0.94	1.00	1.06	1.11	1.26	0.95	1.03	1.05
Muaro Jambi	0.92	0.98	1.07	1.05	0.97	1.06	1.22	0.95	1.05	1.03
Tebo	1.03	0.99	0.96	0.97	1.05	1.05	1.03	1.06	1.02	1.02
Bungo	0.95	1.00	0.96	1.06	1.08	0.97	0.97	0.98	1.13	1.01
Tanjabbar	0.99	0.83	0.91	1.24	1.02	1.03	0.96	1.02	1.07	1.01
Kerinci	1.01	1.04	1.06	0.90	1.02	1.04	0.98	0.98	1.04	1.01
Merangin	1.03	1.01	1.01	0.99	0.97	1.01	1.04	0.96	0.92	1.00
Sei. Penuh	1.00	1.08	0.95	0.95	1.00	0.97	1.01	1.00	0.97	0.99
Batanghari	0.99	1.00	0.94	1.03	0.61	1.03	0.98	1.00	1.07	0.96
Tanjabtim	0.98	0.05	1.00	1.03	1.03	0.96	1.01	0.96	1.11	0.90
Average	1.00	0.92	0.98	1.02	1.08	1.02	1.04	0.99	1.09	1.01

Source: Processed data

Overall, the regencies and cities in Jambi Province reached ratios above 0.8. The high ratio in this indicator shows the region's potential to experience positive equity.

A budget surplus (also called 'SILPA') that the region can use to finance regional expenditure must also be considered in measuring performance. Table 7 compares SILPA with the revenue from general fund sources from other general funds.

**Table 7.** SILPA to revenues from general fund ratio, regency/municipal in Jambi Province, 2013-2021

R/M	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average
Tanjabtim	0.10	4.79	0.05	0.06	0.05	0.11	0.07	0.08	0.07	0.60
Tanjabbar	0.42	0.11	0.01	0.19	0.20	0.21	0.14	0.18	0.05	0.17
Sarolangun	0.15	0.19	0.10	0.08	0.13	0.23	0.11	0.06	0.04	0.12
Sungai Penuh	0.20	0.24	0.17	0.09	0.08	0.05	0.07	0.12	0.06	0.12
Kota Jambi	0.14	0.16	0.12	0.10	0.05	0.13	0.16	0.13	0.06	0.12
Tebo	0.14	0.10	0.05	0.01	0.05	0.07	0.07	0.12	0.03	0.07
Kerinci	0.06	0.08	0.13	0.07	0.08	0.10	0.06	0.03	0.02	0.07
Merangin	0.08	0.08	0.08	0.05	0.02	0.03	0.07	0.05	0.05	0.06
Muaro Jambi	0.05	0.02	0.04	0.07	0.04	0.10	0.07	0.02	0.04	0.05
Bungo	0.07	0.06	0.02	0.03	0.10	0.06	0.02	0.01	0.01	0.04
Batanghari	0.10	0.08	0.01	0.03	0.02	0.04	0.01	0.01	0.01	0.04
Average	0.14	0.54	0.07	0.07	0.07	0.10	0.08	0.07	0.04	0.13

Source: Processed data

Related to the results in table 6, it can be seen that Tanjabtim had the highest ratio. The high ratios indicate that the regions can finance expenditures in a possible deficit. Batanghari regency had the lowest average ratio for the past nine years.

In addition to the comparison, the financial condition from the operational aspect can also be seen from the region’s ability to pay its short-term obligations (Table 8). Researchers only use total cash and cash equivalents. Because the local district and city governments in Jambi Province do not have short-term investments, all regions have long-term investments. Still, they cannot be used anytime for operational activities.

**Table 8.** General cash to general funds obligations ratio, regency/municipal in Jambi Province, 2013-2021

R/M	2015	2016	2017	2018	2019	2020	2021	Average
Tebo	4.69	0.16	1.19	2.42	107.23	1,080.63	199.39	199.39
Tanjabbar	0.37	77.37	49.99	2.67	217.15	444.33	135.31	135.31
Muaro Jambi	37.73	35.08	9.96	19.87	459.10	128.10	114.97	114.97
Sarolangun	224.94	4.42	9.06	18.20	252.22	43.70	92.09	92.09
Tanjabtim	6.19	14.40	55.95	94.50	131.03	63.06	60.86	60.86
Merangin	38.80	4.49	1.35	3.96	182.92	129.71	60.21	60.21
Kerinci	4.57	8.21	3.62	5.84	96.24	60.74	29.87	29.87
Sei. Penuh	19.27	18.68	36.21	14.42	9.06	21.96	19.93	19.93
Kota Jambi	13.98	2.67	2.33	3.95	32.12	24.87	13.32	13.32
Batanghari	0.80	2.78	11.62	11.52	5.48	42.92	12.52	12.52
Bungo	0.27	0.96	12.87	3.92	6.26	1.32	4.27	4.27
Average	31.97	15.39	17.65	18.30	136.26	185.58	67.52	67.52

Source: Processed data

From Table 8, it appears that the level of this ratio was quite high in all regencies and municipalities in Jambi province. The high ratio is not only an indicator to measure financial condition but also shows the effectiveness of cash management. Excessively high ratios demonstrate excessively high cash balances and short-term investments; thus, optimizing asset management to improve community services is necessary.

**Debt structure factors**

The general debt structure is an indicator to assess financial conditions. The deficit significantly contributes to increased government debt (László, 2022). Since the post-Keynesian era, government debt and GDP and their relationship and fluctuations have been important components of macroeconomic theories (Yared, 2019; Nguyen & Luong, 2021). Scholars have proposed that when the government issues additional public bonds and implements fiscal deficit policies, it can effectively expand domestic demand and promote regional economic development (Wu, 2020). In addition, others have demonstrated that the effects of raising debts and levying taxes on finance are the same and that the behavior of local governments raising debt will not affect social resources, investment, labor supply, and other factors, which proves the neutrality of debt (Coibon et al. 2021).

This study compared general funding obligations to the total revenue of general funds in 2013-2021, presented in Table 9. The lower the ratio, the better the financial condition of a region. This ratio demonstrates the region's ability to pay short-term debt from the normal annual income flow.

**Table 9.** General fund obligations to total revenue of general funds ratio, regency/municipal in Jambi Province, 2013-2021

R/M	2015	2016	2017	2018	2019	2020	Average
Muaro Jambi	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tanjabtlim	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Batanghari	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Sei. Penuh	0.01	0.00	0.00	0.00	0.01	0.01	0.01
Merangin	0.00	0.01	0.01	0.01	0.00	0.00	0.01
Sarolangun	0.00	0.02	0.01	0.01	0.00	0.00	0.01
Tanjabbar	0.03	0.00	0.00	0.01	0.00	0.00	0.01
Kerinci	0.03	0.01	0.02	0.02	0.00	0.00	0.01
Kota Jambi	0.01	0.03	0.02	0.03	0.00	0.00	0.02
Bungo	0.05	0.03	0.01	0.01	0.00	0.00	0.02
Tebo	0.01	0.08	0.05	0.03	0.00	0.00	0.03
Average	0.01	0.02	0.01	0.01	0.00	0.00	0.01

Source: Processed data

Five regencies and cities in Jambi Province performed similarly for this indicator because the average ratio in five years is 0.01. Tebo Regency is the only region having a ratio of 0.03. This ratio can still be considered good because it is below 0.1. Low ratios indicate short-term liabilities that can be easily served by a normal stream of annual income (Ritonga, 2016).

On average, the financial condition of regencies and municipalities in Jambi Province is good when viewed from this indicator, as the ratio of all regions was below 0.05. Low ratios indicate local governments can pay debt service requirements when due (Ritonga, 2016). Debt repayment ability ratios are often used to measure financial conditions (Maher & Nollenberger, 2009) in government and private organizations. Although the focus on this ability is still too narrow, it is necessary to pay attention to broader financial conditions (McDonald, 2018).

#### The regency and municipality of Jambi Province's financial condition analysis

Based on the data analysis of the ratios in Tables 2 to 9, an analysis was conducted based on the stages described in the research method. This combined analysis determines the financial conditions of the regency and municipality governments in Jambi Province from the best to the worst. The results of the combined analysis can be seen in Table 10.

**Table 10.** The Status of financial conditions, regency/municipal in Jambi Province, 2013-2021

R/M	Status of financial conditions
Tanjabbar	Best
Tanjabtlim	Best
Kota Jambi	Better
Sarolangun	Better
Muaro Jambi	Average
Tebo	Average
Kerinci	Average
Sungai Penuh	Average
Merangin	Average
Batanghari	Average
Bungo	Average

Source: Processed data

Table 10 shows that overall the financial condition of the regencies and municipalities in Jambi Province was in a good average position and above. Tanjabbar dan Tanjabtim regency had the best condition. However, from the results of each factor and indicator, Tanjabbar Regency held the highest position only in the two operational factors and expenditure factors. Tanjabtim Regency held the highest position in the three revenue factors: operational, expenditure, and debt. In other factors and indicators, Tanjabbar was never in the lowest position. Tanjabtim was in the lowest position in one operational factor; instead, it was average or above average. So, when the ratios of Tanjabbar dan Tanjabtim regency were calculated had the best position.

Furthermore, from the dimensions of regional independence (Table 1), Tanjabbar dan Tanjabtim regency was still below 10%; from the financial condition of the eight indicators proposed by Brown (1993), however, it had the highest score. Brown's 10 indicators have the power to evaluate the financial condition of local governments (this research only used 8 indicators). Nevertheless, Ritonga (2016) pointed out some weaknesses of those indicators (Brown, 1993), one of which is the total score to the ratio of financial conditions is a relatively non-absolute interpretation.

According to Brown (1993), a local government that scores negatively does not mean it is in a bad financial condition because each ratio is assumed to have the same weight without concerning the more important ratios. In addition, Brown also does not explain the basic groupings of local governments (best, better, average, good, worse, and worst) (Ritonga, 2016). However, using Brown Indicators can be an early warning for the government regions to determine their financial condition to develop policies and take anticipatory measures to avoid financial distress.

## **CONCLUSION AND RECOMMENDATION**

### **Conclusion**

The regions that obtained the best financial condition ratios from the income factor are Jambi and Sungai Penuh municipalities. Tanjabbar Regency held the best financial condition for regional expenditure. From the operational factor, the best position was obtained by Jambi municipality, Tanjabtim, and Tebo regencies. Muaro Jambi regency had the best financial condition from the debt structure factor. Overall, the financial condition of regencies and municipalities in Jambi Province is good. Seven regions' statuses are average, two regions have better financial condition status, and two regions have the best financial condition compared to other regions.

### **Recommendation**

Local governments must pay attention to the performance of local governments in terms of financial conditions. The results of this assessment can be an early warning so local governments can take policies and preventive measures to avoid financial distress. An important strategy that local governments must carry out is to increase their regional income. Intensification and extensification of regional taxes and fees need to be analyzed properly. Local governments should consider increasing their regional income from cultural and natural tourism services.

The limitation of this research is researchers did not consider differences in the acquisition of BPK's (Indonesia Audit Board) opinion as well as population and area in determining the research subjects. All financial reports of the regency and municipality in Jambi Province were used in this study.

For future research, it is suggested to eliminate the limitations of this study. In



addition, future research is also recommended to analyze the relationship between financial ratios in assessing local government financial performance.

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# The effect of income prospects, social media, and environment through motivation on student entrepreneurial interests during the COVID-19 pandemic

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## Abstract

This study aims to determine and analyze the effect of income prospects, social media, and environment on university students' entrepreneurship interest during the Covid-19 pandemic directly and indirectly through motivation. This study uses primary data by distributing questionnaires to respondents. The population of this study is active students of the Faculty of Economics and Business, Universitas Jambi, Indonesia, in the even semester of 2020/2021. The sampling size in this study is determined using Slovin's formula. The number of samples acquired is 191 students. The data is analyzed using path analysis. The results show that income prospects and social media directly affect motivation, while the environment does not directly affect motivation. The prospects of income, social media, and environment do not directly affect the interest in entrepreneurship, while motivation directly affects the interest in entrepreneurship. The motivation variable can mediate the income prospects and social media variable on the interest in entrepreneurship but cannot mediate the environmental variable in the interest in entrepreneurship.

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**Keywords:** *Entrepreneurship, Environment, Income, Social media*

**JEL Classification:** J62, M21, O15

## INTRODUCTION

Based on data, the impact of the pandemic is mostly experienced by Micro, Small, and Medium Enterprises (MSME). Ministry of Cooperatives and Small and Medium Enterprises said that in April 2020, as many as 37,000 MSMEs had reported being affected by Covid-19. Most of the reports were about decreased sales, capital difficulties, hampered distribution, and difficulties in raw materials. Department of Manpower Cooperative and MSME of Jambi City re-registered the number of MSMEs in Jambi City, Indonesia, which increased in 2019 to as many as 1073 MSMEs and until early 2021, it increased to 3513 MSMEs (Rahmatia, 2021).

During the Covid-19 pandemic, many businesses went bankrupt, and around 30 million MSMEs closed their businesses (Kadin, 2020). According to the Central Statistics Agency (BPS; *Badan Pusat Statistik*), in 2021, the number of MSMEs in Indonesia reached 64 million. This number accounts for 99.9 percent of Indonesia's

existing or ongoing businesses. It reveals that small businesses can increase the income of a nation. The hope of getting income from businesses to making ends meet is one of the reasons why businesses continue to survive during the pandemic. The era of Covid-19 has changed the way businesses market their products. During the Covid -19 pandemic, marketing methods previously done offline have switched to online or digital marketing.

Many researchers from Indonesia and other countries, such as Nigeria, Ethiopia, Cameroon, Tanzania, China, and Myanmar, have researched MSMEs or SMEs. The problems studied also varied according to the problems in their respective countries. Research outside of Indonesia generally examines the factors that affect the performance of MSMEs or SMEs; only a few investigated the factors that encourage someone to participate in entrepreneurship because community participation in entrepreneurship may already be high in these countries. Thus, the researches are more focused on the impact on the performance of MSMEs. Bala & Feng's research (2019) studies the impact of information and communication technology and the environment on the success of MSMEs in Myanmar, a developing country. Andaregie & Astatkie (2022) also examines the impact of using technology on the performance of MSMEs in Ethiopia.

Handoyo et al.'s research (2021) examines what factors lead to the success of small and medium enterprises in Indonesia in accessing international markets by analyzing resources, knowledge, and network theory. Handoyo's research (2020) is quantitative research in which the population is 153 small and medium enterprises registered at the Indonesian Ministry of Cooperatives and SMEs. His research explains that the determining factors for the success of the internationalization of small and medium enterprises in certain countries do not necessarily have a role in other countries. Tambunan's research (2021) studies the impact of the pandemic on small and medium enterprises in Indonesia. This study uses literature research surveying 137 MSMEs in Indonesia from May to September 2022.

Research on small businesses related to digital media is important in communicating about our business to others. Qualitative research was conducted by Horst et al. (2019) on entrepreneurship to see how to run a business using social media. Developing an entrepreneurial identity is required due to changes in the media industry.

Research on the use of social media in business has been studied by several other researchers, such as Lehtisaari et al. (2018), Lima et al. (2019), Horst et al. (2019), Omotosho (2020), Li et al. (2020), Argyris et al. (2020), Sigué & Biboum (2020), and Fang et al. (2022). The results of their research revealed that the role of social media improves the performance of SMEs and fosters innovations for business people. Using social media platforms is also a way to overcome the shortage of resources. Furthermore, it can promote innovations in services.

The use of information technology by utilizing social media in entrepreneurship is also one of the reasons that can affect students' interest in participating in entrepreneurship. Research by Amril & Hardiani (2021) showed that students' entrepreneurial interest in Jambi Province is relatively high. Research by Amril & Hardiani (2021) aims to analyze the characteristics of student entrepreneurial intentions in Jambi province and what factors affect student entrepreneurial intentions where environmental support and economic challenges and opportunities are one of the causes. Ariza's research (2018) also examines entrepreneurial interest among IAIN students in Pontianak. His research showed the importance of fostering an entrepreneurial spirit among students so they can later become strong entrepreneurs. Furthermore, Umiyati's

research (2021) also studies entrepreneurship, but this research examined entrepreneurship on the performance of MSMEs in Jambi City.

Research related to small and medium enterprises during the pandemic has been studied by Asad & Kashif (2021). Small and medium enterprises significantly impact employment and the economy of developing countries. The study results found that during the pandemic, many small and medium businesses went bankrupt except for small and medium businesses, which had innovation, flexible management, and government assistance in financial matters.

Previous studies have also examined how motivation can improve SME performance. Research by Kah et al. (2022) and Komaludin & Wahid (2018) state the need for entrepreneurial motivation to improve the performance of SMEs. Dahmiri (2022) examines financial management on the performance of Small and Medium Industries (IKM; *Industri Kecil Menengah*). The result of Dahmiri's research (2022) revealed that financial management positively affects the performance of SMEs in Jambi Province.

Research by Eijdenberg et al. (2019) that examines entrepreneurial motivation in Tanzania explored entrepreneurial motivation along with socio-demographics. The findings of this study suggest that entrepreneurial motivation changes from being a need to an opportunity motivation. Motivation has also been studied by Kah et al. (2022) using structured interview data with entrepreneurs in Gambia. They examine the motivations for entrepreneurship and the opportunities or challenges that hinder business growth. The results of this study show the factors why people become entrepreneurs: individual motivations such as need, poverty, and job creation. Knowledge, experience, and context include opportunity motivation, norms, and religion.

The Directorate General of the Ministry of Research, Technology, and Higher Education has the Entrepreneurial Student Program (PMW; *Program Mahasiswa Wirausaha*), which aims to assist students with an entrepreneurial desire. This program is committed to fostering enthusiasm, knowledge, skills, and entrepreneurial spirit to form students with an entrepreneurial spirit who are educated, have character and have clear business concepts. Universitas Jambi (UNJA), which has the vision to make UNJA *A World Entrepreneurship University*, is one of the universities that received the Entrepreneurial Student Program (PMW). Universitas Jambi students have won achievements in entrepreneurial student competitions at the regional and national levels. In 2019, UNJA students won first place in the National Entrepreneurial Student Competition (Gemnas; *Gebyar mahasiswa wirausaha nasional*) held by Padang State University. In 2020, UNJA Science and Technology students won first place in the national-level WEB Development competition held by Jakarta State University. Universitas Jambi also holds a Student Creativity Program (PKM; *Program Kreativitas Mahasiswa*), an entrepreneurship field that aims to form productive students.

Termination of Employment Relations (PHK; *Pemutusan Hubungan Kerja*) of employees also impacts the lives of families with children still studying in college. Changes in the way of learning from face-to-face to online systems also affect the expenses of parents with children still studying in college. Tuition fees in the form of Single Tuition Fees (UKT; *Uang Kuliah Tunggal*) which are usually a burden per semester, are now added to the cost of internet quotas for online learning. The Ministry of Education and Culture (Kemendikbud) provides free internet quota assistance for students and college students. This assistance is beneficial for families facing economic problems during the Covid-19 pandemic.

Research on the effect of the family environment on interest in entrepreneurship has been studied by Nisa (2020), Putra et al. (2021), and Yusuf (2020). Research by Osakede et al. (2017) examines the factors that affect entrepreneurial interest among students in Nigeria with a case study of students from the University of Ibadan. This study says that one factor affecting the interest in entrepreneurship among students in Nigeria is the family business background. Research by Octavia (2018) about the business environment on the relationship between market orientation, entrepreneurial orientation, and business performance. Research by Nurmaliza et al. (2018) states that the family environment affects the interest in entrepreneurship among SMK Pekanbaru City students. Research on income expectations has been investigated by Putra et al. (2021) and Mualifah (2020), who say that income expectations affect student interest in entrepreneurship. Yusuf & Efendi's research (2019) also examines the income prospects of one of the factors that affect the entrepreneurial interest of students at Muhammadiyah University of Bengkulu.

Kotler (2016) states that social media allows customers to share text, images, audio, and video coverage. Research on social media on entrepreneurial interest has been studied by several researchers whose research results are still inconsistent by Suratno et al. (2020), Sumerta et al. (2020), and Listiawati (2020). This study's results differ from the study conducted by Prasetio (2020), who said that social media had no effect on interest in entrepreneurship among students. Research by Nawi et al. (2019) examines the use of social media to affect entrepreneurship among state university students in Peninsular Malaysia positively. Purwanto's research (2021) states that social media and the family environment affect entrepreneurial interest among private university students in Banten. Kurniawan's research (2019) examines how to use social media to support business for students at the Faculty of Economics and Business, Universitas Airlangga.

Motivation, according to the research results of Sumerta et al. (2020), affects an interest in entrepreneurship. Prasetio's research (2020) examines intrinsic motivation to affect entrepreneurial interest. Suratno's et al. (2020) study is about motivation as a mediating variable of knowledge and social media influencing entrepreneurial interest. The research of Saadah et al. (2021) explained that motivation is needed as a mediating variable in influencing entrepreneurial interests among students at the Institute of Technology and Business (ITB) Asia Malang. The research of Santoso et al. (2018) revealed that motivation affects entrepreneurial intentions

Research on student entrepreneurial intentions is based on behavioral theory. The theory of Planned Behavior (TPB) elaborates on the Theory of Reasoned Action (TRA). TRA explains that a person's intention or necessity for behavior is caused by two main elements: attitude toward the behavior and subjective norms. At the same time, TPB has an additional factor: perceived behavioral control (Ikhsan & Iskak, 2005). Research Narsa et al. (2019) examined students' interest in entrepreneurship. This separated groups into Economics faculty students who received business education, Engineering faculties who did not receive business education, and business people. The research results showed that the entrepreneurial spirit is inherent in a person from birth, and the research results can also help improve the entrepreneurship curriculum.

Based on the background, the researchers are interested in taking the title *The Effect of Income Prospects, Social Media and Environment through Motivation on Student Entrepreneurial Interests during the Covid-19 pandemic*. The problem of this research is how income prospects, social media, and the environment directly affect motivation and students' entrepreneurship interest during the Covid-19 pandemic and



how income prospects, social media, and the environment indirectly affect motivation to students' interest in entrepreneurship during the Covid 19 pandemic?

**METHODS**

The population in this study is all active students of the Faculty of Economics and Business, Universitas Jambi, Indonesia. Total population of 3502 students. Determining the number of samples uses the Isaac and Michael formula (Sugiyono, 2013):

$$s = \frac{\lambda^2 \cdot N \cdot P \cdot Q}{d^2 (N - 1) + \lambda^2 \cdot P \cdot Q} = \frac{2.706^2 \cdot 3502 \cdot 0.5 \cdot 0.5}{0.1^2 (3502 - 1) + 2.706^2 \cdot 0.5 \cdot 0.5} = 251 \dots\dots\dots (1)$$

Where:

s = number of samples

$\lambda^2$  = Chi-squared with a degree of freedom of 1 and the error rate set in this study is 10%, a value of 2.706 is obtained

N = total population

P = true probability = 0.5

Q = probability of being wrong = 0.5

d = difference (bias) between the sample mean and the population average, set in this study at 10%.

The sample was selected by simple random sampling, with a student database in the academic section of the faculty. A list of questions was given to the selected sample via the Google form. Each respondent answered 27 items with income variables (4 questions), social media variables (5 questions), environmental variables (6 questions), motivation variables (6 questions), and entrepreneurial interests (6 questions).

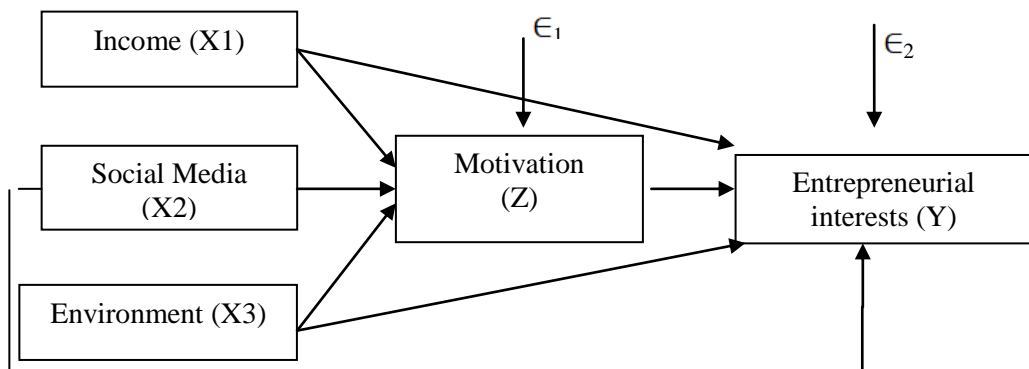
From the number of selected samples, the number of respondents who returned the questionnaire and fulfilled the eligibility to be analyzed was 191 respondents. Therefore, the analysis is based on these 191 respondents.

The analytical tool used in this research is path analysis. Path analysis is an extension of the multiple linear regression analysis. Path analysis uses regression to estimate the causal relationships between variables established based on the theory (Ghozali, 2018). The path equation can be explained as follows:

$$Z = P_{zx1}X1 + P_{zx2}X2 + P_{zx3}X3 + e_1 \text{ (as substructure equation 1) } \dots\dots\dots(2)$$

$$Y = P_{yx1}X1 + P_{yx2}X2 + P_{yx3}X3 + P_{yz}Z + e_2 \text{ (as substructure equation 2) } \dots\dots\dots(3)$$

The equation above explains where Z is motivation, Y is entrepreneurial interests, X1 is income prospects, X2 is social media, X3 is the environment,  $P_{yx1}$ ,  $P_{yx2}$ ,  $P_{yx3}$   $P_{yz}$  is path coefficient and  $e_{1,2}$ , is the term of error/nuisance error.



**Figure 1.** Path diagram model

**Table 1.** Variable operational definitions

<b>Variable</b>	<b>Definition</b>	<b>Indicator</b>	<b>Scale</b>
Income Prospects (X1)	Income is the gross inflow of economic benefits arising from the normal activities of the entity during the period if the inflow results in an increase in equity that does not come from contributions from investors. Ikatan Akuntan Indonesia (2018), Putra (2021), Mualifah (2020)	1. High income 2. Unlimited income	Ordinal
Social Media (X2)	Social media is a group of Internet-based applications built on the ideological and technological foundations of Web 2.0 and enables the creation and exchange of user-generated content. Web 2.0 became the basic platform of social media. Fang (2022), Prasetio (2020), Li (2020), Omotosho (2020), Nawi et al. (2019), Kurniawan (2019), Horst et al., (2019),	1. Participation 2. Openness 3. Communication 4. Interconnected 5. Skills	Ordinal
Environment (X3)	The environment includes the circumstances and the natural world where certain techniques cause a person's behavior to change. Purwanto (2021), Nisa (2020), Bala, H., & Feng, X. (2019), Nurmaliza (2018), Hasbullah (2015)	1. Family environment 2. Campus environment 3. Social Environment	Ordinal
Motivation (Z)	Desire in an individual stimulates one to take action; there are two methods of motivation: direct and indirect. Kah et al. (2022) Suratno's et al. (2020), Sumerta et al. (2020), Eijdenberg (2019), Hasibuan (2017)	1. There are job challenges 2. The ability to overcome adversity 3. Able to face the risk 4. Reward 5. Opportunity 6. Responsibility	Ordinal
Entrepreneurial Interests (Y)	A person's desire to be self-employed or run their own business. Saadah (2021), Kumara (2020), Yusuf, M., & Sutanti. (2020), Narsa (2019), Yusuf, E., & Efendi, R. (2019). Rahayu (2018), Ariza (2018),	1. There is a sense of interest in the world of entrepreneurship 2. Paying attention to everything related to entrepreneurship 3. There is active involvement in activities related to entrepreneurship. 4. Future-oriented	Ordinal

## RESULTS AND DISCUSSION

### Respondent profile

Characteristics of respondents based on gender, age, year of college entry, department, entrepreneurial interest, and parents' occupation are given in Table 1.

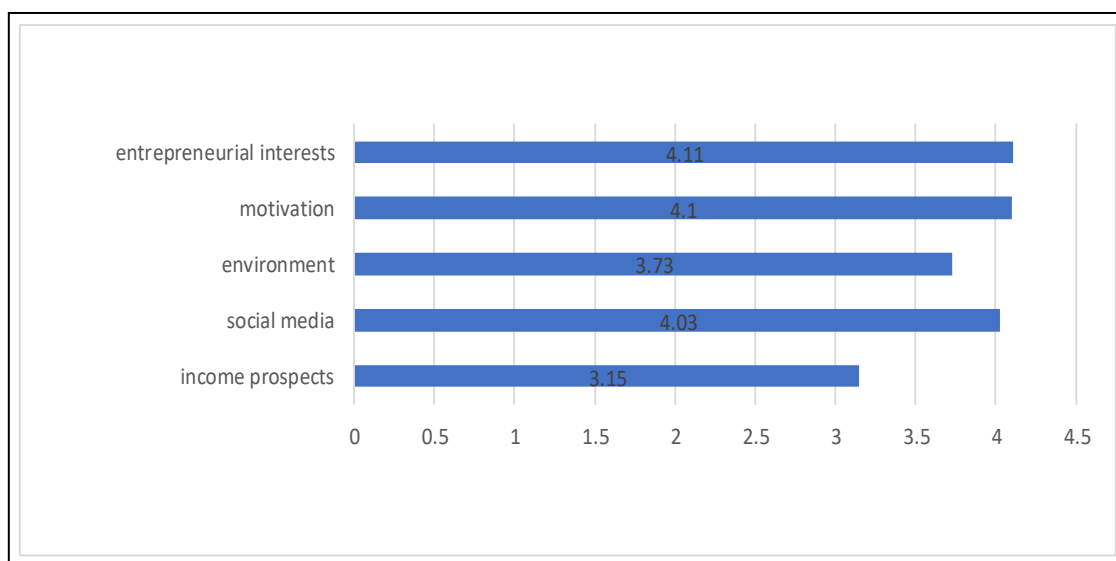
**Table 2.** Characteristics of respondents

Characteristics	Description	Frequency	Percentage (%)
Gender	Male	58	30.4
	Female	133	69.6
Class year	2017	21	11
	2018	81	42.4
	2019	52	27.2
	2020	37	19.4
Department	Economics	68	35.6
	Management	39	20.4
	Accounting	84	44
Age	≤ 20 years old	58	30.4
	> 20 years old	133	69.6
Entrepreneurial interest	interested	183	95.8
	Not interested	8	4.2
Parents' job	Civil servant	29	15.2
	Trader	24	12.6
	Farmer	55	28.8
	Army (TNI)	1	0.5
	Private sector	47	24.6
	Other	35	18.3
<b>Number of respondents</b>		<b>191</b>	

Based on Table 2, the number of female respondents is more dominant than males. Class of 2018 students filled out questionnaires more dominantly than other class years, as many as 42.4%. The student from the Department of Accounting filled out the most questionnaires compared to the Department of Economics and Department of Management, namely 44%. In the age category, the data were dominated by students aged over 20 years. The number of students interested in participating in entrepreneurship turned out to be very large, which is 95.8%, and only a few said they were not interested. This shows that the Covid-19 pandemic did not make respondents who are students of the Faculty of Economics and Business less involved in entrepreneurship. Most of the respondents' parents are farmers, namely 28.8%.

### Description of research variables

The questionnaire uses a scale of 1-5; the average variable obtained is above numbers 3 and 4. The highest average value is obtained by the variable of interest in entrepreneurship, which is 4.11, and the motivational variable, which is equal to 4.10, followed by social media variables is 4.03, the environmental variable as many as 3.73, and the lowest one which is the variable of income prospect that is 3.15. These results show that the variables studied are factors that can affect students of the Faculty of Economics, Universitas Jambi, in their interest in joining entrepreneurship. The data is also supported by 95.8% of respondents who said they were interested in entrepreneurship during the pandemic.



**Figure 2.**The average value of the research variables

**Validity and reliability test**

Based on the validity test of the returned questionnaire results, it can be seen that all statements are valid. Based on the reliability test of the returned questionnaire results, it can be seen that all statements are reliable.

Path analysis is an analytical technique used to analyze the inherent cause-and-effect relationship between variables arranged in a temporary order by using the path coefficient as a value in determining the magnitude of the effect of the exogenous independent variable on the endogenous dependent variable (Sarwono, 2012).

*Hypothesis Testing 1: Income prospects, social media, and the environment directly affect motivation and students’ entrepreneurship interest during the Covid-19 pandemic.*

Table 3 is the result of the output of hypothesis testing for sub-structure 1:

**Table 3.** Hypothesis Test Results of Sub-structure 1

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	12,802	1,141		11,225	,000
Income Prospects	,370	,085	,336	4,349	,000
Social Media	,226	,067	,245	3,353	,001
Environment	,083	,064	,091	1,296	,197

*Dependent Variable: Motivation*

Table 3 shows that income prospects directly affect motivation, social media directly affects motivation, and the environment does not directly affect motivation. This research aligns with Suratno et al.’s (2020) research on social media affects motivation.

Income prospects directly affect a person’s motivation. The definition of income, namely Financial Accounting Standards (PSAK) Number 23 of 2018, states that income is the gross inflow of economic benefits arising from the normal activities of an entity

during the period if the inflow results in an increase in equity that does not come from contributions from investors. The greater the prospect of income, the greater the motivation of the Faculty of Economics and Business students to become entrepreneurs. The use of social media also directly affects motivation. According to Kotler (2016), social media is a substitute for communication between sellers and consumers where the wider and more social media that can be used, the greater the motivation. The use of social media during the pandemic, especially in its use for transactions with consumers, has increased. In contrast, before the pandemic, transactions were often carried out face-to-face but now have switched to online transactions. Government regulations regarding the Implementation of Restrictions on Community Activities (PPKM) during a pandemic are one of the reasons why the use of social media has increased in transactions.

**Table 4.** Hypothesis test results of sub-structure 2

Model	Unstandardized		Standardized	t	Sig.
	Coefficients		Coefficients		
	B	Std. Error	Beta		
(Constant)	3,146	1,402		2,244	,026
Income Prospects	,045	,085	,037	,529	,597
Social Media	,127	,066	,124	1,921	,056
Environment	,086	,061	,086	1,410	,160
Motivation	,640	,069	,579	9,208	,000

Based on Table 4, it can be seen that income prospects do not directly affect entrepreneurial interests, social media does not directly affect entrepreneurial interests, the environment also does not directly affect entrepreneurial interests, and motivation has a direct effect on entrepreneurial interests

The results of this study are in accordance with the theory of income stated in Financial Accounting Standards (PSAK) number 23 of 2018, which explains that income is the gross inflow of economic benefits arising from the normal activities of an entity during the period of the inflow results in an increase in equity that does not come from contributions from investors capital. According to the Indonesian dictionary (KBBI), revenue is the money a company or organization receives from its activities, such as selling products and/or services to customers. The greater the income prospects, in this case, the money received, the greater or higher the interest of students of the Faculty of Economics and Business in entrepreneurship. However, the effect in this research is not direct, but the income prospects have an effect if there is motivation as an intermediary or intervening variable.

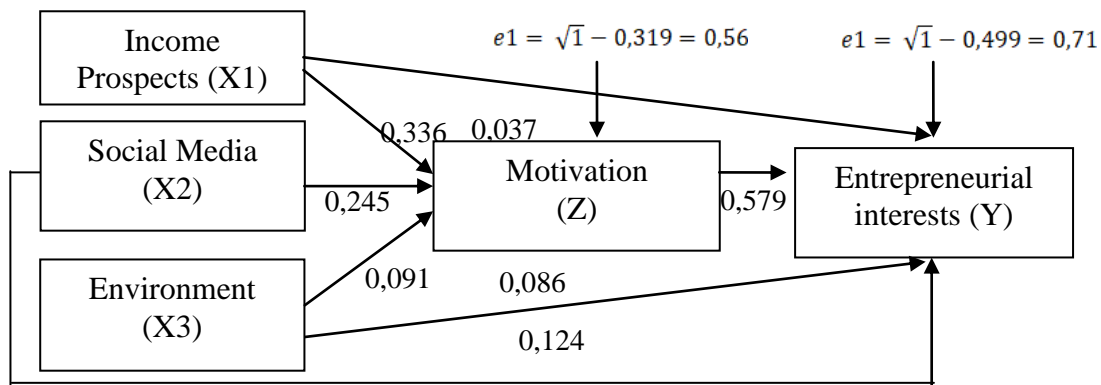
According to Hasibuan (2017), the motivation in this discussion is both direct and non-material such as bonuses, and indirect motivation, such as facilities that support the smooth running of work. Motivation has a direct effect on interest in entrepreneurship. According to the theory by Abraham Maslow (Ikhsan & Iskak, 2005), a psychologist in 1943, a person’s motivation is due to needs that must be met, including physiological needs such as food, clothing, and a place to live. These needs motivate someone to want to do something, such as entrepreneurship.

This research aligns with Prasetyo (2020), who says that using social media does not affect students’ entrepreneurial interests, and motivation affects students’ entrepreneurial interests. This study is also in line with research conducted by Puspitaningsih (2014), Sumerta et al. (2020), Suratno et al. (2020), and Saadah et al. (2021), which show that motivation has a positive and significant effect on

entrepreneurial interests. This study is not in line with the research done by Nawi et al. (2019), Kumara (2020), Listiawati (2020), Sumerta et al. (2020), Suratno et al. (2020), and Purwanto (2021) say that social media and family environment affect entrepreneurial interests. This study also does not align with Putra et al. (2021), who say income prospects and environment affect entrepreneurial interests. This study also does not align with Hendrawan & Sirine (2017), who say motivation affects entrepreneurial interests.

*Hypothesis Testing 2: Income prospects, social media, and the environment indirectly affect through the motivation of students' interest in entrepreneurship during the Covid-19 pandemic.*

The magnitude of the indirect effect is determined by multiplying the beta value of the effect of the independent variable on the dependent variable. The total effect is determined by adding the Beta value of the direct effect of the independent variable on the dependent variable with the value of the indirect effect of each independent variable.



Sobel Test :  $t_{table} = 191 - 5 = 186$  with sig 0,05% = 1.97280

**Figure 3.** Research Framework

Based on Figure 3 above, it can be concluded that the structural equations for each sub-structure are as follows, the Structural Equation of Sub-structure 1 is  $Y = 0,336X_1 + 0,245X_2 + 0,091X_3 + e_1$ , and the Structural Equation of Sub-structure 2 is  $Y = 0,037X_1 + 0,124X_2 + 0,086X_3 + 0,579Z + e_2$ .

The details of the indirect effects are presented as follows:

1. The effect of income prospects on interest in entrepreneurship with motivation as an intervening variable ( $PZX_1 \times PYZ$ ) =  $0,336 \times 0,579 = 0,020844$
2. The effect of social media on interest in entrepreneurship with motivation as an intervening variable ( $PZX_2 \times PYZ$ ) =  $0,245 \times 0,579 = 0,141855$
3. The effect of environment on interest in entrepreneurship with motivation as an intervening variable ( $PZX_3 \times PYZ$ ) =  $0,091 \times 0,579 = 0,052689$

The details of the total effect are presented as follows:

1. The effect of income prospects on interest in entrepreneurship with motivation as an intervening variable ( $PZX_1 + (PZX_1 \times PYZ)$ ) =  $0,037 + 0,020844 = 0,057844$
2. The effect of social media on interest in entrepreneurship with motivation as an intervening variable ( $PZX_2 + (PZX_2 \times PYZ)$ ) =  $0,124 + 0,141855 = 0,265855$
3. The effect of environment on interest in entrepreneurship with motivation as an intervening variable ( $PZX_3 + (PZX_3 \times PYZ)$ ) =  $0,086 + 0,052689 = 0,138689$

**Table 5.** The direct effect of substructural equations 1 and 2

<b>Hypothesis Test</b>	<b>Beta (<math>\beta</math>)</b>
The effect of income prospects (X1) on motivation (Z)	0,336
The effect of social media (X2) on motivation (Z)	0,245
The effect of environment (X3) on motivation (Z)	0,091
The effect of income prospects (X1) on entrepreneurial interests (Y)	0,037
The effect of social media (X2) on entrepreneurial interests (Y)	0,124
The effect of environment (X3) on entrepreneurial interests (Y)	0,086
The effect of motivation (Z) on entrepreneurial interests (Y)	0,579

Table 6 shows the magnitude of the indirect effect and the magnitude of the total effect.

**Table 6.** Indirect effect and total effect

<b>Effect</b>	<b>Indirect effect</b>	<b>Total effect</b>
X1 to Y through Z	0,020844	0,057844
X2 to Y through Z	0,141855	0,265855
X3 to Y through Z	0,052689	0,138689

To determine whether the mediation effect was significant, it was tested with the Sobel Test. Based on Table 6 and Table 7, the value t count is greater than t table  $3,921939 > 1,973$ . It can be concluded that the motivation variable with an effect of 0.020844 can be an intervening variable on the relationship between income prospects on interest in entrepreneurship. The t-count value is greater than  $3,153872 > 1,973$ . It can be concluded that the motivation variable with an effect of 0,141855 can intervene in the relationship between social media on interest in entrepreneurship. The value of the t count is smaller than t table  $1,277122 < 1,973$ . It can be concluded that the motivation variable with an effect of 0,052689 cannot intervene in the relationship between environment on interest in entrepreneurship.

**Table 7.** Summary of motivation variable mediation relationship

<b>Relationship</b>	<b>T<sub>value</sub></b>	<b>Sig</b>	<b>Conclusion</b>
X1 to Y through Z	3,921939	0,00008	Have effect
X2 to Y through Z	3,153872	0.00150	Have effect
X3 to Y through Z	1,277122	0,19900	Have no effect

Motivation as an intervening variable can mediate income prospects and social media variables on the interest in entrepreneurship of students of the Faculty of Economics and Business. The greater the income prospects that can be achieved and the wider the use of social media will affect the motivation to increase interest in entrepreneurship. According to the definition of income as money received from customers, the greater the money received, the more motivation and interest in entrepreneurship. In this study, the motivational variable cannot mediate the environmental interest in entrepreneurship. According to Hasbullah (2015), the environment is a situation where certain techniques cause a person's behavior to change. The results of this study show that environmental conditions, both the campus environment and the family environment, have not been able to increase student entrepreneurship interest. This can also be seen from the profiles of respondents from families with parents from various types of work. This research aligns with Suratno's et

al. (2020) research that says that social media affects motivation and students' entrepreneurship interest.

## **CONCLUSIONS AND RECOMMENDATIONS**

### **Conclusions**

Income prospect variables and social media directly affect motivation, while the environment variable does not directly affect motivation during the Covid-19 pandemic. It means that the greater the prospect of income that can be achieved and the wider use of social media, the greater the motivation will be, while environmental conditions have not been able to increase motivation. Income prospects, social media, and environmental variables do not directly affect students' entrepreneurial interests during the Covid-19 pandemic. In contrast, motivation directly affects students' entrepreneurial interests during the Covid-19 pandemic. This means the income prospects that can be achieved, the use of social media, and the environmental conditions have not been able to affect students' entrepreneurial interests directly. Still, the amount of motivation they have can directly affect students' entrepreneurship interests during the Covid-19 pandemic.

The motivational variable can mediate the income prospect and social media variables on students' entrepreneurial interests during the Covid-19 pandemic. It means that the greater the income prospect that can be achieved and the wider use of social media will affect the motivation to increase students' entrepreneurial interests during the Covid-19 pandemic. The motivational variable is not able to mediate environmental variables on students' entrepreneurial interests during the Covid-19 pandemic, meaning that environmental conditions have not been able to increase students' motivation in entrepreneurship

### **Recommendations**

For students, social media should continue to be used to search for information and share information. Students can use social media to grow skills in carrying out entrepreneurial activities. For policymakers in the faculty to create a campus environment that can encourage students to be motivated to have an interest in entrepreneurship, such as increasing entrepreneurial activities and always revising the curriculum for entrepreneurship courses so that changes in the business world can be considered for updating teaching topics. Future researchers can expand the research survey by adding to the population from other faculties at UNJA or other tertiary institutions in Jambi Province.

This research was conducted during the pandemic, so questionnaires were distributed using Google Forms. Hence, there were no direct interviews between the researchers and the respondents (students of the Faculty of Economics and Business). The research sample used only one faculty, the Faculty of Economics and Business, Universitas Jambi, so the respondents' answers could not represent the number of students in Jambi City.

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# Who get paid higher? A study on wages decomposition between manufacturing and non-manufacturing workers in Indonesia

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## Abstract

In 2008, Indonesia became a member of the G20, and it is estimated that in 2030 it will be in the top seventh economic countries if it can keep growing. Nevertheless, high economic growth was followed by an inequality problem. This study will analyze the wage gap between manufacturing and non-manufacturing workers. Using Sakernas 2020 and the Mincer wage model regression, the result showed that all independent variables: age, level of education, gender, region of residence, marital status, toddler, disability status, and certificate training influence wages for both manufacturing and non-manufacturing workers. Next, the Blinder-Oaxaca method decomposes the wage gap between both groups. It is shown that manufacturing workers get higher wages than non-manufacturing workers because of differences in the characteristic of workers and also industry attributes which, in this case, capital intensity.

**Keywords:** *Blinder-Oaxaca, Indonesia, Wages*

**JEL Classification:** C01, J24, J31

## INTRODUCTION

Rich's natural abundance and immense labor force are grace for Indonesia marked with stable and decent economic growth. Thus, in 2008, Indonesia became a member of the G20, and it is estimated that in 2030 it will be in the top 7th economic countries if it can keep growing (Oberman et al., 2012). Nevertheless, high economic growth was followed by an inequality problem, as seen from the Gini ratio data rise over the last decade from 0.3799 in 2010 to 0.3999 in 2020. Researchers have conducted many studies to answer the source of inequality problems with various approaches, like the migration of workers (Nogroho, 2016), differences in human capital (Rahmi et al., 2019), and the most general gender wage gap (Hennigusnia, 2014; Wicaksono et al., 2017; Laurensia & Yuliana, 2020; Nasution & Yuniasih, 2022). However, in Indonesia, there is no discussion about the wage gap associated with the inter-industry wage differential concept, which has been discussed in many countries over recent decades.

Slitchter (1950) pioneered the inter-industry wage differential concept, which found wage variations among workers with similar human capital quality and working conditions. Another various study conducted refers to inter-industry wage differential theory earlier like Dickens & Katz (1987), who discovered that although controlled by labor characteristics and human capital factors, they found a wage gap between high-

skilled and low-skilled workers. Krueger and Summers (1988) also show that a wage gap occurs for workers with identical characteristics and similar working conditions. Many research findings have confirmed similar findings (Du Caju et al., 2010; Papapetrou & Tsalaporta, 2017; Wang et al., 2018). The latest study is based on Slichter (1950) and conducted by Menezes & Raposo (2011). They found proof that a big company pays their workers higher than a small company; which variables that affect it are age, gender, level of education, types of contract, and hours of working. Thus, it can be concluded that the wage gap is both workers' characteristics and industry affiliates (Carpio et al. 2015).

This research will use the inter-industry wage differential concept to study the wage gap between Indonesian workers using the Blinder-Oaxaca decomposition method (Blinder, 1973; Oaxaca, 1973). This method decomposes the wage inequality factor into two parts: the difference of observed characteristics (explained variable) or differences in endowment like age, education, experience, and type of job. The second part is differences in treatment and assessment between two groups in the labor force market or differences in characteristics that are not observed (unexplained variable) or are usually called differences due to discrimination.

Several studies have been conducted using the Blinder-Oaxaca decomposition method. Motellon et al. (2011); Herrera-Idaraga et al. (2016) found that the wage difference is a consequence of regional differences. Nogroho (2016) groups workers based on migration (migration wages differentials), and of course, Blinder (1973); Oaxaca (1973) use discrimination theory to explain wage differences.

The question is, what kind of industry attribute can explain wage differentiation? Griliches (1969) proposes Capital Skill Complementary (CSC) hypothesis, which states that high-skilled workers' skills are more suitable for capital than low-skilled workers. Ultimately, high-skilled workers' productivity rises, getting paid more than low-skilled workers. This hypothesis has been proven empirically by Wang & Ma (2017), Perez-Laborda & Perez-Sebastian (2020), and Correa et al. (2018). Thus according to the capital skill complementary hypothesis, this research will consider capital intensity as an industry attribute to elaborate on the source of a wage gap between workers.

The industry can be divided into labor-intensive and capital-intensive based on capital intensity. Das et al. (2009) identify labor-intensive industries by computing industries' average labor-intensity ( $L/K$ ) ratio. Then each industry calculated the labor-intensity ratio too. All the industries with a labor-intensity ratio higher than the average labor-intensity ratio were considered labor-intensive industries, and all those with a ratio less than average were labeled capital-intensive. At first, this research will use the same method. However, data limitations make us cannot calculate the labor-intensity ( $L/K$ ) ratio. Thus, the researcher will only divide workers into two groups: those who work in the highest capital intensity become 1 group, and the rest into 1 group.

This study will divide workers into manufacturing and non-manufacturing workers. The question that should be answered is how large the wage gap between manufacturing and non-manufacturing workers is and whether endowment causes enlarges the differences or zoom out them.

## **METHODS**

This study uses microdata from National Laborforce Survey (Sakernas) in 2020, which covers Indonesia. The worker grouped into manufacturing and non-manufacturing workers. Variables to be researched are wages, human capital

(education, disability status, certificates of training), and worker characteristics (age, type gender, region residence, marital status, and whereabouts of a toddler). The definition of the operational variable can be seen in Table 1.

Data were analyzed using the descriptive analysis method, multiple regression method, and the Blinder-Oaxaca decomposition method. Models used refer to the Mincer's earning function (1974) with details as follows:

$$\ln Y_i = \beta_0 + \beta_1 X + \varepsilon_i \dots \dots \dots (1)$$

where  $\ln Y_i$  is the natural logarithm of monthly wages. Substituting the function with independent variables to the equation, the empirical modeling of each group of worker is formulated as follow:

$$\begin{aligned} \ln(\text{wage})_{M,N} = & \beta_{0,M,N} + \beta_1 \text{age} + \beta_2 \text{age}^2_{M,N} + \beta_3 \text{Gen}_{M,N} + \beta_4 \text{Mid}_{M,N} + \beta_5 \text{High}_{M,N} \\ & + \beta_6 \text{Univ}_{M,N} + \beta_7 \text{Res}_{M,N} + \beta_8 \text{Mar}_{M,N} + \beta_9 \text{Todd}_{M,N} + \beta_{10} \text{Dis}_{M,N} \\ & + \beta_{11} \text{Trai}_{M,N} + \varepsilon_i \dots \dots \dots (2) \end{aligned}$$

**Table 1.** Definition of operational variable

No	Variable	Definition	Information
1	Index M N	Group manufacturing workers (M) and non-manufacturing workers (N)	
2	Ln(wage)	Income During a month ago	
3	age	Age (calculated based on latest birthday)	
4	age <sup>2</sup>	Age square	
5	Gen	Gender	0. Female 1. Male
6	Mid	Highest level of education completed: Junior High School	0. Other 1. Junior High School
7	High	Highest level of education completed: Senior High School	0. Other 1. Senior High School
8	Univ	Highest level of education completed: University	0. Other 1. University
9	Res	Region of residence	0. Rural 1. Urban
10	Mar	Marital status	0. Not married 1. Ever Marry
11	Todd	Existence toddler	0. No, there is 1. There
12	Dis	Disability status	0. No 1. Yes
13	Trai	Certificate training	0. No 1. Yes

The next step is to measure the wage gap between manufacturing and non-manufacturing workers using the Blinder-Oaxaca decomposition method to decompose the difference in the average wages of the two groups. The method share level of wages into two parts, namely explained and the residual part that cannot be calculated by defined (unexplained) (Blinder, 1973; Oaxaca, 1973). The unexplained part could be considered factor discrimination but can also be interpreted as an amount from the independent variable that is not entered in models.

To decompose, we could form a wages function for each group, namely as follows:

$$\ln Y_{iM} = \beta_{0M} + \beta_M X_M + \varepsilon_i \dots \dots \dots (3)$$

$$\ln Y_{iN} = \beta_{0N} + \beta_N X_N + \varepsilon_i \dots \dots \dots (4)$$

The results of each group could be written as follows:

$$\ln \bar{Y}_{iM} = b_M \bar{X}_M \dots \dots \dots (5)$$

$$\ln \bar{Y}_{iN} = b_N \bar{X}_N \dots \dots \dots (6)$$

The wage gap between the two groups is the total difference in wages between manufacturing and non-manufacturing workers so that the value is determined with reduced equations (5) and (6)

$$\Delta \bar{Y} = (\bar{Y}_M - \bar{Y}_N) = b_M \bar{X}_M - b_N \bar{X}_N \dots \dots \dots (7)$$

To decompose the total wage gap, equation (7) must be customized with a counterfactual of average wages. In this research, the average wage counterfactual uses manufacturing workers as a group reference meaning that manufacturing workers get higher wages. Hence the average wage for non-manufacturing workers could also be written as follows:

$$CF = b_M \bar{X}_N \dots \dots \dots (8)$$

After the counterfactual factor is entered then, the equation of the wages gap becomes as follows:

$$\Delta \bar{Y} = (\bar{Y}_M - \bar{Y}_N) = (b_M \bar{X}_M - b_M \bar{X}_N) - (b_N \bar{X}_N - b_M \bar{X}_N) \dots \dots \dots (9)$$

$$\Delta \bar{Y} = (\bar{Y}_M - \bar{Y}_N) = b_M (\bar{X}_M - \bar{X}_N) - \bar{X}_N (b_N - b_M) \dots \dots \dots (10)$$

Description:

$b_M (\bar{X}_M - \bar{X}_N)$ : difference because of characteristics/endowment (explained)

$\bar{X}_N (b_M - b_N)$ : unexplained

CF: counterfactual variable

**RESULTS AND DISCUSSION**

Table 2 compares sample characteristics of manufacturing and non-manufacturing workers based on the independent variable. The average age of manufacturing workers is 3.15 years old younger compared to the non-manufacturing sample workers, who are 38.28 years old compared with 41.43 years old. Likewise, the concentration sample (mode) has a 13-year-old difference of 25 years old for manufacturing workers, while for non-manufacturing workers is 38 years old. In the group age carry-on that is 65 years old and up, the proportion of manufacturing workers is smaller than non-manufacturing workers, 3.99 percent compared to 6.50 percent. From the education level, manufacturing and non-manufacturing workers have an education highest until high school/equivalent.

Workers in manufacturing and non-manufacturing are both dominated by males compared to females, which is 59.09 percent compared to 40.91 percent. According to the industry, the male manufacturing sample is 53.39 percent, whereas the non-manufacturing male sample is 59.75 percent.

Todaro & Smith (2012) state that in urban, the availability of employment is higher and compensates for higher wages too. Table 2 shows that manufacturing workers live in urban areas more than in rural areas, which is 53.24 percent, compared with area rural by 46.76 percent. Different conditions occur in non-manufacturing workers; 60.97 percent of the workers live in the countryside, while in urban only 39.03 percent. This thing because a part really big area of Indonesia consists of the rural added largest industry that absorbs workers is agriculture which, in general, has location business in rural areas.

Based on marital status, manufacturing, and non-manufacturing workers have a relatively equal proportion of above 80 percent. Likewise, with the existence of toddlers, 70 percent or more manufacturing and non-manufacturing workers have no toddlers.



After the discussion about the characteristics demographic of workers, one decisive factor of wages level is the quality of human capital, measured by disability status indicators and certificates training (on-the-job training). From the side health, 93.03 percent of the worker state that they do not experience disturbance because of disability that will hinder their work, which is a positive condition in the enhancement of welfare. Ironically, the majority of Indonesian workers are both in manufacturing and non-manufacturing. It turns out that employees do not follow a training or have certificate-related training with their job, reaching 89.00 percent for manufacturing workers and 85.73 percent for non-manufacturing workers. By industry, the proportion of manufacturing workers with certificate sector training is larger than non-manufacturing workers.

**Table 2.** Sample characteristics by manufacturing and non-manufacturing

No	Information	Manufacturing	Non-Manufacturing	Total
1	Highest level of education completed (%)			
	• Not school-primary school	31.73	39.97	38.85
	• Junior high school	22.37	17.63	18.28
	• Senior high school	40.06	29.01	30.51
	• University	5.84	13.38	12.36
2	Age			
	• Average (years)	38.28	41.43	41.00
	• Mode (year)	25.00	38.00	38.00
	• >65 Years (%)	3.99	6.50	6.16
3	Gender (%)			
	• Male	53.39	59.75	59.09
	• Female	46.61	40.25	40.91
4	Region of residence (%)			
	• Urban	53.24	39.03	40,50
	• rural	46.76	60.97	59,50
5	Marital Status (%)			
	• Single	19.06	17.68	17.82
	• Ever Married	80.94	82.32	82.18
6	Existence Toddler (%)			
	• There is	25.69	24.35	24.49
	• None	74.31	75.65	75.51
7	Disability Status (%)			
	• Yes	5.81	7.11	6.97
	• No	94.19	92.89	93.03
8	Ownership Certificate Training (%)			
	• Yes	11.00	14.27	13.93
	• Not	89.00	85.73	86.07

Source: Sakernas 2020, processed

### Characteristics of wages

This study aims to see the wage difference between manufacturing and non-manufacturing workers. Before the analysis is conducted, it is necessary to know the average wage picture based on the independent variable, as shown in Table 3.

Based on age, the average wages received by manufacturing workers is 338 thousand rupiahs, bigger than non-manufacturing workers. Manufacturing workers

receive average wages of 1,792,304 rupiahs per month, whereas non-manufacturing workers receive average monthly wages of 1,453,596 rupiahs. Wages received by manufacturing workers show almost positive value in every category characteristic, except in the group 65 years old and up, disability status, and ownership certificate training. This means the average wage of manufacturing workers is higher than non-manufacturing workers for the two categories above.

**Table 3.** Comparison of average wages according to characteristics sample (Rp)

No	Information	Manufacturing	Non-Manufacturing	Average Wage
1	Highest level of education completed			
	• Not school-primary school	943,208	810,397	825,081
	• Junior high school	1,489,440	1,073,413	1,142,356
	• Senior high school	2,332,772	1,662,811	1,781,619
	• University	3,852,127	3,422,811	3,450,289
2	Age			
	• Average (years)	1,792,304	1,453,596	1,499,417
	• Mode (year)	2,248,513	1,666,819	1,696,637
	• >65 Years	622,400	631,966	631,128
3	Gender			
	• Male	2,181,591	1,701,983	1,762,753
	• Female	1,283,160	1,062,971	1,095,714
4	Region of residence (%)			
	• Urban	2,131,684	1,939,216	1,970,589
	• rural	1,161,763	922,241	946,913
5	Marital Status			
	• Single	1,948,719	1,420,618	1,502,669
	• Ever Married	1,747,500	1,461,252	1,498,640
6	Existence Toddler			
	• There is	1,899,786	1,567,150	1,615,424
	• None	1,753,671	1,417,305	1,461,784
7	Disability Status			
	• Yes	970,490	978,491	977,729
	• No	1,827,210	1,484,532	1,531,783
8	Ownership Certificate Training			
	• Yes	2,553,757	2,849,674	2,817,486
	• Not	1,702,213	1,235,087	1,300,210

Source: Sakernas 2020, processed

The largest difference in Table 3 is in the average wage group age most sample quantity (mode). The manufacturing workers get an average wage of 2,248,513 rupiahs, while non-manufacturing workers only get 1,666,819 rupiahs, which means a difference amounting to 581,694 rupiahs. This condition exists because of the difference in mode between the two groups. The mode of manufacturing workers is 25 years old, whereas non-manufacturing workers are 38 years old, so the productivity of the groups will be different hence the average wage.

Based on the level of education, the average wage of manufacturing workers is higher than non-manufacturing workers for every education group. The largest difference occurred at the high school level/equivalent, reaching 670,311 rupiahs. Thereby it could be concluded that this condition is following determinant wages based

on the human capital theory that individuals with higher education will receive more wages too (Baker & Jacobsen, 2007; Burstein & Vogel, 2017)

Based on age, wages received by workers will rise until a certain age and decrease after passing productive age, which could be said to shape an inverted U pattern. This pattern occurs both in manufacturing workers and non-manufacturing workers.

**Comparison with provincial minimum wage (UMP)**

Table 4 shows the distribution of workers according to wages received and by industry. Of the whole worker, as much as 25.06 percent receive wages above the UMP, while 74.94 percent get below the minimum wage. Based on industry, manufacturing workers earn wages above UMP more than non-manufacturing workers, which are 36.90 percent against 23.21 percent.

**Table 4.** Workers according to the field of business and comparison against UMP

Industry	Below UMP (%)	Above UMP (%)
Manufacturing	63.10	36.90
Non-Manufacturing	76.79	23.21
Total	74.94	25.06

Source: Sakernas 2020, processed

The level of education Table 5 shows the existence similarity pattern between manufacturing and non-manufacturing workers: the higher the education level, the bigger the proportion of workers who earn wages above the minimum wage.

**Table 5.** Workers according to industry, education level, and comparison against UMP

Industry	Below UMP (%)	Above UMP (%)
<b>A. Manufacturing</b>		
• Not school-primary school	84.50	15.50
• Junior high school	68.14	31.86
• Senior high school	47.03	52.97
• University	37.78	62.22
<b>B. Non- Manufacturing</b>		
• Not school-primary school	88.42	11.58
• Junior high school	82.54	17.46
• Senior high school	72.01	27.99
• University	44.86	55.14
<b>C. Total</b>		
• Not school-primary school	87.99	12.01
• Junior high school	80,16	19.84
• Senior high school	67.57	32.43
• University _	44.41	55.59

Source: Sakernas 2020, processed

Gender also affects wages received, as seen in Table 6, where the male worker who gets wages above the UMP reaches 30.40 percent, whereas the female is 16.88 percent. By industry, there is a different pattern that a male manufacturing worker who earns a wage above UMP is bigger than a female manufacturing worker (45.42 percent compared to 25.77 percent). In comparison, non-manufacturing female workers have a bigger proportion than non-manufacturing male workers (23.21 percent compared to 15.32 percent).

**Table 6.** Workers according to industry, gender, and comparison against UMP

Industry	Below UMP (%)	Above UMP (%)
<b>A. Manufacturing</b>		
• Male	54.58	45.42
• Female	74.23	25.77
<b>B. Non-Manufacturing</b>		
• Male	71.78	15.32
• Female	84.68	23.21
<b>C. Total</b>		
• Male	69.60	30,40
• Female	83.12	16.88

Source: Sakernas 2020, processed

### Factors affecting wages

From the manufacturing and non-manufacturing wage model, all independent variables significantly influence dependent variables up to the level of 95 % confidence both in simultaneous and partial. The coefficient determination of  $R^2$  in the manufacturing wage model is 31,49 percent, and in the non-manufacturing wage model is 23.22 percent (Table 7).  $R^2$  does not matter because the data used is cross-section data with high heterogeneity (Gujarati, 2003).

**Table 7.** Wage model based on manufacturing and non-manufacturing worker

Variable	Non- industrial		Industry	
	Coefficient	P> t	Coefficient	P> t
Constant	12.4838***	(0.0009)	12.7502	(0.0020)
Age	0.0455***	(0.0000)	0.0383***	(0.0001)
Age <sup>2</sup>	-0.0005***	(0.0000)	-0.0005***	(0.0000)
<b>Gender</b>				
Female (reference)				
Male	0.4645***	(0.0002)	0.5253***	(0.0004)
<b>Level of education</b>				
Not school-primary school (reference)				
Junior high school	0.1655***	(0.0003)	0.2938***	(0.0006)
Senior high school	0.4000***	(0.0003)	0.6422***	(0.0006)
University	0.8429***	(0.0003)	1.0865***	(0.0010)
<b>Region of residence</b>				
Rural (reference)				
Urban	0.2756***	(0.0002)	0.2838***	(0.0005)
<b>Marital Status</b>				
Not Married (reference)				
Ever Married	0.1012***	(0.0003)	0.0731***	(0.0007)
<b>Existence Toddler</b>				
None (reference)				
There is	-0.0420***	(0.0002)	-0.0453***	(0.0005)
<b>Disability Status</b>				
No (reference)				
Yes	-0.1349***	(0.0004)	-0.1912***	(0.0012)
<b>Certificate Training</b>				
No (reference)				
Yes	0.1273***	(0.0003)	0.0203***	(0.0007)
<b>R-squared</b>	<b>0.2322</b>		<b>0.3149</b>	

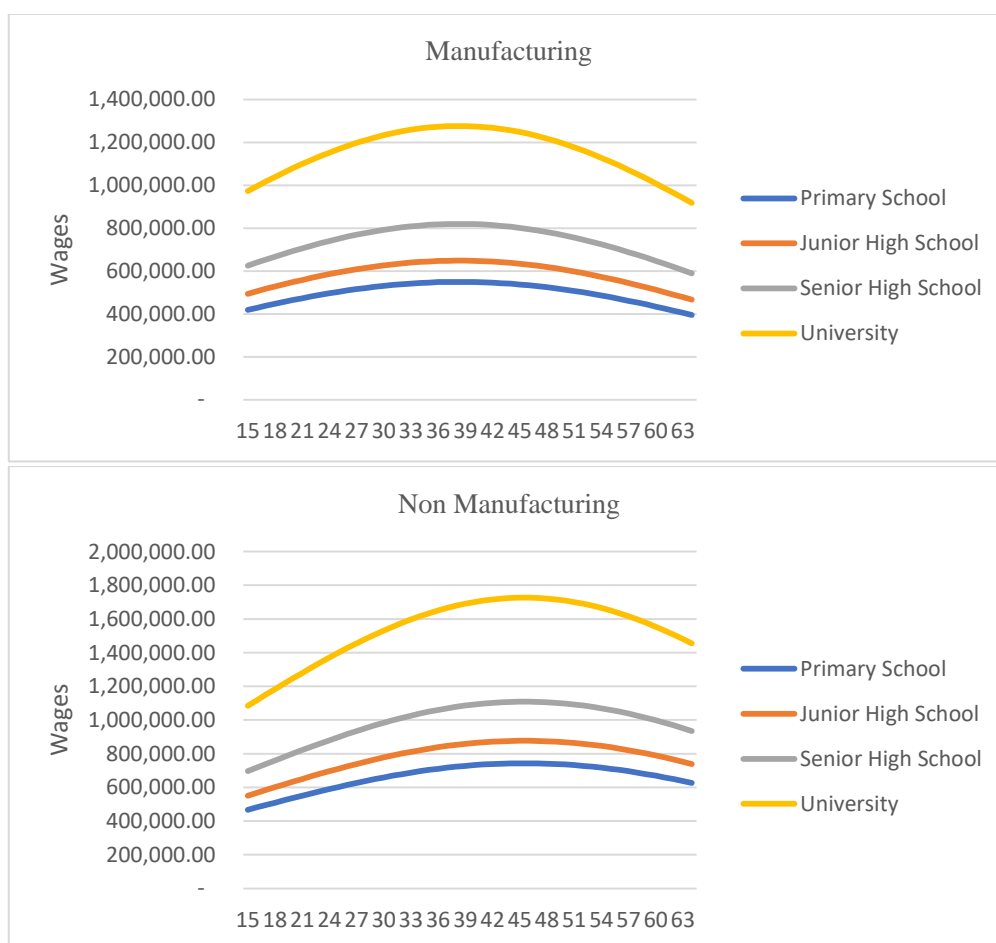
Standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

The two models above show the direction of the same effect on each independent variable in the wage model, both manufacturing and non-manufacturing workers. The difference between both models lies in the value of the independent variable coefficient.

Variable age takes effect quadratic to manufacturing and non-manufacturing workers' income, peaking at 43 and 50 years. The reverse U pattern describes wages received will increase with age, and return decreases at a certain age. This result is in line with the opinion of Willis (1986); Nanfosso & Akono (2009).

According to gender, wages received by manufacturing male workers is the highest among other groups: manufacturing female worker, non-manufacturing male workers, and non-manufacturing female workers. The value of the coefficient on the gender variable shows that male manufacturing workers get wages 52.53 percent higher than female manufacturing workers. In contrast, non-manufacturing male workers get wages 46.45 percent higher than non-manufacturing female workers. This result follows the study by Anker et al. (2000)

Education level takes to a positive effect on the earnings of male or female workers. This is because the higher level of education, the more productivity will also increase, so the potential income obtained will increase (Baker & Jacobsen, 2007). The difference in the influence of the level of education on wages can be seen in figure 2.



Source : Sakernas 2020, processed

Figure 2. Estimation pattern of wages according to education level and industry

Workers in urban areas get more wages than those in rural areas. This thing occurs both in manufacturing workers and non-manufacturing workers. Manufacturing urban workers earn wages 28.38 percent higher than manufacturing rural workers, whereas non-manufacturing urban workers get wages 27.56 percent higher than workers in rural areas.

Marital status has a positive influence on wages received by both groups. This result is to the findings of Hewitt et al. (2002), Nanfosso & Akono (2009), and Parida (2019). At the same time, the existence of toddlers is not in accordance with the hypothesis at the beginning, which negatively influences wages received. It means workers with toddlers accept wages lower than workers who don't have a toddler with details by 4.5 percent for the manufacturing workers and 4.2 percent for group non-manufacturing workers. Allegedly this is because workers who have toddler work in low positions, so they get low wages, too (Nogroho, 2016). Besides, there is a trend that working females will choose a profession with short working hours when they have toddlers, so wages are also low.(Cohen & Haberfeld, 1991; Putri et al. 2022)

Disability status also matters in wages received which is lower wages by 19.12 percent for manufacturing workers and 13.49 percent for non-manufacturing workers. Workers who have a disability will lower productivity, so that reasonable if the wages received are also lower (Forbes et al. 2010)

**The decomposition wage gap between manufacturing and non-manufacturing workers**

The differences in wage levels between manufacturing and non-manufacturing workers could be measured using the Blinder-Oaxaca decomposition method. This method could measure how big a wage gap is incurred and decompose the reason for the wage gap into two parts: characteristics of workers who are observed (endowment) and factors that are not could explain (factor discrimination nor differentiation). Table 8 shows the result of the Blinder-Oaxaca decomposition method.

**Table 8.** Decomposition Blinder Oaxaca of wages gap between manufacturing and non-manufacturing workers

<b>Inwage</b>	<b>Threefold</b>			
	<b>Coefficient</b>	<b>Robust Std Error</b>	<b>Z</b>	<b>P&gt;z</b>
Overall				
Group_1 (Manufacturing)	14.3346***	(0.0002)	5.7e+04	0.000
Group_2 (non-manufacturing)	14.2468***	(0.0001)	1.3e+05	0.000
Difference	0.0878***	(0.0003)	322.20	0.000
Explained (E)	-0.0695***	(0.0001)	-522.06	0.000
Coefficient (C)	0.1244***	(0.0003)	468.26	0.000
Interaction (I)	0.0329***	(0.0002)	214.65	0.000
%E = E/R	-79.1572			
% Discrimination = C/R	141.6856			

Source: Sakernas 2020, processed

Based on the Blinder-Oaxaca decomposition method, the wage gap between manufacturing and non-manufacturing workers is 0,0878, meaning the average wage for manufacturing workers is 8.78 percent higher than for non-manufacturing workers. The 79.15 percent wage gap could be explained by the endowments factor, which is the different characteristics of manufacturing and non-manufacturing workers. That value is high enough; however, it is lower than the discrimination factor that reached 141.68

percent or exceeded the difference that occurs. Of course, the wage gap is incurred because of discrimination and vice versa. The negative sign on coefficient factor endowment shows that differences in characteristics that occur will zoom out the wage gap. So could be concluded in accordance hypothesis that there is a difference in wage-earning by each group where manufacturing workers get higher wages and also by the next hypothesis that the endowment factor lowers the wage gap.

Based on the coefficient of each endowment factor, the positive sign shows that the difference variable endowment will increase the gap, whereas the negative score sign will reduce the gap (Kapsos, 2008). Table 8 shows that positive sign occurs in the region of residence (urban/rural) and disability status (yes/no), while other variables are marked negative. The largest variable that will increase the difference is the region of residence by 2.32 percent. In contrast, the largest variable that lowers the difference is the level of education reached 4.4 percent. This means that the more inequality in development, where many areas are left behind, the bigger the wage difference between manufacturing and non-manufacturing workers, and vice versa. The equal level of education for manufacturing and non-manufacturing workers, the more the wage gap will be reduced.

**Table 9.** Decomposition of Blinder Oaxaca wages worker industrial and non – industrial according to variable

<b>Variable</b>	<b>Total Gap</b>	<b>Factor Endowment</b>	<b>Factor Discrimination</b>
Age		-0.0053	
Gender		-0.0034	
Level of education		-0.0440	
Region of residence		0.0232	
Marital Status		-0.0034	
Existence Toddler		-0.0003	
Disability Status		0.0024	
Certificate Training		-0.0079	
<b>Total</b>	<b>0.0878</b>	<b>-0.0695</b>	<b>0.1244</b>

Source: Sakernas 2020, processed

## CONCLUSIONS AND RECOMMENDATION

### Conclusion

Even though two identical workers have similar characteristics and working conditions, many studies have found that their wages differ depending on industry attributes since some industries pay higher and others pay lower. These phenomena are usually known as inter-industry wage differential.

Using micro data of Sakernas 2020, the theory of inter-industry wage differential based on the complementary capital skills hypothesis has been empirically proven. Manufacturing workers get paid 8,78 percent higher than non-manufacturing workers. The source of the wage gap is 79.5 percent by differences in workers’ characteristics and the rest by industry attributes which is capital intensity.

### Recommendation

These findings suggest that in order to reduce the wage gap, policymakers are expected to facilitate industry gains more capital easier because the more industry has

capital, the higher their worker gets paid.

This study has some limitations, especially in classifying all industries based on their capital intensity. Each industry has a different attribute that is more appropriate to analyze as a source of the wage gap; for example, In agriculture, the wage gap problem usually occurs between formal and informal workers. Therefore, future studies should pursue a more detailed analysis of inter-industry wage differential, focusing only on one kind of industry based on an attribute that best describes it.

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