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The Impact of Transjakarta Bus Rapid Transit (BRT) Operationalization on Economic Growth and Unemployment Rate in DKI Jakarta Province

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Abstract

Special Capital District Jakarta province is one of the most populous cities in Indonesia. People commute every day mostly by using private vehicles to meet their needs. Somehow another alternative comes as one of the longest lengths of BRT track in the world, operationalization of the Transjakarta BRT is expected to be able to contribute to economic growth and improve people's accessibility so that it could reduce the unemployment rate. This paper aims to determine the magnitude of BRT operationalization on economic growth and the unemployment rate in Jakarta. This paper used panel data consisting of 5 cities in Jakarta during 2016-2021. 2 Stage Least Square is being used as a methodology that estimates endogenous & predetermined variables. Secondary data used consist of economic growth, the unemployment rate as the endogenous and BRT kilometer traveled private vehicle units, stock capital growth, and the number of the labor force as the predetermined ones. The findings in this study indicate that the operationalization of BRT contributes 0,01577231 to economic growth and decreases 0,00120415 the employment rate in Jakarta at the significance level of 5% ceteris paribus. It suggests that in the long-run BRT, operationalization plays an important role in the transportation economic sector in Jakarta.

Keywords: Economic Growth, Unemployment Rate, Transjakarta BRT, Jakarta

1. Introduction

Jakarta, as the center of government, economy, business and entertainment, certainly has its own attractions for residents outside Jakarta to come to the capital for various reasons, ranging from working, shopping, seeking entertainment and other needs. This has led to an influx of population in Jakarta, according to data presented by BPS in 2022, the population in DKI Jakarta in 2021 reached 10,644,776 with a population growth rate of 0.78%. In addition, the population density in DKI Jakarta in 2020 is 14,555 people per km^2. Residents of DKI Jakarta certainly have options in choosing transportation. Annual data on the number of motor vehicles in Jakarta reported by BPS states that there is a significant increase in the number of motorcycles, passenger cars, and trucks (Jakarta, 2020).

The aggregate growth of vehicles is 2.03% per year. The limited land for population mobilization in carrying out their activities has created traffic congestion problems. According to Tom Tom Traffic Index, the level of congestion in DKI Jakarta is 36% in 2020. This level of congestion means that on average, travel time is 36% longer than it should be. However, in 2019 when the COVID-19 pandemic had not occurred, and mobility was normal, the level of congestion in Jakarta was 53%. This means that the travel time that should be taken for 30 minutes on a free flow road in Jakarta will take 16 minutes longer when the congestion level is at that number.

Similar conditions are also revealed by (Muneera & Krishnamurthy, 2020) in Thiruvananthapuram, one of the densely populated cities in India, found that two-wheeled vehicles have the highest vehicle composition in their research scope, followed by average cars around 33%, while public vehicles, the average composition of buses is only 4% of total traffic of total traffic. The congestion generated can have various negative impacts on individuals and business economy, including impacts on air quality (from additional vehicle emissions), quality of life (from personal delays), and business activities (from additional costs) and reduction of service areas for labor, suppliers, and customers) (Weisbrod et al., 2003). (Bappenas, 2007) has predicted that if the congestion problem is not addressed, the potential

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loss will reach Rp 65 trillion in 2020. The prediction is calculated based on two parameters, the loss due to vehicle operational costs of Rp 28.1 trillion and the estimated loss of time of around Rp 36.9 Trillion.

The government of DKI Jakarta from time to time has implemented several policies to address traffic congestion, such as the 3 in 1 policy on December 23, 2003, the operationalization of the Busway / Bus Rapid Transit Transjakarta on January 15, 2004, the Odd-Even policy on August 23, 2016, and the operationalization of the MRT on March 24, 2019. These policies have been consistently implemented to date as an effort to address congestion. Of course, the implementation of policies carried out by the Government of DKI Jakarta cannot overlook the fact that DKI Jakarta has incurred a large cost to realize transportation investment development as a solution to traffic congestion in DKI Jakarta. One of them is transportation services that have been operating in the capital since February 1, 2004 until now.

BRT Transjakarta is a Bus Rapid Transit (BRT) system, the first in Southeast and South Asia with the longest route in the world (251.2 km). Transjakarta official service changed status on Thursday (27-3-2014), from *unit pengelola* (UP) to *perseroan terbatas* (PT), which is a regional owned enterprise (BUMD) with a share ownership composition of 99.66% owned by the Government of DKI Jakarta while 0.34% is owned by PT Jakarta Propertindo. Research from (Gaduh et al., 2017) found that the BRT Transjakarta system is not very good at increasing the number of passengers or reducing the ownership of private motorcycles. In addition, the BRT route that takes over some limited roads worsens congestion along its operational route, which affects the increase of travel time for other vehicles.

On the other hand, research conducted by (Harmadi et al., 2015) revealed that the low quality of connectivity due to the lack of public infrastructure is a strong drive for road users to prefer private vehicles over public transportation. The Solow theory (Solow, 1957) argues that the process of technological development is one of the independent variables that has a positive effect on economic growth. (Snowdon, 2006) presents a principle based on the Global Competitiveness Report 2004-2005 that Sala-i-Martin and Artadi in 2004 argue 'macroeconomic and microeconomic competitiveness determinants should not be separated.' So, 3 basic principles were compiled in the Global Competitiveness Index (GCI), one of which is the basic need which is infrastructure.

The development of public transportation modes when viewed from an economic perspective is part of long-term investment. However, when viewed from an economic perspective, further research is needed regarding the relationship between BRT and economic growth and the open unemployment rate. And a comparison with other countries as a benchmark in forecasting the impact of the operationalization of BRT on economic growth and open unemployment rate in an area. Therefore, research is needed on the impact of the operationalization of BRT on economic growth and open unemployment rate in DKI Jakarta Province.

2. Literature Review

2.1. Economic Growth

Economic growth is the development of goods and services production activities in an economic region in a certain year compared to the value of the previous year based on GDP / PDRB at constant prices (Statistik, 2022). Historically, economic growth theories have developed over time, starting with the Harrod-Domar model theory with the simple characteristic that the economic system in the long run achieves the best equilibrium in one equilibrium point. When the economy deviates slightly from its natural growth rate, the consequences are between growing unemployment or prolonged inflation, as this system does not have the power of balance. The shortcomings of this system have been discussed with the assumption of fixed proportions of the combination of Capital and Labor. Conversely, alternative models have developed where the proportions of these factors are flexible and all rigidity is assumed to be non-existent. This model is often called the neoclassical model (Sato, 1964).

According to (Solow, 1956), the production function can be written as follows:

$$Y = F(K, L) \quad (1)$$

The properties of this production function in the Solow Model is constant return to scale, one example of which is the Cobb-Douglas production function. Y can be defined as the value of national output, the value of GDP (Gross Domestic Product) or Gross Regional Domestic Product (GRDP) is determined by the level of capital and the level of labor. In the Solow model, there is also an expenditure approach where if we refer to the open economy model where:

$$Y = C + I + G + (N-X) \quad (2)$$

In this Solow model, we disregard G (Government Spending) and Net Exports (N-X) for simplification.

So from the expenditure approach, the value of the consumption function and investment function is as follows:

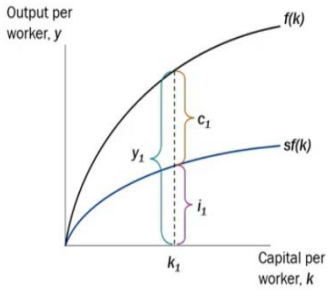
$$Y = C + I \quad (3)$$

Next, if we use the per worker terminology then the function will be as follows:

$$y = c + i \quad (4)$$

Income y will be used for consumption and saving. Saving will be used for investment i, suppose the proportion of income used for saving is s. From income y, s multiplied by y is used for investment, because the proportion of income saved is s. (1-s) y is used for consumption. So the value of investment is sf(k) because y is f(k). Meanwhile, consumption is (1-s) f(k) and if written is as follows:

$$y \nearrow c \Longrightarrow (1\text{-}s)y \Longrightarrow sf(k) \quad (5)$$



Gambar 1. Output curve based on consumption and investment

On the curve shown in Figure 1, we can see that sf(k) is investment, when the k-level is at k1, then the total output value is y1. Some of the income is consumed and invested, i1 is the value of the investment and c1 is the value of the consumption. The value invested will increase the capital so capital will increase, not at level k1 again then will increase k1 + i1. When k1 shifts to the right, then the output value will also increase.

Economic growth of a region can be seen from the change in PDRB (Regional Gross Domestic Product) which is a macro indicator of the success of regional development. PDRB is the total value of final goods and services produced by all economic sectors in a region or the total value added by all business sectors in a region. A region can be said to have better economic activity if the regional economic growth is higher. PDRB based on current prices represents the value added of goods and services calculated using the prices that apply in each year, while PDRB based on constant prices shows the value added of those goods and services calculated using prices that apply in a certain year as a base. PDRB based on current prices can be used to see shifts and economic structure, while constant prices are used to determine economic growth from year to year (Statistik, 2022).

2.2. Open Unemployment Rate

Open Unemployment Rate is the percentage of unemployed individuals to the total labor force. The labor force includes individuals who are working or have a job but are temporarily not working, and unemployed individuals. Unemployment is defined as (1) individuals actively seeking employment, (2) individuals preparing for a new job, (3) individuals who do not seek employment due to feeling that it is impossible to find a job, (4) individuals who are not actively seeking employment due to already having a job but have not yet started working (Statistik, 2022). Furthermore, (BPS, 2022) formulated the following formula:

$$TPT = PP/PAK \times 100\% \quad (6)$$

Explanation:

TPT : Open unemployment rate (%)

PP : Number of unemployed (persons)

PAK : Number of labor force (persons)

According to research by (Farber, 2015), unemployment is often seen as an individual problem caused by a lack of skills and social capital, or as a macroeconomic problem that causes economic growth to slow down. (Leontief, 1936) Keynes' viewpoint states that a free market system will not automatically make adjustments to full employment conditions, government intervention is needed in the form of government policies. One way to address this is through fiscal policy. This fiscal policy is based on Keynes' theory, which emerged as a reaction to The Great Depression that plagued the American economy in the 1930s. Fiscal policy is a policy taken by the government that concerns taxes, revenue, debt, and government spending that aims to address a specific economy.

The unemployment rate is formulated in (Mankiw, 2014) as follows:

(Open Unemployment)/(Open Employment) (7)

Labor force participation Rate

(Labor Force)/(Working age) (8)

2.3. Economic growth and open unemployment rate

The relationship between economic growth and open unemployment rate at the macro level can be understood by referring to Okun's Law. In a country where the level of economic growth is measured by GDP (Gross Domestic Product), when it experiences an increase, it will cause an increase in employment and a decrease in unemployment. This is supported by research from (Lee, 2000) who stated that the sample data used generally support the validity of Okun's law through statistical significance in the parameters. In line with this, (Soylu et al., 2018) using panel data from East European countries in the period 1992-2014 through panel regression data method found that an increase of 1% in GDP decreases the unemployment rate by 0.08%. (Okun, 1963) in his study of the US economy, (Holmes & Silverstone, 2006) empirically proved the inverse relationship between unemployment and potential output, depending on labor force participation, working hours and changes in productivity.

Theoretically, the study by Okun is based on the fact that an increase in labor force will certainly produce more goods and services. Arthur Okun found that the unemployment rate is negatively valued during high real economic growth rate years, while the unemployment rate increases when annual economic growth rate remains low or even negative. However, research conducted by (Romhadhoni et al., 2019) using path analysis during 2013-2015 showed that economic growth has a positive effect on open unemployment rate in the DKI Jakarta Province. This is certainly contrary to the prevailing theory, which is that if economic growth increases, it is expected that adequate labor absorption will occur, thus reducing the open unemployment rate.

The contradiction of Okun's Law with the research (Romhadhoni et al., 2019) certainly does not occur without any particular reason. This can happen because economic growth is only based on macro numbers such as controlled inflation rate, increasing GDP, low exchange rate, and so on, while the real sector, especially Small and Medium Enterprises (SMEs) is less developed and less powerful so that it is unable or less able to absorb unemployment. In addition, economic growth that is not accompanied by production capacity can cause the unemployment rate to increase along with economic growth. This increasing economic growth is capital-intensive, where production activities drive output and generate increasing income rather than labor-intensive economic growth. The DKI Jakarta Province has a high level of urbanization, if urbanization is not well controlled, it will have a negative impact on the economy of the community. One of the impacts that occur if urbanization is not controlled is the increase in unemployment rate. The economic growth in the DKI Jakarta Province which is quite fast is not accompanied by equal distribution in every regional sector, causing a relatively high unemployment rate.

2.4. Economic Growth, Open Unemployment Rate, and the Operationalization of BRT

A government with rapidly developing cities invest heavily in public transportation projects to meet the increasing transportation demand. An environment built with high D-variables (development density, land use diversity, street connectivity, destination accessibility, and distance to transit) is called compact while the low is called sprawling (Reid & Robert, 2017). The development of the defined compact environment has a concept of transit-oriented transportation, where public transportation in the environment is already integrated with each other.

The rapid growth of motor vehicles and dependence on personal vehicles has caused various problems such as traffic congestion, travel uncertainty and delay, traffic accidents, increased energy consumption (oil/gas), increased vehicle costs, urban air pollution, and economic losses due to health problems and lost wages (Kogdenko, 2011). The report

(Metrolinx, 2008) using cost benefit analysis estimates the cost of congestion to be a decrease of more than $2.7 billion in GDP in Ontario, Canada.

Referring to these literatures, if we look at the existence of transportation in the capital city of Indonesia today, the private sector still dominates the market. This is due to the ease provided by private companies in the available applications such as GO-JEK, Grab and other private startup companies in providing transportation services to the public and various other factors that cause the choice to still be dominated by the informal sector. Mass Rapid Transit (MRT) is a term used to describe urban transportation (either road-based or rail-based) that carries large numbers of passengers quickly. This public transportation is typically on a fixed corridor connecting the outskirts of the city to the city center and in some cases has exclusive rights over some or all of its route distance (Fouracre et al., 2003). The United States shows evidence that investments in new transit lines encourage people to switch from private cars to public transportation, thus reducing congestion on public roads (Baum-Snow & Kahn, 2000).

New public transportation lines are seen as a major driver of economic growth and job creation in Singapore (Diao et al., 2017). (Anas et al., 2015) have conducted an analysis using micro and macroeconomics in the transportation sector and found that it provides a wider economic benefit (regional) from new transportation investments in Indonesia. They have found that government investment in the public transportation sector has a positive economic contribution to an area.

A study related to the open network BRT system on property values conducted by (Zhang et al., 2020) suggests that there is an increase in property value up to 1.64% that is 100m closer to frequent feeder bus stops in the western and eastern outskirts of Brisbane. A research conducted by (Nelson & Hibberd, 2019) related to XBT (Express Bus Transit) in Miami-Dade South using shift share analysis tried to look deeper into its relationship with economic growth. They found that XBT stations gained jobs during the recession and recovery years, however, during the recession, it gained jobs at a slower pace, and lost jobs shares after the recession passed. These studies have grown rapidly in various countries, especially countries that have been developing BRT since the early days in Europe and Australia.

Research conducted by (McGreevy, 2021) in the central and mid-Adelaide South Australia found that BRT ‘Curitiba’ is the best option for the area because it is far cheaper than rail-based transportation (light or heavy rail), BRT has the potential to provide a significant number of mobility options in the area, and will be more reliable and comfortable for the local community. On the other hand, research (Ansar et al., 2016) related to infrastructure investment in China even found that infrastructure projects in China failed to provide positive risk-adjusted results. Where the investment was financed with debt, excessive investment in unproductive projects that resulted in debt accumulation, monetary expansion, instability in financial markets and economic vulnerability. The budget given by the government in investing in the transportation sector certainly has a clear purpose towards the development of the economy of an area because looking at it from the perspective of public transportation which is quite vital in providing contributions to the running of various activities in an area.

Infrastructure conditions of roads and electricity have a significant impact on per capita income growth, but not with ports. Investment has been proven empirically as a driving factor for economic growth in Indonesia (Maryaningsih et al., 2014). Simultaneously or together, government spending, and workforce (working labor force) have a significant impact on GDP of districts/cities in Banten province during the period 2010-(Maisaroh & Risyanto, 2018). (Zenou, 2000) in his research shows that there is 'spatial mismatch' because the farther the distance of unemployment from the job, the higher the wages earned by the workers and the higher the unemployment rate. In line with this (Yi, 2006) found that job accessibility with public transportation has a significant impact on employment levels.

Although the use of personal vehicles also significantly contributes to increasing employment status for those less fortunate economically, job accessibility using public transportation has a greater impact in increasing employment levels than personal vehicles. In research conducted by (Fan et al., 2012) in the study area of the Hiawatha Light Rail Line, it was stated that mass transit systems have been studied extensively in the last two decades and have been proven to be an effective tool in reducing regional unemployment levels by improving job accessibility. Furthermore, better public transportation disproportionately improves the quality of life and job opportunities for the urban poor. Public transportation has the potential to increase access for the poor to better labor market opportunities (Kain, 1968). Meanwhile, the relationship between unemployment and population density is generally explored in contexts such as criminology, but they have not been studied together in the field of transportation economics (Kvalseth, 1977).

This is likely a result of the trend in existing research on mass transit systems that focuses heavily on transit planning and operations rather than its economic impacts, while providing utility for groups such as engineers and technicians, generally does not impact policy makers (Bent et al., 2008; Currie, 2005). Public transportation systems can function as a labor market institution, but there are two transportation worlds in the United States (Brandtner et al., 2019). Increases in public transportation mostly benefit cities that are not heavily dependent on personal vehicles. This reliance means that some cities will see little benefit from additional investments in public transportation. Based on the literature review above, we will examine the effect of the Transjakarta BRT on the open unemployment rate in the province of DKI Jakarta.

Based on previous studies, it can be concluded that the operationalization of BRT has a wide-ranging impact on various things. The studies that have been conducted have not specifically and detailedly explained how the exogenous variable of the operationalization of the Transjakarta BRT can affect economic growth and the open unemployment rate in the province of DKI Jakarta. Based on the literature review that has been conducted, the framework of thought in this research is:

Figure 2. Framework of thought

The workforce in a certain area is directly proportional to its mobility. The population consisting of various layers of society in fulfilling all their needs requires transportation facilities to carry out their daily activities. The population can determine their choice in the use of transportation facilities used. The choice of public transportation in this research is limited to the scope of BRT and private vehicles. Based on the empirical study conducted, the high growth of private vehicles accompanied by an increase in road infrastructure is the source of congestion in the province of DKI Jakarta.

This problem results in wasted fuel and travel time calculated by (Bappenas, 2017) of Rp. 67 trillion per year and a slowing of average vehicle speed. Meanwhile, the operationalization of the Transjakarta BRT serves as one form of public transportation in order to address the problem of congestion and to change the mobility of society which tends to use personal vehicles rather than public transportation. Meanwhile, the exogenous variable of increased BRT travel kilometers will imply an increase in the number of BRT fleets. When the number of fleets is more, the waiting time for BRT users will be shorter and the capacity to transport passengers will also increase.

Based on the literature review conducted, the transportation conditions of an area have an impact on economic growth and open unemployment rates in various areas (Brandtner et al., 2019; Fan et al., 2012; Gaduh et al., 2017; Hussein, 2015; Lin, 2020; Saidi et al., 2018). This study will analyze the impact of the operationalization of the Transjakarta BRT as one of the largest public transportation infrastructure investments in the world on the two endogenous variables of economic growth and open unemployment rate.

Based on the literature review and framework of thought above, the tentative hypothesis of this research is as follows:

(1) The operationalization of the Transjakarta BRT has a positive and significant impact on economic growth in the province of DKI Jakarta.

The operationalization of the Transjakarta BRT has a negative and significant impact on the open unemployment rate

in the province of DKI Jakarta.

3. Methods

3.1. Research object

The research on the Impact of the Operationalization of the Transjakarta BRT on Economic Growth and Open Unemployment Rate in the Province of DKI Jakarta will examine the impact of BRT operationalization in 5 administrative cities of DKI Jakarta in the period of 2016-2021. The period is used based on the existing data period of the operationalization of the Transjakarta BRT available at the relevant agency, PT. Transjakarta.

3.2. Research Method

The research method used is quantitative method using the 2 Stage Least Square (2SLS) method. This method is used because there is a simultaneous relationship between endogenous variables of economic growth and open unemployment rate. In doing regression using this model, there are certain requirements that must be met, namely through order condition and rank condition in the two regression equations in this research. The two main regression equations in general form are as follows:

$$y_{i,t}= \alpha_1+\beta_1 brt_{i,t}+ \beta_2 private\_vehicle_{i,t}+ \beta_3 k_{i,t}+ \beta_4 lab_{i,t}+ \beta_5 lag\_y_{i,t}+\varepsilon_1 \quad (8)$$

$$unemp_{i,t}= \alpha_2+\gamma_1 brt_{i,t}+ \gamma_2 private\_vehicle_{i,t}+ \gamma_3 k_{i,t}+ \gamma_4 lab_{i,t}+ \gamma_5 lag\_unemp_{i,t}+ \gamma_6 y_{i,t}+ \varepsilon_2 \quad (9)$$

The endogenous variables in this equation consist of the variables yi,t and unempi,t using data sourced from BPS as proxy for economic growth and open unemployment rate in 5 regions in the province of DKI Jakarta in percentage. Meanwhile, the predetermined variable brti,t uses data sourced from PT.Transportasi Jakarta as proxy for the amount of travel kilometers and the ratio of travel kilometers to the total travel kilometers of the 13 main corridors of the Transjakarta BRT in kilometers and percentages. private_vehiclei,t uses data sourced from the Regional Revenue Agency of the Province of DKI Jakarta, BPS, and Dispenda West Java as proxy for the number of vehicles and the ratio of number of vehicles in units and percentages, taking into account the flow of commuter vehicles in the BoDeTaBek area towards the 5 regions of Jakarta. ki,t uses data sourced from BPS as proxy for the growth of Gross Fixed Capital Formation (PMTB) in 5 regions of DKI Jakarta. labi,t uses data sourced from BPS as proxy for the number of workforce, taking into account the flow of commuter vehicles in the BoDeTaBek area towards the 5 regions of Jakarta. Lastly, it is the lag of each endogenous variable.

3.3. Regression Model

The general form of the regression model in this research was changed into a specific form because the classical assumption tests indicated that the variables in equations (8) and (9) did not meet the requirements for the multicollearity, heteroscedasticity, normality, and autocorrelation tests. Additionally, a new independent variable, dummy_covid, was added to each equation because the research period was 2016-2021. In 2020, the pandemic greatly affected the economy worldwide, and in 2021, the economic situation in Jakarta was still not back to normal. Therefore, the development of the regression model from the two equations became:

$$y_{i,t}= \alpha_1+\beta_1 \log(brt)_{i,t}+ \beta_2 \log(private\_vehicle\_unt)_{i,t}+ \beta_3 k_{i,t}+ \beta_4 \log(lab)_{i,t}+\beta_5 lag\_y_{i,t}+\beta_6 dummy\_covid_{i,t} + \varepsilon_1 \quad (10)$$

$$unemp_{i,t}= \alpha_2+\gamma_1 brt\_r_{i,t}+ \gamma_2 private\_vehicle\_r_{i,t}+ \gamma_3 k_{i,t}+ \gamma_4 \log(lab)_{i,t}+ \gamma_5 lag\_unemp_{i,t}+ \gamma_6 y_{i,t}+ \gamma_7 dummy\_covid_{i,t}+\varepsilon_2 \quad (11)$$

The dummy_covid variable i,t is valued at (0 or 1). A value of 1 is given during the years when the pandemic occurs and the economy is contracting and recovering, specifically in 2020 and 2021. This is done to ensure that there is bias in the results of the subsequent regression model estimation due to the impact of the pandemic during those years. log(brt) i,t is the logarithmic form of the kilometers traveled by BRT Transjakarta. log(private_vehicle_unt)i,t is the logarithmic form of the number of motorcycles and cars that mobilize in the 5 regions of Jakarta. log(lab)i,t is the logarithmic form of the number of workers in the 5 regions of Jakarta. brt_ri,t is the ratio of kilometers traveled by BRT Transjakarta in the 5 regions of Jakarta to the total kilometers traveled by BRT in that year. private_vehicle_ri,t

is the ratio of total private cars and motorcycles in the 5 regions of Jakarta to the total number of cars and motorcycles in that year.

3.4. The Classic Assumptions test and Estimation of the regression model.

(Gujarati, 2009) states that the classic assumptions test is performed in order to ensure that the research results are valid with the theoretically used data that is not biased, consistent and can be an efficient estimation of the regression coefficient. The classic assumptions test is done in order to obtain results of regression analysis that are BLUE (Best, Linear, Unbiased, Estimator) so several classic assumptions tests are performed on the regression model (10) and (11) which consist of normality test, multicollinearity test, heteroscedasticity test, and autocorrelation test.

3.4.1. The Normality test.

The normality test is performed on the 2 equations (10) and (11) through the Eviews 12 software by conducting a Jarque-Bera normality test. This test is performed on the data distribution of the variables with the aim of determining whether the data distribution is normal or not. The results of the normality test indicate.

Tabel 1. The Jarque-Bera Normality Test for Equation (10)

Statistik	Value
Mean	0,001155
Median	0,058323
Maximum	0,639214
Minimum	-0,875519
Std.Dev.	0,442564
Skewness	-0,549032
Kurtosis	2,610758
Jarque-Bera	1,696569
Probability	0,428149

Sumber : Secondary data processing through Eviews 12

Tabel 2. The Jarque-Bera Normality Test for Equation (11)

Statistik	Value
Mean	0,002980
Median	0,905442
Maximum	9,241088
Minimum	-13,53197
Std.Dev.	5,777400
Skewness	-0,567269
Kurtosis	2,675208
Jarque-Bera	1,740835
Probability	0,418777

Sumber : Secondary data processing through Eviews 12

The determination of data distribution can be known based on the results of the Jarque-Bera normality test, as follows.

a. If the probability value is < 0.05, then the residual is not normally distributed.

b. If the probability value is > 0.05, then the residual is normally distributed.

If the probability value is > 0.05 then the hypothesis generated in the Jarque-Bera normality test is as follows:

H_0 : The data distribution is not normal.

H_1 : The data distribution is normal.

The probability values of equation (10) and (11) are 0.428149 and 0.418777 > 0.05, therefore the null hypothesis is rejected, thus the data is said to be normally distributed.

3.4.2. The Multicollinearity Test

The multicollinearity test is performed on the 2 equations (10) and (11) through the Eviews 12 software by conducting a Variance Inflation Factor (VIF) multicollinearity test. This test is performed to assess whether there is correlation or intercorrelation between the independent variables in the regression model. The results of the multicollinearity test indicate.

Table 3. The Multicollinearity Test for Equation (10)

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	435.4518	6058.834	NA
log(brt)	0.397002	1413.864	1.464470
log(private_vech_unt)	5.578008	14641.07	5.877634
k	0.011475	2.956374	2.651727
log(lab)	10.66009	29285.95	5.831089
lag_y	0.007934	2.926448	1.501662
dummy_covid	1.104985	5.124884	3.416589

Source: Secondary data processing through Eviews 12

Table 4. The Multicollinearity Test for Equation (11)

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	944.3216	24898.97	NA
brt_r	0.001254	14.90935	1.685605
private_vech_r	0.009977	111.4530	6.231974
k	0.014635	7.145156	6.408865
log(lab)	5.346102	27832.24	5.541642
lag_unemp	0.008320	10.96409	2.400604
dummy_covid	0.911703	8.012972	5.341981
y	0.016487	12.73333	4.948862

Source: Secondary data processing through Eviews 12

The assessment of multicollinearity between independent variables can be determined by looking at the Tolerance and Variance Inflation Factor (VIF) values as follows:

a. If the centered VIF value < 10, it is stated that multicollinearity does not occur.

b. If the centered VIF value > 10, it is stated that multicollinearity occurs.

The value of the centered of all the exogenous variables of the equation (10) and (11) < 10, thus it is proven that there is no multicollinearity problem.

3.3.3 The Autocorrelation Test

The autocorrelation test is performed on the 2 equations (10) and (11) through the Eviews 12 software by conducting a Breusch-Godfrey Serial Correlation LM Test. This test is performed to assess whether there is correlation of the variables in the estimation model with changes in time. The results of the autocorrelation test indicate:

Table 5. Multicollinearity Test for Equation (10)

Statistik	Value	Statistik	Value
F-statistic	1.333659	Prob. F(2,21)	0.2849

Obs*R-squared	3.381014	Prob. Chi-Square(2)	0.1844

Source: Secondary data processing through Eviews 12

Table 6. Multicollinearity Test for Equation (11)

Statistik	Value	Statistik	Value
F-statistic	1.650098	Prob. F(2,21)	0.2171
Obs*R-squared	4.249143	Prob. Chi-Square(2)	0.1195

Source: Secondary data processing through Eviews 12

The Prob. Chi-Square(2) Obs*R-squared values for Equation (10) and (11) are 0.1844 and 0.1195 > 0.05, respectively, thus it is stated that there is no problem of autocorrelation.

3.4.3. The Heteroscedasticity Test

The heteroscedasticity test is performed on the 2 equations (10) and (11) through the Eviews 12 software by conducting a Heteroskedasticity Test: Breusch-Pagan-Godfrey. This test is performed to assess whether there is inequality of variance of the residuals from one observation to another. The results of the heteroscedasticity test indicate:

Table 7. Heteroskedasticity Test for Equation (10)

Statistik	Value	Statistik	Value
F-statistic	1.650098	Prob. F(2,21)	0.0361
Obs*R-squared	4.249143	Prob. Chi-Square(6)	0.0507
Scaled explained SS	12.25091	Prob. Chi-Square(6)	0.0566

Source: Secondary data processing through Eviews 12

Table 8. Heteroskedasticity Test for Equation (11)

Statistik	Value	Statistik	Value
F-statistic	1.650098	Prob. F(2,21)	0.8491
Obs*R-squared	4.249143	Prob. Chi-Square(6)	0.7948
Scaled explained SS	12.25091	Prob. Chi-Square(6)	0.9954

Source: Secondary data processing through Eviews 12

The Prob. Chi-Square (6) Obs*R-squared values for Equation (10) and (11) are 0.507 and 0.7948 > 0.05, respectively, thus it is stated that there is no problem of heteroscedasticity.

3.4.4. Identification of Order and Rank Condition

To perform the 2SLS method, identification of order and rank condition must be done to determine whether the regression coefficients of the reduced form equation can be used to estimate the structural equation parameters or not. Identification is done in each equation, except for the identity equation and the equilibrium equation. (Porter & Gujarati, 2009) states that there are 3 possible identification results. First, under-identified, which is the condition when the coefficients of the reduced form equation cannot be used to estimate the coefficients of the structural equation, so the structural equation cannot be estimated. Second, Just/exact identified, which is the structural equation coefficients can be determined accurately from the coefficients of the reduced form equation. The method used to estimate the structural equation is Indirect Least Square (ILS). Lastly, over-identified, which is the coefficients of the reduced form equation can produce more than one value of structural equation coefficients. The model used to estimate the equation is two-stage least square (2SLS).

Next, in identifying the order condition (necessary condition) the formula is:

$$(K-M) \text{ vs } (G-1) \quad (12)$$

If (K-M) < (G-1) = Under identified

If (K-M) = (G-1) = Just/exactly identified

If (K-M) > (G-1) = Over identified

Where K is the total number of variables in both equations. M is the number of variables in a particular equation. G is the number of equations in the simultaneous model. In equation (10) K=11 M=7 G=2 so (11-7) > (2-1), the result of the order condition in equation (10) is 4>1, over identified. In equation (11) K=11 M=8 G=2 so (11-8) > (2-1), the result of the order condition in equation (11) is 3>1, over identified.

The next identification is through the rank condition. In a system of equations consisting of G equations, then an equation satisfies the identification criterion if and only if it can form at least one non-zero determinant of order (G-1). The following is the implicit form of equations (10) and (11) as well as the results of the rank condition identification on both implicit equations:

$$-y_{i,t}+\alpha_1+\beta_1\log(brt)_{i,t}+\beta_2\log(private\_vehicle\_unt)_{i,t}+\beta_3k_{i,t}+\beta_4\log(lab)_{i,t}+\beta_5lag\_y_{i,t}+\beta_6dummy\_covid_{i,t}+\varepsilon_1=0 \quad (12)$$

$$-unemp_{i,t}+\alpha_2+\gamma_1brt\_r_{i,t}+\gamma_2private\_vehicle\_r_{i,t}+\gamma_3k_{i,t}+\gamma_4\log(lab)_{i,t}+\gamma_5lag\_unemp_{i,t}+\gamma_6y_{i,t}+\gamma_7dummy\_covid_{i,t}+\varepsilon_2=0 \quad (13)$$

Table 9. Rank Condition of equation (12)

	y	unemp	log(brt)	Log(Priv_vech_unt)	K	log(lab)	lag_y	Dummy_covid	Brt_r	Priv_vech_r	Lag_unemp
~~Persamaan (12)~~	~~-1~~	~~0~~	~~β_1~~	~~β_2~~	~~β_3~~	~~β_4~~	~~β_5~~	~~β_6~~	~~0~~	~~0~~	~~0~~
Persamaan (13)	~~γ_6~~	-1	~~0~~	~~0~~	~~γ_3~~	~~γ_4~~	~~0~~	~~γ_7~~	γ_1	γ_2	γ_5

Source: Data Processing through Rank Condition method.

Table 10. Rank Condition of equation (13)

	y	unemp	Log(brt)	Log(Priv_vech_unt)	K	log(lab)	lag_y	Dummy_covid	Brt_r	Priv_vech_r	Lag_unemp
Persamaan (12)	~~-1~~	~~0~~	β_1	β_2	~~β_3~~	~~β_4~~	β_5	~~β_6~~	~~0~~	~~0~~	~~0~~
~~Persamaan (13)~~	~~γ_6~~	~~-1~~	~~0~~	~~0~~	~~γ_3~~	~~γ_4~~	~~0~~	~~γ_7~~	~~γ_1~~	~~γ_2~~	~~γ_5~~

Source: Data Processing through Rank Condition method.

The results of the rank condition identification on both tables above prove that one of the determinant matrices in Table 9 has a value of $|A|=\gamma 1$ and Table 10 has a value of $|B|=\beta 5$, none of which are zero, $|A|\neq 0$ and $|B|\neq 0$. Therefore, it can be said that these two equations meet the criteria for estimation using the 2SLS method.

3.4.5. 2SLS Regression Estimation

The steps that must be taken in estimating equations using the 2SLS method are determining the reduced form of the structural equation. (Porter & Gujarati, 2009) defines the reduced form equation as an equation that is formed from the structural equation in such a way that each endogenous variable is a function of all predetermined variables. The reduced form equation can be estimated with OLS (Ordinary Least Square), and the regression coefficients of the

reduced form equation are used to estimate the parameters of the structural equation. The following is the reduced form equation model of the equation to be estimated:

$$unemp_{i,t}= \alpha_2+\gamma_1 brt\_r_{i,t}+ \gamma_2 private\_vehicle\_r_{i,t}+ (\gamma_3+ \gamma_6\beta_3)k_{i,t}+ (\gamma_4+\gamma_6\beta_4)\log(lab)_{i,t}+\gamma_5 lag\_unemp_{i,t}+ \gamma_6(\alpha_1+\beta_1\log(brt)_{i,t}+\beta_2\log(private\_vehicle\_unt)_{i,t}+\beta_5 lag\_y_{i,t}+\varepsilon_1)+(\gamma_7+\gamma_6\beta_6 dummy\_covid_{i,t}) +\varepsilon_2 \quad (14)$$

Before conducting further 2SLS testing, a Chow Test is first performed to determine the method for determining the Common Effect (CE) or Fixed Effect (FE) model that will be used in estimating the panel data. The following is the result of the Chow test conducted on the model to be estimated:

Table 11. Chow Test of equation (10)

Effect Test	Statistik	d.f.	Probability
Cross-section F	1.601851	(4,19)	0.2148
Cross-section Chi-square	8.718047	4	0.0685

Source: Secondary data processing using Eviews 12

Table 12. Chow Test of equation (11)

Effect Test	Statistik	d.f.	Probability
Cross-section F	2.767085	(4,18)	0.0593
Cross-section Chi-square	14.378337	4	0.0062

Source: Secondary data processing using Eviews 12

The Probability Cross-section Chi-square in Table 11 is 0.0685>0.05, which indicates that model (10) is estimated using the Common Effect Model (CEM) approach for further Lagrange Multiplier Test. However, the test cannot be performed, as the individuals in this study are 5 individuals representing 5 Jakarta regions traversed by the BRT Transjakarta. Therefore, equation (10) is estimated using the Common Effect Model.

On the other hand, the Probability Cross-section Chi-square in Table 12 is 0.0062 >0.05, which indicates that model (11) is estimated using the Fixed Effect Model (FEM) approach for further Hausman Test. However, the test cannot be performed because the individuals in this study are 5 individuals representing 5 Jakarta regions traversed by the BRT Transjakarta. Therefore, equation (11) is estimated using the Fixed Effect Model. The following is the result of estimating equations (10) and (11) using the 2SLS method with the CEM and FEM approach.

Tabel 13. 2SLS Estimation of Economic Growth

Variabel	Coefficient	Std. Error	t-Statistic	Prob.
c	-9,366345	9,074337	-1.032179	0.3603
log(brt)	1,577231	0.375963	4.195175	0.0137
log(private_vech_unt)	-2,319748	0.753407	-3.079010	0.0370
k	0,365218	0.110960	3.291428	0.0302
log(lab)	1,554680	1.022341	1.520706	0.2030
lag_y	-0,232660	0.049280	-4.721220	0.0092
dummy_covid	-3,994925	0.504377	-7.920507	0.0014
Weighted Statistics				
Root MSE	1.219723	R-squared	0.887456	
Mean dependent var	4.951918	Adjusted R-squared	0.858097	
S.D. dependent var	4.003608	S.E. of regression	1.393022	
Sum squared resid	44.63175	F-statistic	30.22754	
Durbin-Watson stat	2.389798	Prob(F-statistic)	0.000000	
Second-Stage SSR	44.63175	Instrument rank	10	
Prob(J-statistic)	0.139308			
Unweighted Statistics				

R-squared	0.843569	Mean dependent var	4.231628
Sum squared resid	53.42395	Durbin-Watson stat	2.609825

Source: Secondary data processing using Eviews 12

Table 14. 2SLS Estimation of Open Unemployment Rate

Variabel	Coefficient	Std. Error	t-Statistic	Prob.
c	480.7813	90.96339	5.285437	0.0032
brt_r	-0.120415	0.044523	-2.704588	0.0426
private_vech_r	-1.362106	0.715055	-1.904895	0.1151
k	-0.377326	0.117413	-3.213660	0.0236
log(lab)	-31.52919	6.462250	-4.878980	0.0046
lag_unemp	0.081309	0.020673	3.933101	0.0110
dummy_covid	0.567512	0.190580	2.977812	0.0309
y	-0.156305	0.084705	-1.845286	0.1243
Fixed Effects (Cross)				
WEST_JAKARTA--C	-18.78096			
CENTRAL_JAKARTA--C	6.505446			
SOUTH_JAKARTA--C	11.60885			
EAST_JAKARTA--C	12.57516			
NORTH_JAKARTA--C	-11.90849			
Weighted Statistics				
Root MSE	0.677528	R-squared	0.887208	
Mean dependent var	8.845880	Adjusted R-squared	0.818280	
S.D. dependent var	3.275186	S.E. of regression	0.874685	
Sum squared resid	13.77132	F-statistic	16.33688	
Durbin-Watson stat	2.188546	Prob(F-statistic)	0.000000	
Second-Stage SSR	11.11609	Instrument rank	14	
Unweighted Statistics				
R-squared	0.809784	Mean dependent var	7.655061	
Sum squared resid	19.38130	Durbin-Watson stat	2.162094	

Source: Secondary data processing using Eviews 12

4. Result and Discussions

Based on the results of the regression, it was found that the operationalization coefficient of BRT Transjakarta shows a positive and significant coefficient on economic growth. While on the variable of open unemployment rate, BRT Transjakarta provides a negative and significant coefficient. Each level of significance is at the 5% level. The R-Squared value in both models shows 88% in both models. This indicates that the model is able to explain economic growth and open unemployment rate by 88%, while the remaining 12% is explained by other factors. The estimation was done by adding cross-section weights to both models as well as adding white period and white cross-section.

In the economic growth model, the model is estimated using Panel Two-Stage EGLS (Cross-section weights) Common Effect Model, so the characteristics of the 5 city regions in DKI Jakarta are considered the same. While in the open unemployment rate model is estimated using Pooled IV/Two-stage EGLS (Cross-section weights) Fixed Effect Model, so the characteristics of each individual can be captured in the different coefficients between the 5 regions of DKI Jakarta

The operationalization variable of BRT in the economic growth model shows the number 1.577231 at the 5% significance level, which means that a 1% increase in BRT Transjakarta's km travel will increase economic growth by 0.01577231 ceteris paribus. The kilometers traveled is a macro representation of the operationalization of BRT Transjakarta. The more kilometers traveled produced represent the number of passengers transported on a corridor the more, so the mobilization of Jakarta residents and also commuters from Jakarta's surrounding areas in 5 Jakarta city regions increases and has an impact on economic growth in the mobilization area.

In the open unemployment rate model, the coefficient of the BRT ratio variable shows the number -0.120415 at the 5% significance level, which means that a 1 unit increase in km traveled per total km traveled of BRT in that year reduces the open unemployment rate in 5 Jakarta city regions. This represents the operationalization of BRT Transjakarta in the long term being able to improve accessibility for all groups, especially the workforce that does not have private vehicles such as motorcycles or cars. With affordable tariffs, many members of the workforce who previously used private vehicles for their mobility switched to BRT Transjakarta transportation. Furthermore, another consideration is that BRT Transjakarta has a dedicated way of line that is separate from private vehicles, which certainly experience congestion on working days. This makes this public transportation not experience congestion during its journey. In addition, there is Traffic Signal Priority that prioritizes BRT Transjakarta vehicles compared to other vehicles on Jakarta roads.

However, when analyzed in more depth, it will be found that the value of each coefficient is different with a different constant value in each city in Jakarta. For example, in West Jakarta and North Jakarta with the constant coefficients -18,78096 and -11.90849, this becomes a reducing factor of the general constant, which is 480,7813. So the change in constant in the open unemployment rate model in West Jakarta and North Jakarta becomes (480,7813-18,78096) and (480,7813-11.90849) respectively.

The negative coefficient in North Jakarta can be explained through the area coverage and economic potential that is not possessed by other areas, namely the port, as the entry point for exports and imports in the Jakarta area. In addition, North Jakarta also has various sectors that drive the strategic economic wheel of Jakarta, such as warehousing, industrial areas and factories, to the very busy coastal tourism. Infrastructure development projects are also continuously being built in this area, so with various economic potentials possessed, this becomes an added value that makes the condition of labor absorption in this area tend to be better than other areas.

In the regression model in the West Jakarta area, it also generates a coefficient with a negative sign. This can represent the condition of the West Jakarta area which has different characteristics compared to other areas. In the West Jakarta area, geographically it is very strategic. West Jakarta is very close to Soekarno-Hatta International Airport. In addition, West Jakarta is also very close to the JORR (Jakarta Outer Ring Road) toll access, which makes the accessibility and economy in the surrounding area positively impacted. Business and office areas in the logistics field also have high demand in this area due to adequate accessibility. Of course, this is an added value that makes the condition of labor absorption in this area tend to be better than other areas.

Meanwhile, other areas tend to show positive coefficients, indicating that the characteristics of the area are quite dense with workers who do not yet have permanent jobs. So in the same condition, it will be different from the West Jakarta and North Jakarta areas.

Other variables that significantly contribute to economic growth in Jakarta include the number of vehicles, PMTB growth, economic growth lag, and the COVID-19 pandemic. For private vehicles and PMTB growth, the level of significance is 5%, while for economic growth lag and the COVID-19 pandemic, the level of significance is 1%. Meanwhile, the number of employees does not have a significant impact on economic growth in Jakarta.

The number of private vehicles has a negative coefficient on economic growth of -2.319748, which means that a 1% increase in the number of private cars and motorcycles mobilizing in Jakarta will reduce economic growth by 0.02319748, ceteris paribus. This is due to the congestion caused, which leads to wasted fuel and overall time productivity inefficiency.

The PMTB growth variable has a positive and significant contribution to economic growth, with a coefficient of 0.365218, which means that a 1% increase in PMTB growth in Jakarta will increase economic growth by 0.365218 ceteris paribus. The economic growth lag variable has a negative and significant contribution to economic growth, with a coefficient of -0.232660, which means that a 1 unit increase in the previous year's economic growth rate in Jakarta will decrease economic growth by 0.365218 ceteris paribus. The COVID-19 pandemic variable has a negative and significant contribution to economic growth, with a coefficient of -3.994925, which means that the economic growth rate is negatively impacted by the COVID-19 pandemic, resulting in a decrease of 3.994925 in economic growth, ceteris paribus.

Other variables that significantly contribute to the open unemployment rate in Jakarta include PMTB growth, the number of employees, the lag of the open unemployment rate and the COVID-19 pandemic. For PMTB growth, the lag of the open unemployment rate and the COVID-19 pandemic, the level of significance is 5%, while for the number of employees it is 1%. The ratio of the number of vehicles and economic growth does not have a significant impact on the open unemployment rate in Jakarta.

The PMTB growth variable has a negative and significant contribution to the open unemployment rate, with a coefficient of -0.377326, which means that a 1 unit increase in PMTB growth in Jakarta will decrease the open unemployment rate by 0.377326 ceteris paribus. The number of employees variable has a negative and significant contribution to the open unemployment rate, with a coefficient of -31.52919, which means that a 1% increase in the number of employees in Jakarta will decrease the open unemployment rate by 0.3152919 ceteris paribus. The lag of the open unemployment rate variable has a positive and significant contribution to the open unemployment rate, with a coefficient of 0.081309, which means that a 1 unit increase in the lag of the open unemployment rate in Jakarta will increase the open unemployment rate by 0.081309 ceteris paribus. The COVID-19 pandemic variable has a positive and significant contribution to the open unemployment rate, with a coefficient of 0.567512, which means that the open unemployment rate is positively impacted by the COVID-19 pandemic, resulting in an increase of 0.567512 in the open unemployment rate ceteris paribus.

5. Conclusions

This research reveals that in the long term, the implementation of BRT Transjakarta has a positive impact on economic growth and a negative impact on the open unemployment rate in 5 areas of Jakarta. The positive impact is not separate from the generally increasing number of passengers from year to year and the flexible management of the bus fleet that adapts to the crowded corridors. As the number of BRT Transjakarta fleets in the field increases, it will linearly add kilometers traveled in that period. The increase is based on the increasing demand of passengers every year, so the waiting time for passengers is shortened with the addition of buses that are appropriate.

Increasing accessibility for the public contributes to the movement of the real sector economy in Jakarta. The workforce without access to private transportation can easily reach their destinations through economical public transportation with routes spread throughout Jakarta. This of course opens up opportunities for the workforce that have spatial dependence on their place of work, thereby increasing the chance for more widespread job opportunities and reducing the open unemployment rate in Jakarta.

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