HONG KONG JOURNAL OF SOCIAL SCIENCES

香港社會科學學報

第一的第 60 期 (2022 春/夏) Vol. 60 Autumn/Winter 2022

Open Access Article https://doi.org/10.55463/hkjss.issn.1021-3619.60.47

# Impact of the COVID-19 Pandemic on the Economic Performance in Indonesia: Simultaneous Equations Approach

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***Received: December 2, 2022 ▪ Reviewed: December 17, 2022***

***▪ Accepted: December 29, 2022 ▪ Published: January 30, 2023***

**Abstract:**
This study explains the relationship between economic performance and tax revenues in Indonesia and the impact of COVID-19 on Indonesia's economic performance using a new approach, namely the three-stage least squares model. This approach is used based on the alleged simultaneous relationship that occurs between economic performance variables and tax revenue variables. The results of the analysis prove that the variables of economic performance and tax revenue have a simultaneous relationship, so that the two variables influence one another. Additionally, the results of the analysis show that the COVID-19 pandemic has had a negative effect on economic performance in Indonesia. Therefore, the implementation of economic protection policies for vulnerable groups in society, namely the poor and near-poor, needs to be carried out properly. The novelty of the results is the use of the three-stage least-squares model to determine the relationship between economic performance variables and tax revenues simultaneously.

**Keywords:** COVID-19, economic performance, Indonesia, simultaneous equations, three-stage least squares.

# 新冠肺炎大流行对印度尼西亚经济表现的影响：联立方程法

**摘要：**
本研究使用一种新方法，即三阶段最小二乘模型，解释了印度尼西亚经济绩效与税收收入之间的关系以及新冠肺炎对印度尼西亚经济绩效的影响。这种方法的使用基于所谓的经济绩效变量和税收变量之间发生的同步关系。分析结果证明，经济绩效变量与税收收入变量存在同步关系，两个变量相互影响。此外，分析结果表明，新冠肺炎大流行对印度尼西亚的经济表现产生了负面影响。因此，需要妥善落实针对社会弱势

群体，即贫困人口和半贫困人口的经济保护政策。结果的新颖之处在于使用三阶段最小二乘模型来同时确定经济绩效变量与税收收入之间的关系。

**关键词：**新冠肺炎、经济表现、印度尼西亚、联立方程、三阶段最小二乘法。

# 1. Introduction

The COVID-19 pandemic has been recorded as entering Indonesia in 2020. This pandemic has caused many changes to occur in Indonesia. This was driven by the emergence of various protective policies to prevent the spread of COVID-19. One of the policies implemented by the government during the COVID-19 pandemic was Large-Scale Social Restrictions (PSBB). The PSBB policy is considered capable of reducing the rate of spread of COVID-19 in Indonesia, but simultaneously, the PSBB policy reduces the amount of household consumption, even though this household consumption greatly influences Indonesia's Gross Domestic Product (GDP). Household consumption has recorded a decline during the COVID-19 pandemic in Indonesia (Badan Pusat Statistik, 2022a).

Furthermore, the decline in household consumption has increased the unemployment rate in Indonesia due to the large number of companies that have laid off their jobs during the COVID-19 pandemic (Anas, 2021). Additionally, Indonesia's economic conditions have been exacerbated by the decline in foreign investment and domestic investment during the COVID-19 pandemic. Foreign investment was recorded to have decreased by 20.86% during the COVID-19 pandemic (Syarifuddin & Setiawan, 2022), whereas domestic investment decreased by 16.07% (Badan Pusat Statistik, 2022b).

Several studies have been conducted regarding the relationship between the COVID-19 pandemic and various economic indicators in Indonesia. The COVID-19 pandemic in Indonesia has disrupted the supply chain of various goods and services needed by the community (Achmad et al., 2021). Additionally, the COVID-19 pandemic has led to a weakening of the mobility that can be carried out by residents in Indonesia due to various restrictions imposed by the government (Khoirunurrofik et al., 2022). Practically, other strategic sectors such as the tourism sector have also been negatively affected by the COVID-19 pandemic. The results of previous research show that the performance of the tourism sector tended to decline during the COVID-19 pandemic. This decrease was caused by a decrease in the level of tourist arrivals, both foreign and domestic tourists, and decreased demand for merchandise traded at tourist sites (Pham & Nugroho, 2022). Furthermore, the agricultural sector is also a sector affected by the COVID-19 pandemic. The agricultural sector during the COVID-19 pandemic was faced with weakening demand for agricultural products, thus driving down the performance of the agricultural sector (Malahayati et al., 2021; Stephens et al., 2022; Yaddanapudi & Mishra, 2022).

Previous studies used time series data to determine the impact of the COVID-19 pandemic on the performance of various economic sectors in Indonesia. However, other studies show that the COVID-19 pandemic is location-specific, meaning that each region will have a different effect due to differences in the handling procedures for the COVID-19 pandemic that occurred (Al Dhaheri et al., 2021). Additionally, the geographical location of an area also fiscal policies to maintain the momentum of economic growth during the COVID-19 pandemic (Bui et al., 2022; Lahiri & Yang, 2022). Based on this, this research was conducted to determine the impact of the COVID-19 pandemic on economic performance and tax revenues in Indonesia.

This study uses a simultaneous equation approach using a three-stage least-squares model. The model is used in research due to several reasons. First, the emergence of 2 or more dependent variables that mutually influence one another causes the model to be unable to be solved with multiple regression models in general. The three-stage least-squares model can help solve the simultaneous model more efficiently (Greene, 2002).

# 2. Theoretical Background

In short, economic growth is a process of increasing output per capita. Economic growth means the development of activities in the economy that cause goods and services produced in society to increase. The most widely used theory related to economic growth to date is the Keynesian theory. Keynes in the book The General Theory of Employment, Interest, and Money states that national income growth is determined by the amount of consumer spending, government spending, investment, and net exports. According to Keynes, to increase economic growth as measured by an increase in national income, it is necessary to increase consumer demand, demand for government spending, demand for investment, as well as demand for exports and imports.

Consumption expenditure is an important part of aggregate demand. According to the Keynesian theory, aggregate demand determines the level of output and the amount of employment in the economy. The more demand for the consumption of goods and services, the more companies will produce, and the more jobs will be created. The role of economic policy is also closely related to the level of consumption. To understand this, we should understand that according to Keynes, consumption depends on current disposable income, i.e., current income minus taxes.

Romer's endogenous theory suggests that economic growth is affected by taxation in the long term (Osunkwo, 2020). Romer and Romer (2010)

demonstrated that taxation underpins economic growth and strengthens global competitiveness and provides a stable and predictable fiscal environment, thereby helping raise funds to finance social and physical infrastructure needs, reducing long-term dependence on aid, and ensuring good governance through strengthening the government accountability to its citizens.

Theoretical findings in the literature indicate that taxation can have both negative and positive impacts on economic growth. The negative effect is due to distortions in choice and the effect of the discouragement factor inherent in taxes. The positive impact is indirectly caused by expenditures financed by taxation. Thus, the role of taxation in economic growth still needs to be studied.

## 3. Literature Review

The results of previous studies indicate that there are indications of a simultaneous relationship between economic performance and tax revenues. A simultaneous relationship is a relationship that occurs when the independent variable in one equation simultaneously becomes the dependent variable in another equation (Prasada et al., 2022a). This study uses a simultaneous equation model, namely the three-stage least squares model because the three-stage least squares model has advantages compared to the multiple regression model in general, namely the OLS model or the two-stage least squares simultaneous equation model. The three-stage least squares model is a very efficient model for estimating 2 or more equations, where each dependent variable of each equation influences one another (Greene, 2002).

Previous research shows that a country's tax revenue has a positive effect on the country's economic growth (Alinaghi & Reed, 2021; Celikay, 2020). This encourages the better economic performance of a country. However, simultaneously, other studies show that economic performance has a positive effect on a country's tax revenue (Adefolake & Omodero, 2022; Neog & Gaur, 2020). Additionally, several variables are suspected of influencing Indonesia's economic performance, namely tax revenue variables, government spending variables, inflation variables, and money supply variables (Gechert & Heimberger, 2022; Prasetyo, 2020; Van, 2020). Furthermore, several variables are also suspected of influencing tax revenues, namely economic performance variables, foreign direct investment variables, and domestic direct investment variables (Faizah et al., 2019; Gaspareniene et al., 2022; Minh Ha et al., 2022). Therefore, it is hypothesized that:

*Hypothesis 1:* There is a simultaneous relationship between economic performance and tax revenues.

The COVID-19 pandemic has had a huge impact on economic conditions. It is estimated that COVID-19 will reduce global domestic product growth from 2.9% to only 2.4% (Gupta et al., 2020). This is supported by previous research, which shows that the COVID-19 pandemic has a negative effect on the supply chain of goods and services (Goel et al., 2021). Furthermore, the COVID-19 pandemic has brought many changes to the workforce sector and social conditions in society, thus contributing to a negative impact on overall economic performance (Murdiono et al., 2021; Nair et al., 2022). Therefore, it is hypothesized that:

*Hypothesis 2:* COVID-19 has a negative impact on economic performance.

## 4. Materials and Methods

### *4.1. Data and Variables*

This study uses secondary data sourced from the Central Bureau of Statistics of the Republic of Indonesia. The data include data on Gross Regional Domestic Product at constant prices 2010 = 100, government tax revenues, government spending, inflation, money supply, foreign investment, and domestic investment from 2004 to 2021 from 33 provinces in Indonesia (data from North Kalimantan Province combined with East Kalimantan Province data because North Kalimantan Province is a division of East Kalimantan Province that occurred in 2012). Additionally, this study also used a dummy variable for the period before and when the COVID-19 pandemic occurred. The dummy variable consists of the numbers 1 and 0 where the number 1 indicates the period before the COVID-19 pandemic occurred and 0 indicates the period when the COVID-19 pandemic occurred. Several studies conducted show that the COVID-19 pandemic officially entered Indonesia in 2020 so 2020 to 2021 is designated as the period for the COVID-19 pandemic. Details of the variables used in this study are presented in Table 1.

Table 1. Variables in the study (Developed by the authors)

| Variables | Units | Symbols | Expected Sign |
|---|---|---|---|
| **Endogenous Variables** | | | |
| Gross Regional Domestic Product | IDR Trillion | GRDP | + |
| Tax revenue | IDR Billion | TTAX | + |
| **Exogenous Variables** | | | |
| Tax Revenue Lag 1 | IDR Billion | LTTAX | + |
| Government Expenditure | IDR Billion | TEXP | + |
| Inflation | percent | INFL | + |
| Money Supply (M2) | IDR Trillion | MSP | + |
| Foreign Direct Investment | USD Millions | FDI | + |
| Domestic Investment | IDR Trillion | DDI | + |
| Dummy COVID-19 | Dummy | CVD | + |

This study uses two independent variables that are treated as two variables that influence one another simultaneously. These variables are GRDP and TTAX variables. Additionally, the independent variables in this study totaled 6 variables, namely LTTAX, TEXP, INFL, MSP, FDI, DDI, and CVD.

### *4.2. Data Analysis*

The data analysis used in this study is an analysis using panel data. Panel data allows the use of cross-section data and time series data simultaneously. This study uses cross-sectional data, namely data from all provinces of Indonesia. Furthermore, the time series data used in this study are data for the period from 2004 to 2021.

The data obtained is then analyzed using the three-stage least squares model. The model makes it possible to perform simultaneous equation analysis. This study synthesizes that there is a simultaneous relationship between GRDP and TTAX variables. The results of previous studies indicate that the GRDP variable can influence the TTAX variable. Simultaneously, other studies have shown the effect of the TTAX variable on the GRDP variable. The equation used in this research can be written mathematically as follows:

*Equation 1:*

$$GRDP = \gamma 0 + \gamma 1\ TTAX + \gamma 2\ TEXP + \gamma 3\ INFL + \gamma 4\ MSP + \gamma 5\ CVD + u$$

*Equation 2:*

$$TTAX = \beta 0 + \beta 1\ GRDP + \beta 2\ FDI + \beta 3\ DDI + \beta 4\ LTTAX + v$$

Based on equations (1) and (2), it can be seen that the GRDP and TTAX variables are endogenous variables in the model. This equation can be solved using three stages in the three-stage least-squares model. The first stage is to estimate the equations prepared using the ordinary least squares model to produce the predicted values of each equation. The second stage is carried out using the two-stage least squares model so that residual values will be obtained to determine cross-equation correlations. The third stage is carried out using the generalized least squares (GLS) model to obtain the values of each available parameter in the simultaneous equation (Greene, 2002).

The three-stage least-squares model must first pass a post-estimation test before being used. These tests include the endogeneity test, weak instrument test, and overidentification test (Prasada et al., 2022a). The endogenous test ensures that the GRDP and TTAX variables are endogenous variables so that the solution for these equations must be carried out using a simultaneous equation, in this case, the three-stage least squares model. The endogeneity test on the model was carried out using the Hausman endogeneity test method (Prasada et al., 2021). Furthermore, the weak instrument test is a test conducted to determine whether the instrument variables used in the model can play a good role or not (Prasada et al., 2022b). Variables that can play a good role in the model are strong instrument variables. The weak instrument test was carried out using the eigenvalue indicator. Furthermore, the three-stage least squares model is said to be valid when the model complied meets the just-identified or over-identified model criteria (Prasada & Dhamira, 2022). The test was carried out using the Sargan method.

Before the series of three-stage least-squares model analyses is carried out, the data collected needs to be tested for stationarity. This is motivated by the data structure consisting of cross-sectional and time-series data. This stationarity test is carried out to ensure that the research data avoids certain data patterns so that the three-stage least squares analysis results obtained do not produce spurious regression. The stationarity test in this study used the Levin-Lin-Chu (LLC) method (Levin et al., 2002). This method is considered appropriate for conducting stationarity tests on panel data.

## 5. Results

The results of the stationarity test conducted on the research data show that the research variables have different levels of stationarity. Most variables are stationary at the first difference. These variables are the RGDP, TTAX, TEXP, MSP, FDI, DDI, and LTTAX variables, while the INFL variable is stationary at the level (Table 2). These results can be seen from the probability value of LLC, which is smaller than the alpha levels of 1% and 10%. The three-stage least squares analysis in this study uses stationary variables, either at the level or at the first difference. This is done to avoid spurious regression.

Table 2. LLC stationarity test (Developed by the authors)

| Variables | Stages | Statistics LLC | Prob. | Information |
|---|---|---|---|---|
| GRDP | 1st Difference | -1.56 * | 0.06 | Stationary |
| TTAX | 1st Difference | -10.82 *** | 0.00 | Stationary |
| TEXP | 1st Difference | -4.69 *** | 0.00 | Stationary |
| INFL | Levels | -12.40 *** | 0.00 | Stationary |
| MSP | 1st Difference | -4.98 *** | 0.00 | Stationary |
| FDI | 1st Difference | -9.42 *** | 0.00 | Stationary |
| DDI | 1st Difference | -11.02 *** | 0.00 | Stationary |
| LTTAX | 1st Difference | -5.74 *** | 0.00 | Stationary |

*** Significant at 1% alpha; * Significant at 10% alpha

After the stationarity test has been carried out properly and the stationarity level of each variable has been determined, then further analysis can be carried out using the three-stage least squares model. Before the results of the analysis can be properly interpreted, the endogeneity test, weak instrument test, and overidentification test need to be carried out first. The results of the analysis on the endogenous test show that the GRDP and TTAX variables are endogenous variables. This can be seen from the probability value of the endogeneity test on the GRDP and TTAX variables, which are significant at the 1% alpha level (Table 4). Moreover, the results of the weak instrument test show that the model in the GRDP equation and the TTAX equation has a smaller probability value than the 1% alpha level this means that the instrument variables used in the model are strong instruments to explain the

endogenous variables in the model. Finally, the over-identification test using the Sargan method shows that the GRDP equation is included in the just-identified category with a probability value of the Sargan test that is significant at the 1% alpha level, while the TTAX equation is included in the over-identified category with a probability value of the Sargan test greater than 10% alpha. Both of these equations can satisfy the requirements for using the three-stage least squares model from the Sargan test, namely, the equation is just-identified or over-identified.

Table 3. Overall summary statistics (Developed by the authors)

| Variables | Units | Obs. | Means | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|---|
| GRDP | IDR Trillion | 594 | 246.72 | 359.86 | 10.05 | 1,856.30 |
| TTAX | IDR Billion | 594 | 2,410.00 | 5,010.00 | 6.00 | 43,400.00 |
| TEXP | IDR Billion | 594 | 6,710.00 | 10,100.00 | 90.50 | 84,200.00 |
| INFL | percent | 594 | 5.93 | 4.35 | -0.89 | 41.11 |
| MSP | IDR Trillion | 594 | 3,510.00 | 1,950.00 | 971.00 | 7,180.00 |
| FDI | USD Millions | 594 | 819.93 | 1,977.42 | 0.10 | 27181.00 |
| DDI | IDR Trillion | 594 | 4.89 | 9.60 | 0.00 | 62.09 |
| CVD | Dummy | 594 | 0.89 | 0.31 | 0.00 | 1.00 |

In Table 3, it can be seen that the average gross regional gross domestic value of the provinces in Indonesia is IDR 246.72 trillion. The lowest GRDP was obtained by Gorontalo Province with a value of 10.05 IDR Trillion and the highest GRDP value was obtained by the Special Capital Region of Jakarta with a value of 1,856.30 IDR Trillion. The difference between the highest and lowest GRDP values has a fairly large gap. This is because development gaps still occur between provinces on the island of Java, especially the Province of the Special Capital Region of Jakarta, and other provinces outside Java Island. The same thing also happened to the performance of tax revenues. Tax revenues between provinces in Indonesia have quite large gaps. The lowest tax revenue performance is in West Papua Province, while the highest tax revenue performance is in the Province of the Special Capital Region of Jakarta. West Papua Province has the lowest tax revenue performance due to the small amount of income generated in the region. Furthermore, the average value of government spending per province in Indonesia is IDR 6,710.00 billion. The average inflation per province was 5.93 percent. The highest inflation rate occurred in 2005 in all provinces of Indonesia. The highest inflation reached 41.11 percent. The high inflation in 2005 was caused by the increase in the price of fuel oil. This has contributed to increasing prices in all economic sectors in Indonesia. West Papua Province has the lowest tax revenue performance due to the small amount of income generated in the region. Furthermore, the average value of government spending per province in Indonesia is IDR 6,710.00 billion. The average inflation per province was 5.93 percent. The highest inflation rate occurred in 2005 in all provinces of Indonesia. The highest inflation reached 41.11 percent. The high inflation in 2005 was caused by the increase in the price of fuel oil. This has contributed to increasing prices in all economic sectors in Indonesia (Muthalib et al., 2018). FDI and DDI variables are also seen to have fluctuating values. FDI and DDI are variables that are central to determining economic performance in a region. FDI and DDI can increase labor absorption, accelerate international market expansion, and increase production capacity (Pramudita et al., 2019; Yasin et al., 2022).

Table 4. Three-stage least-square regression results (Developed by the authors)

| Variables | Coefficient | Std. Error | t-Statistics | Prob. |
|---|---|---|---|---|
| **Dependent variable: GRDP** | | | | |
| TTAX | 0.0233 | 0.0021 | 109.9000 | 0.0000 |
| TEXP | 0.1159 | 0.0100 | 115.8000 | 0.0000 |
| INFL | 0.0013 | 0.0015 | 0.8300 | 0.4090 |
| MSP | 0.0401 | 0.0118 | 34.0000 | 0.0010 |
| CVD | 0.0090 | 0.0049 | 18.3000 | 0.0680 |
| Cons. | 0.0144 | 0.0053 | 27.3000 | 0.0060 |
| Adj. $R^2$ | | | | 0.3869 |
| F test | | | | 0.0000 |
| Over identification test | | | | 0.0000 |
| Weak identification test | | | | 0.0000 |
| Endogeneity Test | | | | 0.0000 |
| **Dependent variable: TTAX** | | | | |
| GRDP | 50.6940 | 0.5119 | 9.9000 | 0.0000 |
| FDI | 0.0185 | 0.0094 | 19.8000 | 0.0480 |
| DDI | 0.0290 | 0.0150 | 19.3000 | 0.0530 |
| LTTAX | 0.8537 | 0.0189 | 45.1500 | 0.0000 |
| Cons. | -0.1364 | 0.0189 | -72.3000 | 0.0000 |
| Adj. $R^2$ | | | | 0.9884 |
| F test | | | | 0.0000 |
| Over identification test | | | | 0.0267 |
| Weak identification test | | | | 0.0000 |
| Endogeneity Test | | | | 0.0318 |

The statistical test results show that the developed model meets all the post-estimation criteria before using the three-stage least-squares model. The results of the endogeneity test show that the GRDP and TTAX equations have a Hausman probability value that is smaller than the 5% alpha level. These values indicate that the GRDP and TTAX variables are endogenous variables, so the use of a simultaneous model is the right thing to do to avoid bias in the estimation process. Furthermore, the results of the Sargan test show that the GRDP and TTAX equations are included in the category of overidentified equations so to solve these equations, a simultaneous equation model must be used. The eigenvalue probability value on the weak instrument test is significant at the 1% alpha level. This illustrates that the instrument variables used are strong instruments that can explain endogenous variables well. Furthermore, the GRDP equation and the TTAX equation have Adj. $R^2$ values. The Adj. $R^2$ is quite high, namely 0.3869 and 0.9884, respectively. The higher Adj. $R^2$ indicates the greater the variation in the endogenous variables that can be explained by the exogenous variables. Additionally, the probability value of the F statistic in each equation is significant at the 1% alpha level. The results of the statistical tests carried out show that the three-stage least-squares model developed in this study is robust and valid.

The results of the analysis using the three-stage least squares model show that the COVID-19 period dummy variable (CVD) is significant at the 10% alpha level (Table 4). This shows that there is a significant difference in economic performance as indicated by the GRDP value in the period before COVID-19 occurred and the period when COVID-19 occurred. The regression coefficient of the CVD variable was positive, indicating that the period before the COVID-19 pandemic had higher economic performance compared with the period after the COVID-19 pandemic.

Several other variables also influence economic performance in Indonesia. These variables are tax revenue (TTAX), government spending (TEXP), and Indonesian money supply (MSP). The TTAX variable has a positive regression coefficient, so it can be interpreted that the higher the tax revenue earned, the better the economic performance will be, and vice versa. Furthermore, the variables TEXP and MSP also show a positive regression coefficient, meaning that the higher government spending and the greater the amount of money supplied, the higher the value of GRDP in Indonesia. These results follow previous studies conducted regarding these variables. The results of previous studies indicate that economic performance in a region is influenced by its macroeconomic environment, which is positively influenced by the variables of tax revenue, government spending, and the amount of money in circulation (Gechert & Heimberger, 2022; Prasetyo, 2020; Van, 2020).

In the TTAX equation, the results of the three-stage least squares analysis show that several variables have a significant influence on government tax revenues, namely gross regional domestic product (GRDP), foreign direct investment (FDI), domestic investment (DDI), and the previous year's tax revenues (LTTAX). The GRDP variable has a positive regression coefficient, indicating that an increase in the GRDP value can increase tax revenue. Furthermore, the FDI, DDI, and LTTAX variables also have positive regression coefficients, meaning that an increase in FDI, DDI, and LTTAX can encourage an increase in the value of GRDP in Indonesia. This result agrees with the results of previous research, which stated that tax revenue will be influenced by variables of economic performance, foreign direct investment variables, and domestic direct investment variables (Faizah et al., 2019; Gaspareniene et al., 2022; Minh Ha et al., 2022).

## 6. Discussion

### *6.1. Impact of COVID-19 on Indonesia's Economic Performance*

COVID-19 officially entered Indonesia in 2020. This brought many changes in various regions of Indonesia. The occurrence of the COVID-19 pandemic forced the government to conduct various responsive programs to prevent the spread of the COVID-19 pandemic. These programs include various restriction programs ranging from limiting people's travel both domestically and abroad to limiting community activities in public places (Djalante et al., 2020). The two programs are considered to be capable of preventing the spread of the COVID-19 pandemic and protecting the Indonesians from exposure to the COVID-19 virus. Nonetheless, these programs had a negative impact on the overall economic performance.

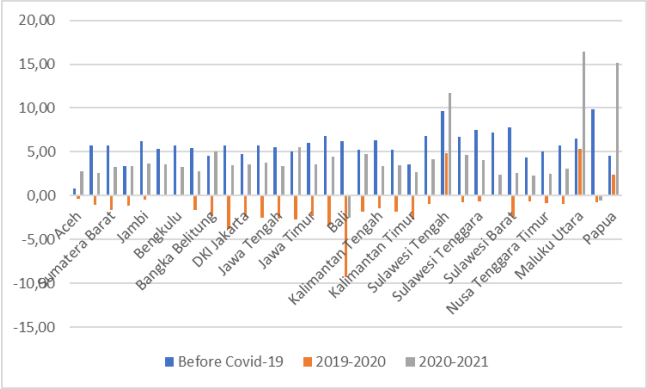


Figure 1. Economic growth per province in Indonesia

Indonesia's economic performance can be seen from Indonesia's economic growth. Indonesia's economic growth in the phase before the COVID-19 pandemic showed positive performance, where Indonesia's economic growth could reach an average rate of 5.78% per year. This positive performance is also reflected in the economic performance of each province of Indonesia. All provinces in Indonesia showed positive average economic growth per year in the phase before the COVID-19 pandemic. However, economic performance in almost all provinces experienced negative growth in 2019–2020, which were the first years the COVID-19 pandemic occurred in Indonesia. The worst economic performance occurred in the Province of Bali with economic growth of -9.33% (Figure 1) (Subawa et al., 2022). Three provinces were not affected by the negative impact of the COVID-19 pandemic (provinces with positive economic growth during the Covid-19 pandemic period), namely Central Sulawesi Province, North Maluku Province, and Papua Province. This is because the three provinces are considered dependent on central government transfer funds, so they have a well-maintained fiscal space to overcome the COVID-19 pandemic (Desdiani et al., 2022).

Furthermore, economic performance experienced positive growth again in the second year that the COVID-19 pandemic occurred in Indonesia (2020–2021). This is driven by the increasingly organized various programs carried out by the government to control the spread of COVID-19 in Indonesia. Additionally, in the second year of the COVID-19 pandemic, it was shown that the government could control the spread of COVID-19 well. This fact can be seen from the highest peak infection prevalence rate, which reached 26.3% in 2020, and in 2021, the highest peak infection prevalence rate was 21.80% (February 2021) (Setiadi et al., 2022). Furthermore, the

government is also actively implementing programs to overcome the short-term impact of the COVID-19 pandemic by providing full financial support to the poor and near-poor categories of people (Sparrow et al., 2020). These programs include the family hope program (PKH), staple food cards, pre-employment cards, and electricity subsidies (Roziqin et al., 2021).

The three-stage least squares model also provides statistical information that there are differences in economic performance before and when the COVID-19 pandemic occurred in Indonesia, where Indonesia's economic performance before the COVID-19 pandemic was better than Indonesia's economic performance during the COVID-19 pandemic. The lower economic performance during the COVID-19 pandemic was caused by the government's many policies limiting community activities. These restrictive activities trigger delays during the production and distribution of goods or services (Huang et al., 2022; Li et al., 2022). Furthermore, travel restrictions imposed by the government led to a slowdown in the growth of the tourism sector in Indonesia (Henseler et al., 2022). This increased the unemployment rate, decreased wages, and ultimately reduced people's purchasing power, thus having a negative impact on Indonesia's economic performance (Truong & Truong, 2022; Vázquez-Martínez et al., 2021).

### *6.2. Factors Affecting GRDP*

The results of the analysis using the three-stage least squares model show that 3 variables have a significant effect on Indonesia's GRDP value. The first variable is TTAX, where this variable has a positive relationship to the GRDP variable. Tax is one important component that can support state revenue. Increasing state revenue can be a strong capital for the country to conduct continuous development. This will have a positive influence on improving economic performance in Indonesia.

In addition to the TTAX variable, the TEXP variable, which shows total government spending, is also a variable that has a positive relationship with improving Indonesia's economic performance. Government spending is support for improving economic performance. Government expenditures made to finance various productive activities such as improving infrastructure, education, research, development, etc. can have a positive impact on increasing the productive capacity of the economy.

The next variable is MSP, which has a positive and significant effect on GRDP. The money supply is one of the economic indicators that can help support economic performance in a region. The higher money supply will impact the availability of the amount of money that can be used to increase economic growth. Nevertheless, the money supply needs to be controlled properly because a money supply that is too high can lead to hyperinflation, which can reduce overall economic performance.

### *6.3. Factors Affecting TTAX*

The results of the analysis show that an increase in economic performance also has a positive impact on increasing tax revenues, and vice versa. Better economic performance will affect the greater the sources of tax revenue that can be managed by the government. Furthermore, the FDI variable also has a positive influence on increasing tax revenues. Higher FDI has a consequence of increasing the potential for technology transfer from abroad to within the country. Additionally, FDI also can increase the potential for knowledge transfer, which will benefit the host country. This can further increase the host country's tax revenue potential.

The DDI variable has a positive and significant influence on tax revenues. The greater DDI can increase the greater impact on potential tax revenues. DDI is an economic indicator that can increase tax revenue through investment. A higher DDI means that more domestic funds can be invested in productive economic activities, to increase a country's tax revenue. The LTTAX variable also has a positive influence on increasing tax revenue. The previous year's tax revenue can be used as a reference for tax revenue in the following year. Therefore, the previous year's good tax revenue will affect the increased tax revenue this year.

## 7. Conclusion

The COVID-19 pandemic has had a negative impact on economic performance in Indonesia. This was caused by the disruption of economic activity in various main economic sectors, such as tourism, manufacturing, and transportation. The negative impact of the COVID-19 pandemic can be overcome by implementing various appropriate policies in the short and long term. These policies include economic protection policies for vulnerable groups in society, namely the poor and the near-poor. Additionally, it can also be concluded that the GRDP and TTAX variables have a simultaneous effect, where the influence of each variable is positive. This means that an increase in GRDP can increase TTAX and an increase in TTAX can increase GRDP. The results of the analysis show that GRDP can be increased by increasing tax revenues, increasing government spending, and controlling the money supply in optimal conditions. Furthermore, tax revenues can be increased by increasing GRDP, FDI, DDI, and tax revenues in the previous year.

The study can also conclude that the three-stage least-squares model is an appropriate and efficient model to be used in the GRDP and TTAX equations simultaneously. This can be seen from several indicators used, namely the high value of Adj. $R^2$, F test value, endogeneity test results, over identification test results, and weak identification test results. These results imply that the simultaneous equation approach with the three-stage least squares model can be used well to estimate the effect of economic variables that are suspected to have a simultaneous relationship.

## 8. Limitations and Further Study

In this study only uses macroeconomic variables to determine the factors that affect economic performance and tax revenues in Indonesia, while social variables are considered constant. Future research is expected to be able to use social variables such as the population development index in the equation of economic performance and tax revenues.

## Authors' Contributions

P.B.A. served as a conceptor and wrote the manuscript; S. is in charge of perfecting the concepts prepared by B.P.A.; A.A.A. is in charge of supervising the results of the analysis carried out; I.Y.P. acted as a data analyzer, interpreted the results of the analysis, and wrote the results of the research.

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