

Conference Paper

Have Investment and Technology Been Effective in Reducing Unemployment? (An Analysis in Indonesia Using Generalized Method of Moment)

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ABSTRACT

To achieve the SDGs (Sustainable Development Goals), especially the 8th goal, the government needs to be concerned about reducing unemployment. Two of the government's efforts are increasing investment and ICT (information and communication technology), where this study aims to evaluate the effectiveness of these efforts and other economic indicators on unemployment rates. This study uses the provincial panel of Indonesia data from 2012 to 2020, which is analyzed through dynamic panel data regression with the Generalized Method of Moment (GMM) Arellano-Bond approach. This analytical method is used because the variables are dynamic and able to estimate the short-run as well as the long-run effect. The results show that Domestic Direct Investment (DDI), economic growth, and regional minimum wages significantly reduce unemployment rates. Furthermore, the elasticity results show that for every 1 percent increase in domestic investment in a province, it will reduce the unemployment rate in the short run by 0.144 percent and in the long run by 0.205 percent. Meanwhile, ICT development is proven to increase unemployment, where every 1 percent increase will increase unemployment in the short run by 0.501 percent and in the long run by 0.713 percent. This study can be used as an evaluation material for the government and the stakeholders. Especially, to formulate strategies so that technological development does not become a time bomb for employment problems. In addition, increasing investment, dominantly from domestic, in the sectors that absorb many laborers is needed to accelerate the economy wheel performance.

Keywords: Domestic direct investment, foreign direct investment, GMM Arellano-Bond, ICT development, unemployment

Introduction

The high unemployment rate has become a big problem in many countries, including Indonesia. This is because the impact is not only on the country's economy but also on families and the surrounding environment. Unemployment triggers criminal acts and socially delinquent behavior that can lead to people's restiveness (Ajufo, 2013; Farrington, et al., 2016). This issue has also been included in one of the SDGs' goals, exactly the eighth. The unemployment rate target set in 2024, as stated in The Mid-Term National Development Plan (RPJMN) by BAPPENAS, is 4.0-4.6 percent (BAPPENAS, 2019). Meanwhile, Indonesia's unemployment rate in 2021 still shows a figure of 6.49 percent (BPS, 2021). Various efforts have been made, for example, by utilizing external funding.

External funding through investment, both from domestic (DDI) and abroad (FDI), is important in increasing employment. The Investment Deregulation Director of the Investment Coordinating Board (BKPM) said that the absorption of Indonesian workers through investment

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reached around 1.4 million people in 2013-2014 (Purwanto, 2019). This is because direct investment increases production capacity (such as equipment capital), encouraging job opportunities (Steven, 2021). But after that, BPKM shows that in 2018 there were only around 930 thousand people left, which is because many of these investments went into capital-intensive industries (Purwanto, 2019). Therefore, the effects of investment on unemployment may not be significant.

In line with that, the Director-General of the Ministry of PUPR emphasized that the economic growth from labor-intensive industries can absorb a larger workforce (MenPan, 2021). Then, if it is associated with the economic sector, the formal sector is more dominant in increasing economic growth because it creates purchasing power certainty (Htoo, 2020). This is due to the existence of guaranteed wages and tax contributions. Therefore, the number of workers in the formal sector should continue to be increased, wherein August 2021 in Indonesia reached 40.55% or has increased by 1.02% (BPS, 2021).

Besides investment and economic growth, another factor that affects employment is the wage rate. When the regional minimum wage increases, the interest of job seekers will also increase, and the problem is whether the existing job opportunities can accommodate this interest. On the other hand, when the regional minimum wage is low, the interest of job seekers will decrease so that the workforce chooses to be self-employed. This will cause friction in the labor market, reducing output, affecting employment, and pushing job seekers into low-productivity own-account work (Poschke, 2019).

Last but not least, technology may influence labor demand. The more advanced technology creation is intended to increase productivity and reduce production costs which ultimately improves the economy (Ministry of Finance, 2017). But this impacts the low absorption of labor, while at the same time, new jobs are created. Abbasabadi and Soleimani (2021) show that in many countries, the development of digital technology causes unemployment to grow maximally and then decline along with the expansion of technology that exceeds a certain value. Furthermore, Van Roy et al. (2018) detail that the high-tech manufacturing sector has significantly increased unemployment. This can happen because of low cognitive, uncreative, and inadequate skills to operate technology.

Therefore, this study aims to prove whether the variables mentioned above significantly reduce unemployment rates. Thus, this study uses yearly balanced panel data of 33 provinces in Indonesia from 2012 to 2020. The expected contribution from this study can be an evaluation material for the government & stakeholders to formulate strategies to reduce unemployment. Moreover, this is expected to be a consideration for the government, especially related to investment and ICT development efforts that have been carried out to reduce unemployment

Material and Methods

This study is conducted in 33 provinces in Indonesia from 2012 to 2020. According to the introduction section, the dependent variable used in this study is unemployment. Meanwhile, the independent variables are domestic and foreign direct investments, economic growth, regional minimum wage, and the ICT (Information and Communication Technology) index. All of the data were compiled from BPS-Statistics Indonesia (<https://bps.go.id>).

Regarding the analysis, this study employed two types of analyses. First, the descriptive analysis to gain fresh insight into the unemployment condition in Indonesia and its relationship with technology and economic variables visually. Second, the inferential analysis (using dynamic panel analysis – GMM Arellano-Bond) to identify the relations of domestic and foreign direct investments, economic growth, regional minimum wage, and ICT index to the unemployment rate. The dynamic panel method is used because the variables are dynamic, especially economic variables, which allows for a correlation between explanatory endogenous variables and errors. Using Ordinary Least Square (OLS) estimation will make the model biased and inconsistent (Arellano &

Bond, 1991). Thus, the GMM Arellano-Bond estimation method was used. This study uses ArcGIS and R to do the analysis.

Results and Discussion

Results

Descriptive analysis

Figure 1 below shows that four provinces in Indonesia have a high unemployment rate in 2020, namely Banten, DKI Jakarta, West Java, and Riau Islands. This means that 3 of them are located on Java Island, and the rest are provinces with medium and low levels of unemployment spread across all islands in Indonesia. One thing that is quite interesting here is that for the last three years before 2020 (2017-2019), the Riau Islands Province has never been included in the category of areas with a high unemployment rate. This shows that the COVID-19 pandemic has significantly increased the number of unemployed in the Riau Islands.



Figure 1. Unemployment rate classification of Indonesian Provinces in 2020

Meanwhile, another thing observed is that the only province on Java Island with a low unemployment rate is Yogyakarta. For the Sumatra Island, only Lampung, Jambi, and Bangka Belitung which have a low unemployment rate. As for Sulawesi Island, 2 out of 6 provinces have moderate unemployment rates, namely North and South Sulawesi Provinces. On Kalimantan Island, only South and Central Kalimantan are classified as having low unemployment rates. Last, in the easternmost part of Indonesia, it is seen that Papua has a low unemployment rate.

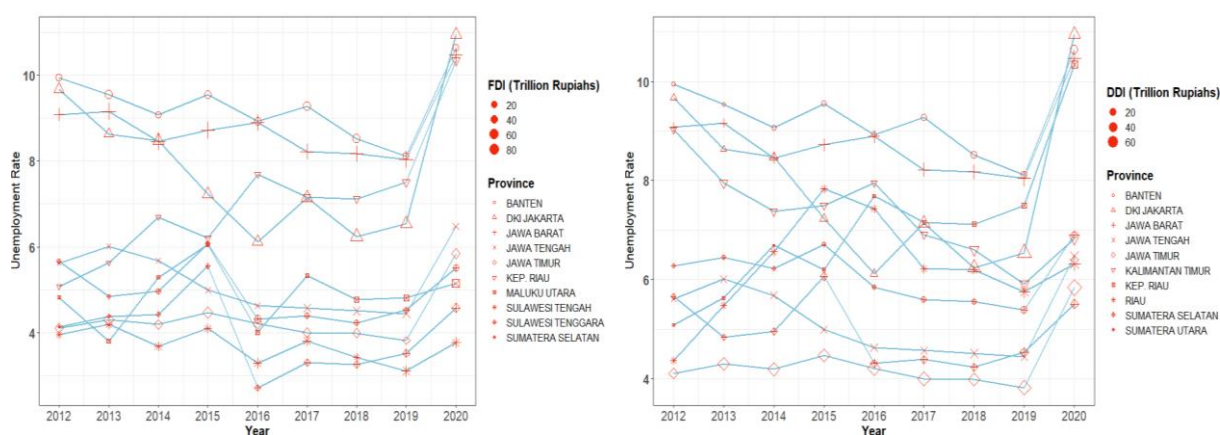


Figure 2. Unemployment trends in ten provinces with the highest FDI (left) and DDI (right)

Another thing that can be reviewed visually is how unemployment trends are related to investment and ICT. Figure 2 on the left shows unemployment trends in the ten provinces with

the highest FDI, where the lines represent the unemployment rate trends and the dots represent the provinces. From the graph, it can be seen that the highest FDI is dominated by the provinces on Java Island, as well as DDI. However, it can also be seen that the provinces on the Sumatra Island dominate the highest DDI after Java Island. Furthermore, the unemployment trend in many provinces also tends to decrease before 2020. This shows that foreign and domestic investment in each province can reduce unemployment visually.

Figure 3 shows the unemployment rate trend with the highest ICT index. All provinces on Java Island are included in the top-ten list of ICT indexes, followed by Sumatra Island, which has two provinces included. It can be seen that the unemployment rate fluctuates in almost all provinces with the highest ICT index, but there was a downward trend until before 2020. Meanwhile, knowledge about the effect of an increase in the ICT index and investment on the unemployment rate's decrease has not been able to be explained in Figures 2 and 3. Therefore, a statistical effort through inferential analysis is needed to make the decision more reliable.

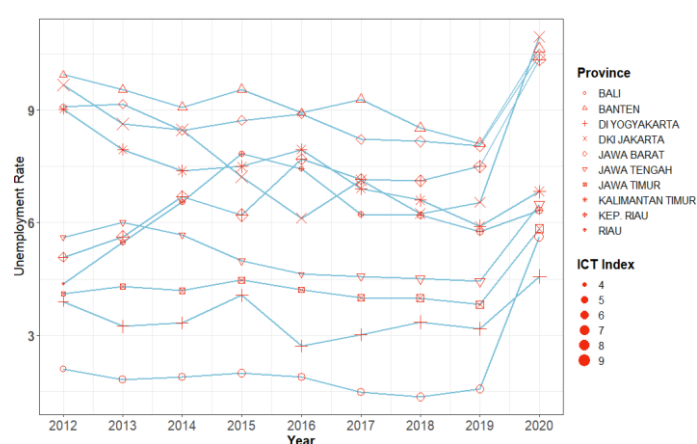


Figure 3. Unemployment trends in ten provinces with the highest ICT Index

Inferential analysis

Table 1 presents the relationship between the lag one unemployment rate, investment, economic growth, regional minimum wage, ICT index, and unemployment rate using dynamic panel analysis with the GMM Arellano Bond estimation method. The resulting model in Table 1 can be written in a mathematical equation as follows:

$$UnEmp_{i,t} = 0.297UnEmp_{i,t-1} - 0.066Ln(FDI)_{i,t} - 0.144Ln(DDI)_{i,t} - 0.111EcGrowth_{i,t} - 1.081Ln(Wage)_{i,t} + 0.501ICT_{i,t} \quad (1)$$

Based on the dynamic panel data model below, information can be obtained regarding which indicators are significant and how they affect the unemployment rate. This model has passed the simultaneous significance test (p-value Wald test < 0.05) and robustness test: autocorrelation and heteroscedasticity (p-value Arellano-Bond m_2 and Sargan > 0.05). Therefore, the results can be trusted for further analysis purposes. The following results show that the lag one unemployment rate, domestic investment, economic growth, regional minimum wages, and the ICT index significantly affect the unemployment rate.

In more detail, we can note that at the direction of the significant influence of independent variables. It can be seen that domestic direct investment, economic growth, and regional minimum wages have an inversely proportional effect on unemployment. This shows if there is an increase in these three variables' values, the unemployment rate tends to decrease. Meanwhile, two other variables, namely lag one unemployment rate and the ICT index, have the same effect as unemployment. So, if there is an increase in these two variables' values, the unemployment rate will also tend to increase.

Table 1. GMM model results for unemployment rate

Predictors	Estimated Coefficients	Standard Error	Z	P-Value
$UnEmp_{i,t-1}$	0.297052	0.178513	1.6640	0.096105*
$Ln_FDI_{i,t}$	-0.065849	0.084167	-0.7824	0.433999
$Ln_DDI_{i,t}$	-0.144360	0.083151	-1.7361	0.082543*
$EcGrowth_{i,t}$	-0.111449	0.038316	-2.9087	0.003630***
$Ln_Wage_{i,t}$	-1.081003	0.415354	-2.6026	0.009252***
$ICT_{i,t}$	0.501305	0.224181	2.2362	0.025341**
Simultaneous Test	Wald Test	0.00000		
Robustness Test	Arellano-Bond Test (m_2)	0.69754		
	Sargan Test	0.19707		

Notes: Significant at 1% (***), 5% (**), 10% (*) level

Furthermore, we review domestic investment's short and long term effects, as shown in Table 2. In that case, they have a negative coefficient, which means an increase in domestic investment will reduce the short and long term unemployment rate. The short-term elasticity of domestic investment of -0.1444 indicates that for every ten percent increase in domestic investment in a province, it will reduce the current unemployment rate by 1.444 percent. Meanwhile, the long-term elasticity of -0.2054 indicates that for every ten percent increase in domestic investment in a province, it will reduce the unemployment rate in the long run by 2.054 percent.

These results also indicate that the short and long-term effects of economic growth on the unemployment rate are opposite. The short-term elasticity of economic growth of -0.1114 indicates that for every ten percent increase in the economic growth of a province, it will reduce the current unemployment rate by 1.114 percent. Meanwhile, the long-term elasticity of -0.1585 indicates that for every ten percent increase in the economic growth of a province, the long-term unemployment rate will decrease by 1.585 percent.

In line with the previous two variables, wages also have an opposite effect on unemployment. The short-run elasticity of wages shows -1.081, meaning that every one percent increase in the regional minimum wage in a province will reduce the current unemployment rate by 1.081 percent. If in the long term, it will reduce the unemployment rate to 1.5378 percent. Lastly, the ICT index has positive implications with a short-term effect of 0.5013, which means that every one point increase in the ICT index in a province will reduce the current unemployment rate by 0.5013 percent.

Table 2. Estimation results of elasticities

Predictors	Elasticity	
	Short run	Long run
$Ln_DDI_{i,t}$	-0.144360	-0.205364
$EcGrowth_{i,t}$	-0.111449	-0.158545
$Ln_Wage_{i,t}$	-1.081003	-1.537814
$ICT_{i,t}$	0.501305	0.713147

Discussion

From the results of the descriptive analysis, there is some information about the unemployment condition in Indonesia. For example, Riau Island is in the high category of unemployment rate in 2020, which has never happened in the previous year (2017-2019). One of the causes is the decline in available employment, mainly in Manufacturing (1.15 percent) and Construction (0.92 percent). Changes in the number of labor demands since the COVID-19 pandemic resulted in many workers being laid off or stopped working, then their status changed to unemployment (Sultan, 2021). In addition, according to the Governor of the Riau Islands

Province, Ansar Ahmad, there are still many workers who do not have the expected expert qualifications, while the value of the foreign and domestic investment in the Riau Islands is among the highest in Indonesia. Therefore, the less-skilled workers are easy to replace at any time, for example, in the current pandemic conditions (Ogen, 2021). This is following the data that 5.84 percent of formal workers in 2019 became informal workers in 2020 (BPS Kepri, 2020).

Another piece of information is about Yogya, which is the only province with a low unemployment rate in Java. However, it does not mean Yogyakarta is not struggling to deal with the unemployment problem. This is evidenced by the fact that in August 2020, the unemployment rate in Yogyakarta rose by 1.39 percent compared to August 2019. The employment opportunities decreased, especially in the Accommodation and Food Service Activities (1.16 percent), Business Services (0.83 percent), and Construction (0.76 percent) (BPS Yogyakarta, 2020). Therefore, most provinces in Indonesia had an increase in unemployment compared to before the pandemic, although the unemployment rate was still relatively low compared to other provinces.

From inferential analysis, this study finds that FDI has no direct relationship to Indonesia's unemployment reduction. This result is in line with Widia et al. (2019), which shows that in ASEAN 5, in the short term, FDI is not able to influence unemployment. Likewise, a study by Alalawneh (2020) reveals that in the short term, there is no causal relationship between FDI and unemployment in the Middle East and North Africa region in various forms. This can be due to the opposite goal, where the domestic government is trying to attract FDI to open new job opportunities which will reduce domestic unemployment, but there is a tendency for foreign investors to bring workers from their countries, so the foreign workers are absorbed in a domestic country (Tegep et al., 2019). Indonesia seems to be experiencing this since the average ratio of foreign workers absorption per IDR 1 trillion of FDI in Indonesia showed an increasing trend from 3090 workers in 2016 to 4411 workers in 2020.

In contrast to FDI, an increase in DDI has proven significant in decreasing the unemployment rate. Utilizing DDI properly will greatly benefit a country because all the profits will return to the country itself. The state has also become independent of the other countries' policies, especially regarding worker issues, so more domestic workers are absorbed (Djulius et al., 2019). In 2020, DDI reached Rp413.5 trillion, which was dominated by the transportation, warehouse, and telecommunications sectors (22.6%) and construction (16.5%) (BPS, 2020). This is in line with the Indonesian government's program to enhance sectors related to human resources, such as infrastructure and construction, telecommunications, health, and tourism sectors (BAPPENAS, 2019). This existing program is an attraction for domestic investors because of the prospect of large profits and tends to reduce the level of domestic unemployment and lead to an increase in people's welfare (Nasution et al., 2021).

Besides DDI, economic growth has a significant negative impact on unemployment too. This result confirms that Okun's Law applies in Indonesia in this study period. This assumption is based on the fact that when economic growth grows more than 2.25%, every 1% output increase will reduce unemployment by 0.5% (Mankiw, 2009). In addition, this finding is also in line with the research of Saungweme et al. (2019) in Zimbabwe that increased economic growth was proven to create more formal jobs. Therefore, the number of informal workers or those who are vulnerable to falling into unemployment will decrease. This negative correlation between economic growth and the unemployment rate can indicate that economic growth can be used as an important tool in reducing and achieving the desired level of employment (Hjazeen et al., 2021). Of course, the government also has to maintain the growth in the number of formal workers and labor-intensive industries.

Moreover, regional minimum wages also have a significant negative impact on reducing unemployment in Indonesia. These results are in line with IMF (2016) which says that in the case of the Republic of Croatia, it is proven that there is a negative effect between wage increases on demand for low-skilled unemployment. This can happen because the percentage of low-skilled unemployment is higher than that of high-skilled unemployment. Then there is also the

unemployment trap phenomenon, which to capture this high-skilled unemployment, it is necessary to increase the regional minimum wage. Therefore, later this wage increase will increase overall employment. In line with Comola and de Mello (2011) also suggest the existence of a lighthouse effect, where inactive workers will be attracted to the labor market due to rising wages. This increase in the regional minimum wage will provide readiness and ability for companies, the economic sector, and the community to develop and improve business activities. In addition, a conducive business climate also needs to be created by the government to expand the level of community economic participation to increase welfare and benefit from economic development.

Last but not least, the government's efforts to improve technology are like a double-edged sword. On the one hand, technological improvements can certainly increase productivity so that there will be an increase in economic growth. But on the other hand, it raises inequality and employment problems. Over the past decade, technology-based jobs have replaced many jobs, such as bank tellers, factory workers, ticket sellers, postal workers, tailors, and others (Jaradat et al, 2020). Van Roy et al. (2018) also emphasize this, who states that the high-tech manufacturing sector has significantly reduced unemployment. The reason is low cognitive, not creative, and inadequate skills to operate technology. Meanwhile, Casey (2018) also mentions from the productivity side that there has been a technical change where when worker productivity increases due to technology, fewer workers are needed to operate the existing capital stock, assuming everything is the same.

Conclusion

This study aims to describe the direct relationship between investment and technology on unemployment in Indonesia using dynamic panel data at the provincial level from 2012 to 2020. The investment studied is a foreign direct investment and domestic direct investment. This study concludes that Banten, Jakarta, Riau Islands, and West Java are included in the category of high unemployment rates. DDI, Economic Growth, and Regional Minimum Wages are positive and significant variables that reduce unemployment rates. Meanwhile, ICT development is proven to increase unemployment. Therefore, the government needs to formulate strategies so that technological development does not become a time bomb for employment problems. Moreover, increasing investment, dominantly from domestic, in the sectors that absorb many laborers is needed to accelerate the economy wheel performance. As a result, if the decision-making on this significant variable is correct, it will not only impact the unemployment problem, but also other problems related to the Indonesian economy and welfare can be resolved.

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