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Resilience in Crisis: Examining the Impact of Interest Rates, Trade Openness, and Unemployment on Indonesia's Economic Recovery from COVID-19

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Abstract
This paper attempts to capture the contribution of real interest rates, trade openness, and unemployment to Indonesia's economic recovery after the COVID-19 crisis. Using multiple linear regression on annual data from 2011 to 2023, the study examines the influence of the three variables on Indonesia's GDP growth throughout the recovery phase. By incorporating a dummy variable for the post-crisis period, the analysis captures shifts in economic dynamics after 2021. The findings show that trade openness and unemployment significantly impact GDP. Trade openness has a negative relationship with GDP, suggesting that reliance on international markets may have hampered recovery. Unemployment also shows a negative association with GDP, underscoring the importance of labor market stability in supporting economic resilience. Although real interest rates did not demonstrate statistical significance, they are main influential in shaping the economic environment, signaling the value of a balanced approach to monetary policy in crisis recovery. The study theoretically contributes to how economic resilience in emerging markets is viewed by highlighting the interactions between monetary, trade, and labor market variables. The findings also have some important implications for policymakers, who will be reminded that reducing unemployment and helping to boost local industry is important in fostering growth. Additionally, cautious adjustments in trade policy may enhance stability, particularly during times of global uncertainty. Future research could expand by examining sector-specific impacts, a more granular timeframe, or comparative.

Keywords: Interest Rates; Trade Openness; Unemployment; Economic Recovery; COVID-19; Multiple Linear Regression; Indonesia

Introduction

Research Background

Global economic disruption was unprecedented due to the COVID-19 pandemic. For Indonesia, being an emerging market economy, the situation looked grimmer. Indonesia being an emerging economy depends on trade, labour-oriented industries, and responsive monetary policies. The response to this crisis tests not only economic resilience but also policy flexibility. The sudden attack of the pandemic brought with itself challenges of such serious magnitude that it automatically called for rapid and

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multi-faceted responses concerning falling GDP, rising unemployment, and disrupted trade flow among other impacts.

Economists and policymakers alike have been very much interested in the economic recovery process in Indonesia, as arguably a model for other emerging markets. Of the factors that have been critical for recovery, monetary policy is especially prominent through adjustments of real interest rates, while the importance of open trade channels was also noted. Besides, consumer demand and general economic growth are influenced by the stability of the labor market, which is depicted by the unemployment rate. In this regard, the recovery of Indonesia in response to COVID-19 will attempt to reveal how the economies of emerging countries can be better prepared and respond to future shocks. Thus, this research makes an academic and practical contribution by assessing the effectiveness of these particular factors in Indonesia's recovery strategy.

Research Purpose and Significance

More specifically, this study investigates real interest rates, trade openness, and unemployment impact on the recovery of Indonesia's GDP during the COVID-19 crisis. By examining those variables, this study also wants to know the role of monetary policy, international trade, and the labor market in shaping economic resilience from the crisis. The research is thus expected to be useful for policymakers in formulating recovery strategies and putting in place economic structures that are shock-resistant in the future.

This research holds significant implications both for Indonesia and other emerging economies. Understanding the effects of interest rates, trade policies, and labor market conditions on GDP recovery can help in formulating effective policy measures. The insights generated could assist governments in making data-driven decisions that promote stability, growth, and resilience. Additionally, by analyzing Indonesia’s economic response, this study contributes to the broader literature on crisis management in emerging markets, providing a framework for assessing the recovery potential of other economies with similar characteristics.

Research Questions

Based on the aforementioned research background, this study focuses on answering the following research questions:

What is the impact of real interest rates on Indonesia’s GDP recovery?

How does trade openness contribute to GDP growth during the recovery period?

What role does unemployment play in supporting or hindering GDP growth?

Research Methods

Hence, to dwell on these research questions, this paper applies a quantitative approach with multiple linear regression. Indeed, the MLR model would be specifically apt because it will permit an analysis of more than one independent variable's combined effects. A structural dummy is created to separate the pre- and post-crisis periods in

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trying to catch the structural changes that might have afflicted the economy during the COVID-19 crisis.

This methodology allows the study to assess the relative significance and impact of each independent variable on GDP. By applying a robust econometric model, the research can isolate the effects of real interest rates, trade openness, and unemployment, providing a clear view of how each factor has contributed to Indonesia's economic resilience. The use of a dummy variable further enhances the model's capacity to capture shifts in economic conditions that may be attributed to the crisis, offering a nuanced understanding of the recovery process.

Paper Structure

The structure of this paper is as follows. Section 2 reviews the relevant literature and theoretical basis. Section 3 analyzes the research hypotheses and research design. Section 4 contains the methodology and test that has been used to conduct the empirical analysis. Section 5 includes the findings and discussions of the study based on relevant results. Section 6 contains a summary including the conclusion, limitations, recommendations, and implications of the study.

Literature Review and Theoretical Basis

Interest Rates and Economic Recovery

Interest rates are important in monetary theory because their influence acts directly on the three major economic activities, saving, and spending taken together to determine the course of the economy. Lower interest rates make borrowing less expensive and encourage investment and expenditure, whereas higher rates can reduce inflation by reducing these activities but also delay growth. Central banks make use of interest rate changes during economic booms or downturns to boost recovery or stability. This relation is especially important in the context of Indonesia's recovery from COVID-19 since interest rates have played a significant role in monetary policy actions to offset economic contraction.

In Indonesia, interest rate adjustments during the COVID-19 pandemic were instrumental in stabilizing financial markets. Vidiati et al. (2022) highlighted the impact of these adjustments on investment in money and forex markets, noting the importance of financial literacy to effectively leverage these monetary policy tools. Bank Indonesia's monetary regulations enabled the money market to efficiently channel funds, thus supporting overall economic growth and stability. Findings suggest that, while interest rate reductions generally promote investment, the effectiveness of these measures can be limited by low financial literacy among the general population.

The theoretical foundations of monetary policy, as articulated by economists like Bernanke (2002), emphasize the role of central banks in promoting economic growth, price stability, and employment. This is achieved by controlling the money supply and adjusting interest rates. Central banks, through these measures, aim to achieve sustainable growth while preventing inflation. Friedman further extended that the stance of monetary policy bears significantly on the various sectors of the economy.

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Then, interest rates come into being in monetary policy when lower interest rates tend to grease the wheels of borrowing and growth, and higher rates brake the inflation rate. This was a pandemic that showed the rest of the world something that had never been seen or experienced by economies. In the times of the COVID-19 economic slump, many countries tried to push monetary stimulus through cuts in interest rates and stability of the exchange rate. As Bernanke also underlined, since the world was experiencing slower economic growth and lower real interest rates, the environment for monetary policy became increasingly challenging and focused more on the interlinkages between monetary and financial stability. This observation has been relevant to the emerging market economy of Indonesia as well, in which interest rate management became one of the key tools to contain spillovers.

Indonesia, as an EME, experienced significant financial market disruptions during the global market panic in March 2020. This financial volatility necessitated accommodative policies from Bank Indonesia, including lower policy interest rates and large-scale monetary easing. Such measures aligned with the strategies of central banks globally, which injected liquidity into financial markets to counteract the effects of the pandemic. In developed markets, these actions took the form of quantitative easing (QE), while EMEs, including Indonesia, combined interest rate reductions with liquidity injections. Bank Indonesia's approach included bond purchases to stabilize the financial markets, which was crucial for sustaining financial conditions along the rupiah yield curve.

Despite these monetary interventions, there were certain gaps and limitations in Indonesia's monetary policy response. Amajihono (2020) noted that, even with reduced loan interest rates, the demand for credit fell due to uncertain economic conditions. This decline in credit uptake illustrates a limitation in the efficacy of reduced interest rates as a standalone tool for economic recovery, especially in times of crisis when consumer and business confidence is low. Moreover, while low real interest rates have created favorable conditions in financial markets by reducing funding costs, the overall impact on long-term economic growth remains mixed.

This body of literature highlights the dual role of interest rates in promoting GDP growth and stabilizing markets during periods of economic recovery. However, the evidence suggests that interest rate policy alone may be insufficient to sustain recovery, particularly in the face of low credit demand and limited financial literacy. These findings underscore the importance of comprehensive monetary policies that address both market stability and public awareness. For Indonesia, an effective recovery strategy may require not only accommodative interest rate policies but also initiatives to enhance financial literacy and support broader access to financial markets.

Trade Openness in Crises

Trade openness is believed by many to be one of the main causes of economic growth since increased openness enhances resource allocation and further fuels specialization, which is partly rooted in theories of absolute and comparative advantage. The Heckscher-Ohlin model suggests that open trade allows a country to take advantage of

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its factor endowments, given labor and capital for example, which results in efficient resource allocation and, accordingly, higher growth rates. This foundation is further supported by Solow's Growth Model, which suggests that economies with greater trade openness reach stable income levels faster due to efficient resource allocation, thus achieving sustainable growth. The Endogenous Growth Theory introduced by Romer (1986) and Lucas (1988) also emphasizes that trade openness promotes long-term economic growth through the diffusion of ideas, technology, and learning across borders.

Empirical studies lend weight to these theories. The World Bank (2000) review, for example, highlights a broad consensus that trade openness positively influences per capita income, with findings by Frankel and Romer (1999) suggesting that each one-point increase in the trade-to-GDP ratio could boost per capita income by between 0.5 % and 2%. However, the specific mechanisms through which these gains manifest remain debated. Globalization is typically linked to increased competition, which pressures domestic firms to enhance efficiency and adopt new technologies. Furthermore, openness appears particularly advantageous for poorer countries, reducing income inequality across nations (Ades and Glaeser, 1999).

Despite these benefits, limitations arise when considering the conditions necessary for trade openness to foster growth. Beck (2002) argues that the effectiveness of trade openness depends on the development of a country's financial sector. His study illustrates that countries with advanced financial systems are better equipped to leverage trade gains, as these systems support high-return manufacturing projects that can enhance comparative advantage. This finding implies that while trade reforms may benefit economic growth, countries should also strengthen their financial sectors to maximize the economic potential of increased trade.

The COVID-19 pandemic has underlined how susceptible and resilient trade-dependent economies are. Examining monthly trade data of 34 exporting countries to 173 destinations, Hayakawa and Mukunoki (2021) realized that during the pandemic, the trade flows fell significantly, and preliminary shocks have been particularly sensitive to non-essential durable goods. Conversely, trade-in medical supplies surged, indicating sector-specific resilience amid global disruptions. These findings reveal the uneven impact of external shocks on trade and suggest that open economies may experience varying degrees of resilience depending on their sectoral composition.

In the context of emerging markets like Indonesia, trade openness presents both opportunities and challenges. Behera and Rath (2024) conducted a study on ASEAN nations including Indonesia finding that while trade openness can increase exposure to global shocks, leading to higher output volatility, it may also provide stability through diversification and improved market access. However, their analysis indicates that Indonesia and Thailand showed relatively muted impacts on output volatility from trade openness, suggesting that the relationship between trade openness and economic stability may vary significantly across ASEAN economies.

The literature, while largely supportive of trade openness as a growth driver, presents some gaps. There is no clarity about how trade openness interacts with domestic factors such as inflation and FDI that Behera and Rath found significantly influence

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output volatility in the ASEAN nations. Further, while generally beneficial, the effects of trade openness are not uniform across industries, as was seen in COVID-19, and hence require policies that allow for such disparity. It is, therefore, left to future studies to investigate the interaction between openness to trade and other macroeconomic factors in a socio-economic context like Indonesia. The consideration of such lacunae may lead Indonesian policymakers to explore ways in which openness to trade can be explored for beneficial outcomes with the least adverse risks, especially during periods of economic turbulence.

Unemployment and Economic Stability

The relationship between unemployment and GDP is widely examined, particularly within the framework of Okun's Law, which posits an inverse relationship: as GDP rises, unemployment tends to fall. This concept, first introduced by Okun (1962), was later applied to various economies, including Jordan by Alamro and Al-dalaien (2014), who found that while GDP growth did contribute to reduced unemployment, the effect was modest. Their findings support the notion that economic growth drives job creation, though the impact varies depending on factors like labor productivity versus labor demand. This relationship is particularly relevant to Indonesia, where GDP growth during the post-COVID recovery could potentially lower unemployment rates. However, the application of Okun's Law in emerging markets like Indonesia is limited due to unique structural factors, such as high informal employment rates and lower baseline productivity, which may weaken the direct applicability of Okun's findings.

Labor market theories also contribute to understanding the GDP-unemployment relationship. Irmen (2009) highlights frictional unemployment, which arises during job transitions, as an essential element in economic growth. In a semi-endogenous growth model, Irmen found that labor market institutions, like job-matching agencies, reduce unemployment duration, facilitating economic growth. A well-managed labor market thus balances growth and employment by minimizing friction. However, there is limited research on how Indonesian labor institutions specifically impact this balance, marking a gap in understanding the GDP-unemployment relationship within Indonesia's labor market context.

Another approach comes from Rahman (2013), who, in turn, analyzed the interdependencies of GDP with per capita GDP, literacy rate, and unemployment for a sample of countries. Rahman found from his study that there is a strong negative correlation between per capita GDP and unemployment, which implies that higher individual productivity can lower the rate of unemployment and, therefore, strengthen the economy. This finding is particularly relevant for Indonesia, where policies aimed at enhancing workforce productivity could support GDP growth and reduce unemployment. However, additional empirical research is needed to determine its efficacy in Indonesia's post-crisis scenario, even though Rahman's findings highlight the potential advantages of raising individual productivity and boosting education.

The COVID-19 pandemic has badly affected Indonesia's labor market as well as its GDP. According to Olivia, Gibson, and Nasrudin (2020), due to reduced demand,

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production cuts resulted in massive layoffs, which further aggravated unemployment and thereby plunged into a socio-economic downturn. High unemployment rates contributed to reduced household income and consumption, creating a feedback loop that hindered GDP recovery. These findings underscore the critical role of fiscal and monetary policies in restoring demand and stabilizing employment, particularly through incentives for firms to retain employees and social security measures for laid-off workers. However, due to the relatively recent nature of the pandemic, there remains a gap in longitudinal studies examining the long-term effects of these interventions on Indonesia's recovery.

The literature collectively emphasizes that while economic growth can drive job creation and reduce unemployment, these effects vary across contexts. For Indonesia, the focus on labor market policies, productivity, and education is vital for supporting economic resilience. Yet, limitations in the direct applicability of Okun's Law, insufficient research on labor market institutions, and gaps in pandemic-specific studies leave room for further exploration. Addressing these gaps could enhance the understanding of Indonesia's unique recovery dynamics and inform more targeted policies to foster sustainable economic growth.

Research Hypotheses and Research Design

Relationship Between Real Interest Rates and Economic Recovery

The role of interest rates in influencing economic recovery has been highly debated, especially following global financial crises. This debate extends beyond developed economies to emerging markets (EMEs) like Indonesia. In this regard, it is worth underlining that the existing literature strongly promotes the view of a direct impact of real interest rates on economic growth, which becomes evident from studies such as those by Breeden (1986), Cochrane (1991), and Harvey (1988). This no doubt underpins the basis for why interest rates rank among the key apparatus for stabilizing economies.

The EME nations were sensitive to rate changes, as they showed through their data that they were way more susceptible to large-scale capital outflows and spikes in government bond yields than advanced economies. This sensitivity is especially relevant in Indonesia's case, as it highlights how real interest rates may play a measurable role in post-pandemic GDP recovery. Research reveals that, despite borrowing in local currencies, EMEs, including Indonesia, could not shield themselves from the global turmoil caused by the pandemic (Hofmann et al., 2020). However, there is limited focus on how country-specific factors, such as Indonesia's monetary policy decisions, impacted its recovery trajectory. Given this context, Hypothesis 1 (H1) posits that there is a measurable impact of real interest rates on Indonesia's GDP recovery during the post-COVID-19 period. This hypothesis seeks to address a gap in the literature by focusing specifically on Indonesia's experience, adding insight into how real interest rates influenced the nation's economic resilience and growth amidst global financial uncertainty.

H1: There is a measurable impact of real interest rates on Indonesia's GDP recovery during the post-COVID-19 period.

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Relationship Between Trade Openness and Economic Recovery

Trade openness is generally accepted as one of the fundamental preconditions of growth, especially for developing countries such as Indonesia, whose integration with international markets could spur recovery and growth. The fact that openness has been elaborated upon as a variable in economic models-for instance, Romer's 1986 endogenous growth model-strongly attests to how openness sparks growth through providing access to huge markets and encouraging innovation pressures of competition. Barro et al. (1995) further emphasize that openness promotes capital accumulation and economic expansion, aligning with capitalist growth tendencies that spur development.

For developing economies, trade openness holds unique significance, as it enables these countries to harness external capital and technology flows to advance their economic standing. Karras (2003) reports that the impact of trade openness on economic growth is positive, statistically significant, and economically relevant: open economies can sustain higher growth rates than more closed economies. This also lends credibility to the findings of Rodrik (1988) and Thirlwall (2000), under neoclassical and absolute advantage theories, respectively, that openness raises productivity and improves institutional quality and that it promotes long-term growth. These perspectives underscore the "integration view," which advocates for global economic convergence by overcoming trade barriers. In this view, market integration is a key factor in promoting sustainable growth, particularly for developing nations (Rodrik et al., 2004). Further, the compensation hypothesis suggests that openness can achieve economic growth stability or reduced volatility; Iyke (2017), Sachs and Warner (1995), and Vamvakidis (2002) found evidence of a positive relationship between openness and economic growth stability. In line with this body of research, Hypothesis 2 (H2) posits that trade openness positively contributes to Indonesia's GDP growth during the COVID-19 recovery period. This hypothesis highlights the anticipated role of openness in Indonesia's economic resilience, suggesting that increased trade integration may help stabilize and strengthen GDP growth in the post-crisis phase.

H2: Trade openness positively contributes to Indonesia's GDP growth during the recovery period following the COVID-19 crisis.

Relationship Between Unemployment and Economic Recovery

Unemployment is a significant concern in developing countries like Indonesia, where high unemployment rates indicate inefficient use of labor resources and potentially hinder economic growth (Hjazeen et al., 2021). In the short term, unemployment often lags behind other economic indicators, meaning that a decline in unemployment may only follow other signs of recovery. Therefore, unemployment is considered a lagging economic indicator. Sustainable growth requires stable inflation and low unemployment levels (Castellet and Domingo, 1997), and the inverse relationship between unemployment and GDP growth is captured by Okun's Law. This law posits that economic growth reduces unemployment, with GDP losses associated when unemployment exceeding its natural rate.

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Research by Zagler (2003), focusing on European countries, reveals that rising unemployment rates lead to decreased growth rates in the short term. While long-term effects may vary, the general pattern in developing countries suggests that high unemployment, especially after economic shocks, significantly impedes GDP growth. Supporting this, Uz, Donghui, and Imran's (2012) analysis of European countries demonstrated a statistically significant negative impact of unemployment on GDP per capita. Their findings highlight that increased unemployment adversely affects overall economic productivity.

However, some studies, such as the bibliometric analysis by Neto and Silva (2013), suggest that GDP growth can sometimes correlate with rising unemployment if it results in wage increases that deter hiring. Göçer and Erdal (2015) extend this perspective, finding that strong GDP growth alone may not reduce unemployment, particularly among youth, unless supported by effective labor policies. For Indonesia, Hypothesis 3 (H3) reflects this understanding: a high unemployment rate is expected to inversely impact GDP during the recovery phase. This inverse relationship emphasizes the need for targeted employment policies to support economic resilience and growth in Indonesia's post-COVID-19 period.

H3: Unemployment rate has an inverse relationship with Indonesia's GDP during the economic recovery phase, slowing down overall growth.

Research Design

In this research, a quantitative approach is employed, utilizing multiple linear regression (MLR) to examine the impact of real interest rates, trade openness, and unemployment on Indonesia's GDP recovery post-COVID-19. MLR is deemed appropriate for this study as it allows for the quantification of relationships between multiple independent variables and GDP growth, providing a clear statistical understanding of each factor's contribution to economic recovery. The research design involves the use of secondary data. Therefore, this study will be based on some economic indicators: GDP, real interest rates, trade openness, and unemployment rates which must be sourced from reliable sources to ensure the analysis produced is robust.

The unit of analysis for this study is yearly economic data for Indonesia, specifically covering the years before and after the COVID-19 pandemic, which provides insights into both crisis and recovery periods. This dataset offers a longitudinal perspective, as it spans multiple years, tracking changes across a defined period. This longitudinal design is essential in capturing the temporal effects of economic policies and external factors on GDP recovery, distinguishing the pre-2021 period from the post-crisis recovery phase.

By structuring the research design in this way, the study aims to capture not only immediate impacts but also longer-term trends, providing a comprehensive understanding of the economic recovery in Indonesia. This approach complements the more detailed methodology section, which will cover the specific steps, model specifications, and data sources used for the regression analysis.

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Methodology

Variable Selection

Dependent Variable

- GDP Value: This variable represents Indonesia's economic output and is the primary indicator of economic recovery. It is appropriate for measuring the overall economic impact of the COVID-19 crisis and the recovery process.

Independent Variables

- Real Interest Rate: Included in the understanding of monetary policy for economic recovery, the real interest rate determines the cost of borrowing, which subsequently influences the investment and consumption patterns. This variable helps in assessing how monetary policy adjustments affected GDP during recovery.
- Trade Openness: The degree to which Indonesia is open to international trade, possibly affecting economic recovery via trade revenues and external demand.
- Unemployment rate: This indicates labor market conditions and, coupled with this, at least the level of consumer spending that determines GDP growth.

Dummy Variable

- After Cutoff (2021): This dummy variable distinguishes economic conditions before and after the COVID-19 crisis, capturing economic shifts due to recovery measures and policy interventions from 2021 onward.

Sample and Population

This paper reviews Indonesia's macroeconomic performance during the period 2011-2023, predicated on a few important indicators comprising GDP, real interest rates, trade openness, and unemployment rates. The population concerns Indonesia's annual macroeconomic data about these variables, chosen for their relevance to the study of Indonesia's economic recovery process, in particular concerning the COVID-19 pandemic. The sample consists of 13 annual observations from 2011 to 2023, which include years with complete data across all selected variables. This timeframe captures the pre-crisis, crisis, and post-crisis phases, providing a comprehensive perspective on Indonesia's economic response and recovery. While the sample size is limited, it adequately reflects meaningful trends in economic resilience and the impact of policy interventions.

The included figure 1, visualizes GDP trends over the sample period, highlighting a clear upward trajectory in GDP value over time with a noticeable shift after 2021, marked by the red dashed line. This cutoff year represents the post-COVID-19 recovery phase, where government interventions and policy measures aimed to stabilize and stimulate the economy. The graph helps illustrate the distinct phases within the study period, providing a contextual backdrop for examining how variables such as interest rates, trade openness, and unemployment influenced GDP across these phases.

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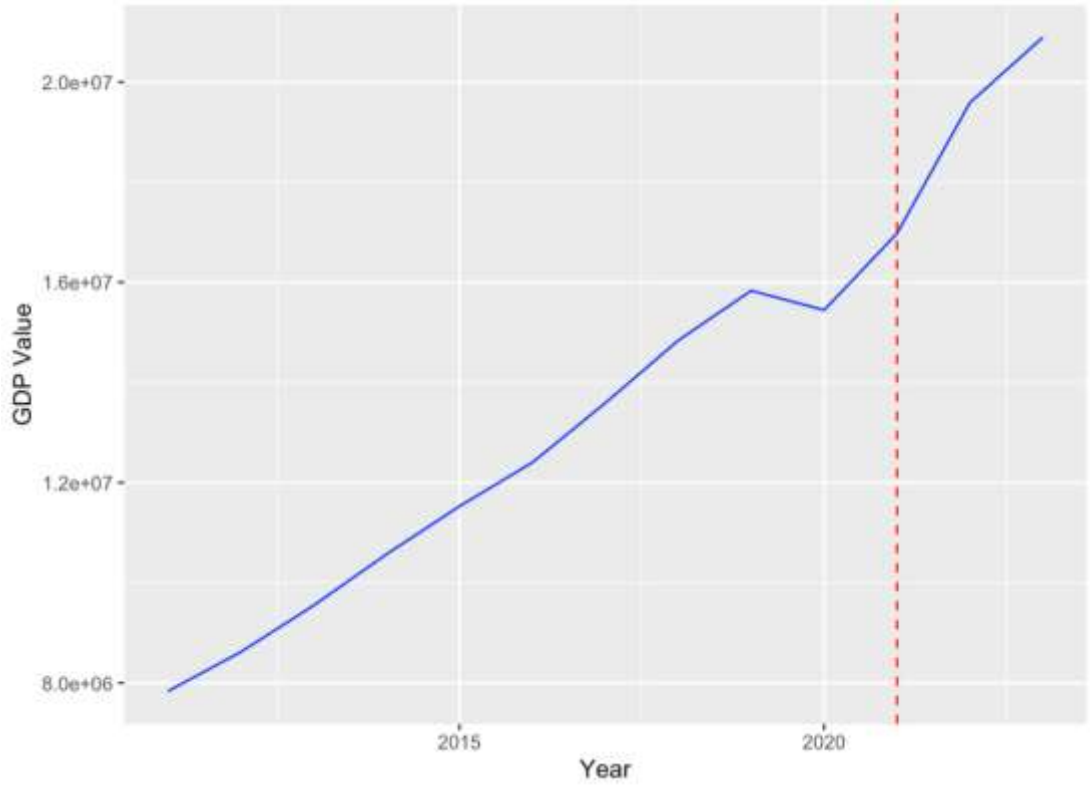
Figure 1: GDP Value Over Time with Cuttoff Year (2021)



Data Type and Collection

This study employs the time series data approach, which comprises yearly data for GDP, real interest rates, trade openness, and unemployment rate, specifically focusing on changes before and after the COVID-19 crisis. The author used secondary data collected from the Central Bureau of Statistics, World Bank, OECD, Statista, Trading Economics, and the annual report of Bank Indonesia over the period from 2011 to 2023. The annual reports were sourced from the publicly available official websites.

Data Analysis Technique

This study involves using Excel for data input and RStudio version 4.3.3 for performing a set of data analyses, which are divided into several parts including descriptive statistics analysis, correlation analysis, multiple linear regression analysis, and robustness test.

Descriptive Statistic Analysis

Computing descriptive statistics is a common preliminary step in data analysis. These descriptive statistics in this preliminary step provide an overview of the general patterns with prevalent characteristics within the dataset. Minimum and maximum, mean, and standard deviation are the descriptive statistics computed for each variable.

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Correlation Analysis

This analysis would be useful in testing the strength and direction of the linear relationship between any two variables. The outcome of the correlation analysis is represented in matrix form and is expressed with a Pearson correlation coefficient that ranges from -1 to 1. A coefficient close to 1 means a perfect positive correlation, indicating when one variable increases, the other variable also tends to increase. On the other hand, a number near -1 is indicative of a strong negative relationship wherein an increment of one variable goes with a decrease in the other. A value around 0 will indicate almost no linear relationship between variables.

Multiple Linear Regression Analysis

A statistical method for analysing how one variable depends on multiple independent variables is multiple linear regression analysis. This method investigates how changes in the independent and control factors affect the dependent variable, assuming a linear connection between the dependent and independent variables. The following equation represents the model used in this study:

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \varepsilon$$

Note:

Y = GDP Value
$\beta 0$ = constant term
$\beta 1 - \beta 4$ = regression coefficient
$X1$ = real interest rate
$X2$ = trade openness
$X3$ = unemployment rate
$X4$ = after cutoff (dummy variable)
ε = error term

The after cutoff dummy variable helps isolate the effects of the COVID-19 period by distinguishing observations before and after the crisis. This dummy variable allows the model to capture changes in GDP trends that may be attributed to recovery measures, such as fiscal or monetary interventions during the post-crisis period.

Robustness Test

Robustness test in statistical analysis is crucial for ensuring the reliability and stability of the main model. This test helps determine whether the findings of the main model remain consistent under different conditions. In this study, robustness testing is conducted using the sensitivity analysis method.

Findings and Discussions

Descriptive Statistics Analysis

The results for the descriptive statistics are displayed:

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Table 2: Descriptive Statistics

Variable	N	Mean	St. Dev.	Min	Max
GDP Value	13	13,665,626,00	4,080,119.00	7,831,726.00	20,892,377.00
Real Interest Rate	13	6.44	2.93	-0.96	9.99
Trade Openness	13	42.76	5.35	32.97	50.18
Unemployment Rate	13	4.12	0.49	3.42	5.15

The average value of the GDP is approximately 13.67 million, with a standard deviation of about 4.08 million. This is a reflection of relatively high variation during the period under consideration. The lowest value was 7.83 million, while that of the highest was 20.89 million. This suggests that fluctuations were extreme and might have been influenced by the economic effect of the pandemic and further recovery efforts.

The average real interest rate is 6.44% with a standard deviation of 2.93%, reflecting moderate dispersion. The interest rate fluctuated within the bracket range from -0.96% to 9.99%. While negative rates might reflect monetary policies to spur growth during the crisis, the higher bound could reflect the tightening measures as part of the post-crisis stabilization process.

The openness to trade stands at an average of 42.76%, with a standard deviation of 5.35%, which indicates relatively stable levels by showing moderate fluctuations. The range from 32.97% to 50.18% perhaps shows the shocks that global trade had because of the pandemic and later recovered as supply chains got back to normal. Unemployment rate: An average of 4.12% and a standard deviation of 0.49% indicate pretty consistent levels with minor changes. The unemployment rate ranges from 3.42% to 5.15%, showing that the crisis indeed did affect the labor market, with how the increasing rates are probably more representative of the initial economic decline, while the rates closer to the end show gradual improvement as recovery came along.

Correlation Analysis

Table 2: Correlation Analysis

	GDP Value	Real Interest Rate	Trade Openness	Unemployment Rate
GDP Value	1.000	-0.301	-0.537	-0.829
Real Interest Rate	-0.301	1.000	-0.413	0.255
Trade Openness	-0.537	-0.413	1.000	0.386
Unemployment Rate	-0.829	0.255	0.386	1.000

The correlation matrix provides insight into the relationships among the variables in this study. First, there is a weak negative relationship between GDP value and real interest rate, with a correlation coefficient of -0.301. This suggests that higher real interest rates may be associated with a slight decline in GDP, aligning with economic

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theory that high interest rates can dampen economic activity by increasing borrowing costs; however, this effect appears minimal in this dataset.

The relationship between GDP value and trade openness shows a moderate negative correlation of -0.537, which is somewhat unexpected. This could suggest that, during this period, greater trade openness did not directly correspond to GDP growth in Indonesia. This may be due to external shocks or changes in trade dynamics, especially during the COVID-19 recovery phase. In contrast, GDP value and unemployment rate exhibit a strong negative correlation of -0.829, the most significant relationship in the matrix. This aligns well with economic expectations, as rising unemployment is generally associated with lower GDP, reflecting reduced economic output and demand during economic downturns.

Other relationships provide additional context. Trade openness and real interest rates have a moderate negative correlation of -0.413, indicating that higher trade openness could correspond with lower real interest rates, possibly due to policy measures supporting trade. Furthermore, the unemployment rate and trade openness have a moderate positive correlation of 0.386, suggesting that higher trade openness may be associated with slightly higher unemployment, possibly due to structural adjustments in the labor market influenced by trade policies. Lastly, the real interest rate and unemployment rate show a weak positive relationship of 0.255, implying that higher interest rates may be modestly associated with increased unemployment, which aligns with the economic theory that high interest rates can suppress investment and job creation.

Overall, the correlations suggest that, inversely, the unemployment rate varies with GDP most strongly, while other variables such as trade openness and real interest rate have weaker associations. These preliminary findings set the foundational understanding of how these factors might influence Indonesia's GDP-particularly economic recovery after the COVID-19 crisis.

Multiple Linear Regression Analysis

Based on the regression output provided in Table 5, the multiple linear regression equations can be represented as follows:

$$\text{GDP value} = 51{,}066{,}151 - 488{,}584\ \text{Real Interest Rate} - 355{,}818\ \text{Trade Openness} - 4{,}622{,}789\ \text{Unemployment Rate} + \varepsilon$$

The real interest rate has an estimated coefficient of -488,584 with a significance level just above 0.05 ($p < 0.1$). This suggests a potentially negative relationship between real interest rates and GDP, indicating that higher interest rates might reduce GDP growth. However, since it's not statistically significant at the 5% level, this relationship is weak. Trade openness has a significant negative coefficient (-355,818, $p < 0.05$), implying that as trade openness increases, GDP decreases slightly, contrary to typical expectations. This result might indicate that trade openness had negative effects during this period, possibly due to global economic downturns impacting Indonesia's trade-dependent sectors. The unemployment rate has a significant negative effect on GDP (-4,622,789, $p < 0.05$), which is consistent with the

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hypothesis that higher unemployment adversely affects GDP by reducing overall demand and economic productivity.

$$\text{GDP value} = 37{,}940{,}752 - 68{,}942\ \text{Real Interest Rate} - 305{,}882\ \text{Trade Openness} - 2{,}868{,}478\ \text{Unemployment Rate} + 4{,}607{,}520\ \text{After Cutoff} + \varepsilon$$

Model (2) indicates that when the after_cutoff dummy is introduced, the effect of real interest rates becomes less negative (-68,942) and is statistically insignificant ($p > 0.1$). This suggests that controlling for the post-crisis period diminishes the impact of interest rates on GDP, aligning with the hypothesis that the influence of interest rates might be indirect and less impactful during recovery phases. This model shows a slightly reduced negative impact (-305,882, $p < 0.05$) but remains significant. The persistence of the significance level suggests that trade openness consistently affects GDP negatively, supporting the hypothesis that external market dependencies can hinder economic growth during global crises. This model also shows a negative effect (-2,868,478, $p < 0.1$) with slightly less magnitude, but the relationship remains significant. This outcome aligns with the hypothesis that unemployment inversely impacts GDP, although the presence of the post-crisis dummy reduces the coefficient's strength, indicating some mitigating effects of recovery policies. The introduction of the after_cutoff dummy in Model (2) has a significant positive coefficient (4,607,520, $p < 0.05$). This result suggests that the post-COVID-19 period is associated with an increase in GDP, likely reflecting the impact of economic recovery measures. This finding supports the hypothesis that recovery interventions positively influenced GDP after the crisis.

Table 3: Regression Result

	Dependent variable:	
	gdp_value	
	(1)	(2)
real_interest_rate	−488,584*	−68,942
	(249,016)	(261,896)
trade_openness	−355,818**	−305,882**
	(143,022)	(116,120)
unemployment_rate	−4,622,789**	−2,868,478*
	(1,460,851)	(1,367,500)
after_cutoff		4,607,520**
		(1,868,386)
Constant	51,066,151***	37,940,752***
	(6,092,077)	(7,214,518)
Observations	13	13
R^2	1	1
Adjusted R^2	1	1
Residual Std. Error	2,002,286 (df = 9)	1,600,755 (df = 8)
F Statistic	14*** (df = 3; 9)	17*** (df = 4; 8)
Note:		*p<0.1; **p<0.05; ***p<0.01

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Testing Hypothesis

Hypothesis 1: There is a measurable impact of real interest rates on Indonesia's GDP recovery during the post-COVID-19 period. This hypothesis is partially supported. The interest rate effect is weakly significant in Model (1) but diminishes in Model (2), suggesting that its direct impact on GDP is limited during the post-crisis recovery.

Hypothesis 2: Trade openness positively contributes to Indonesia's GDP growth during the recovery period following the COVID-19 crisis. Contrary to expectations, trade openness shows a negative impact on GDP in both models. This suggests that trade openness may have had adverse effects during the crisis and recovery periods, possibly due to external vulnerabilities impacting Indonesia's economy during global downturns.

Hypothesis 3: The unemployment rate has an inverse relationship with Indonesia's GDP during the economic recovery phase, slowing down overall growth. This hypothesis is supported by both models, as unemployment consistently exhibits a strong, negative impact on GDP, highlighting the importance of labor market stability in economic recovery.

Overall, Model (2) with the dummy variable appears to capture the post-crisis dynamics more effectively, suggesting that Indonesia's recovery was influenced by factors that became significant after the COVID-19 pandemic. This model underscores the role of targeted recovery measures in stabilizing GDP growth during the crisis recovery period.

Model Fit

Both regression models demonstrate a high degree of explanatory power, as indicated by their R-squared and adjusted R-squared values. Model (1), which includes real interest rates, trade openness, and unemployment rate, explains approximately 82% of the variance in GDP. This suggests that the independent variables collectively provide a strong fit for understanding GDP fluctuations. Model (2), which includes a dummy variable for the post-2020 COVID-19 recovery period, yields an even higher R-squared value close to 1.0, implying that nearly all the variance in GDP is accounted for. This increase in explanatory power with the addition of the dummy variable highlights the relevance of post-crisis conditions in shaping Indonesia's economic recovery. The F-statistics for both models are also highly significant, supporting the robustness of the models and indicating that the independent variables are meaningful predictors of GDP. Model (2) has a notably higher F-statistic compared to Model (1), further reinforcing that the inclusion of the after_cutoff variable enhances the model's ability to capture economic dynamics during and after the COVID-19 crisis. These fit measures indicate that Model (2), with the post-crisis dummy, provides a more comprehensive understanding of Indonesia's economic recovery trajectory following the pandemic.

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Robustness Test

Model (1): Removing Trade Openness

The coefficient for the real interest rate (305,576) is positive, though it is not statistically significant. This suggests that while real interest rates have a positive association with GDP, this effect may not be a strong driver in the model. Unemployment significantly negatively influences the GDP, with a coefficient of -4,233,148 and the p-value being less than 0.05. This result aligns with expectations that a high rate of unemployment is met with low levels of GDP, further cementing that it is through the labor market that economic recovery is determined. The after_cutoff dummy variable shows a significant positive coefficient (5,465,781, $p < 0.05$), indicating a noticeable shift in GDP levels after the COVID-19 recovery period. Removing trade openness does not significantly alter the significance of the unemployment rate and the after_cutoff variable, which remain significant. This implies that the model is relatively robust to the exclusion of trade openness, as the relationship between unemployment and GDP, as well as the recovery phase effect, are stable.

Model (2): Removing Unemployment Rate

The coefficient for real interest rate changes direction, becoming negative (-59,386), but remains statistically insignificant. This suggests that interest rate changes alone may not strongly influence GDP in this model. When the unemployment rate is excluded, the coefficient for trade openness remains negative and significant (coefficient = -398,157, $p < 0.05$). This indicates that lower trade openness is still associated with lower GDP, suggesting that trade openness plays a crucial role in GDP performance. The after_cutoff variable becomes even more significant (6,646,296, $p < 0.01$), further underscoring the impact of the post-crisis recovery phase on GDP.

Robustness Assessment

The results from the sensitivity analysis suggest that the model is relatively robust:

After Cutoff Variable: The after_cutoff dummy variable consistently shows a positive and significant impact on GDP across both models, suggesting that the recovery period following the COVID-19 crisis plays a significant role in GDP growth.

Core Relationships: The core relationships between GDP and the main independent variables—trade openness and unemployment—remain stable when each variable is omitted. The trade openness variable remains negative and significant in Model (2), while the unemployment rate retains its negative and significant effect in Model (1).

Real Interest Rate: Real interest rates are not statistically significant in either model, indicating that changes in this variable may have limited influence on GDP within this specific timeframe.

In conclusion, the sensitivity analysis confirms the robustness of the model, especially in capturing the significant impacts of unemployment, trade openness, and the post-crisis recovery phase on GDP. Removing one variable at a time does not

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fundamentally alter the conclusions, providing confidence in the stability of these results.

Table 4: Regression Result

	Dependent variable:	
	gdp_value	
	(1)	(2)
real_interest_rate	305,576	−59,386
	(283,369)	(307,364)
unemployment_rate	−4,233,148**	
	(1,630,515)	
trade_openness		−398,157**
		(126,141)
after_cutoff	5,465,781**	6,646,296***
	(2,370,278)	(1,872,979)
Constant	27,875,104***	29,538,329***
	(7,884,111)	(7,043,055)
Observations	13	13
R^2	1	1
Adjusted R^2	1	1
Residual Std. Error (df = 9)	2,062,355	1,878,943
F Statistic (df = 3; 9)	13***	16***
Note:	*p<0.1; **p<0.05; ***p<0.01	

Discussion of Findings

Interest Rates and GDP

Real interest rate variables, though theoretically very important to influence economic growth through their impact on investment and consumption, have insignificantly small impacts on the GDP within this model. This result points to the possibility that during the COVID-19 recovery in Indonesia, other factors may have played a more direct role in driving economic growth. The lack of significance for interest rates could imply that despite adjustments by the central bank to stimulate the economy, the responsiveness of GDP to interest rate changes was limited. This may be due to the unique challenges of the COVID-19 crisis, where demand-side constraints and global

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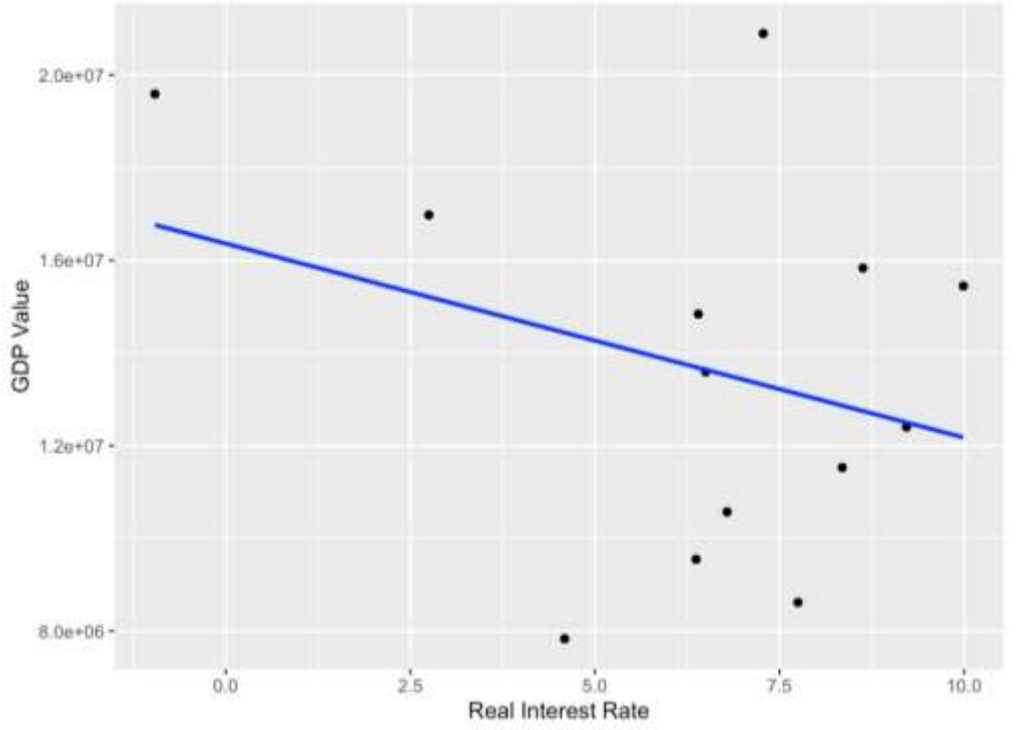
economic disruptions overshadowed traditional monetary policy tools. This result aligns with studies on emerging markets that sometimes show weaker sensitivity to interest rate policies, particularly during crises. The finding would, therefore, become imperative to policymakers while one attempts to consider the efficiency of interest rate policies in pursuing recovery and thus proposes complementary measures other than monetary policy.

Figure 2: GDP Value and Real Interest Rate



Trade Openness and GDP

Trade openness demonstrates a negative and significant impact on GDP in the regression results. This result is somewhat unexpected, as economic theory often links greater trade openness to growth benefits through access to international markets and resources. This may therefore reflect some of the challenges faced by Indonesia's trade sector during the pandemic, such as supply chain disruption, decreased global demand, and shifting trade policies. In general, heavy reliance on international trade for emerging economies like Indonesia is a double-edged sword, since external shocks might disproportionately shake GDP in times of global crisis. That would imply that, if there is an economic downturn, reliance upon foreign trade would act as a brake on the road to recovery. The implication for the policymaker, therefore, is the more shockproofing put into the national economy, the less it would be at the mercy of foreign exogenous shocks.

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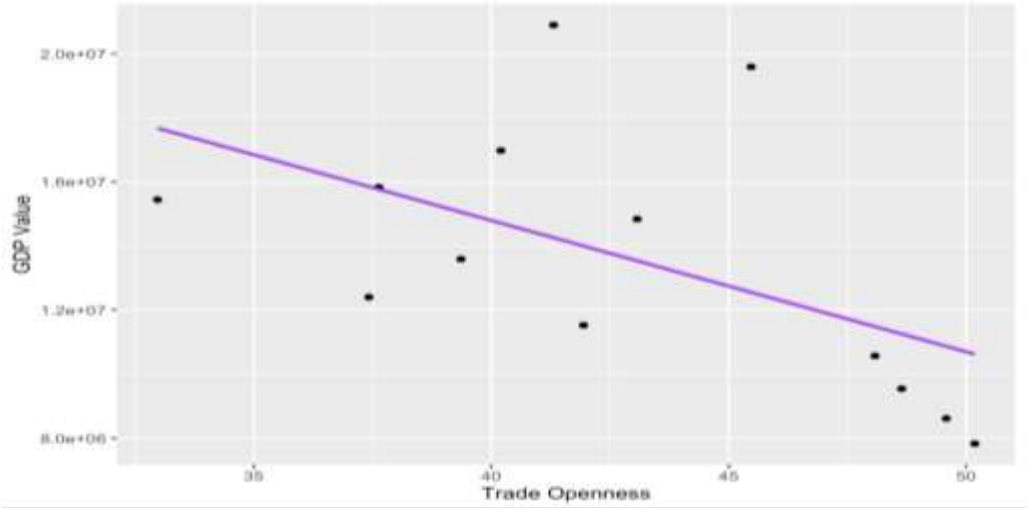
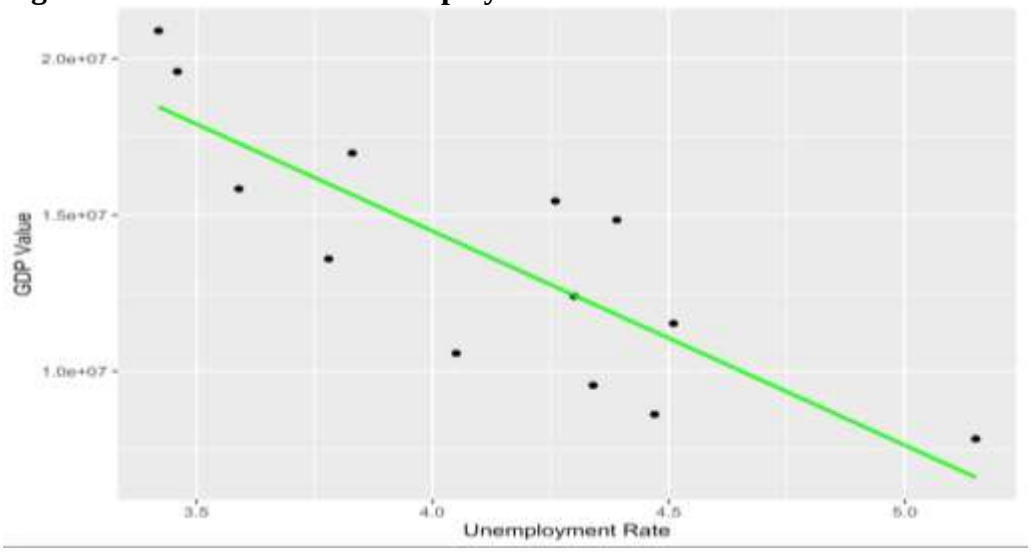
Figure 3: GDP Value and Trade Openness



Unemployment Rate and GDP

Unemployment shows a strong negative relationship with GDP, as expected. Higher unemployment rates typically reduce consumer spending and decrease overall demand, leading to slower economic growth. This result emphasizes the importance of labor market stability in supporting GDP growth, particularly during the recovery phases. The significant negative coefficient for unemployment underscores the necessity of job-creation policies and labor market interventions to sustain economic recovery post-crisis. This finding is in line with conventional economic theory, which links employment levels with consumer demand and overall economic health. For Indonesia, focusing on labor market interventions during recovery periods may be crucial in achieving sustained GDP growth, highlighting the essential role of employment in economic resilience.

Figure 4: GDP Value and Unemployment Rate



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Post-crisis Recovery

The inclusion of the after_cutoff dummy variable, which represents the post-2021 COVID-19 recovery period, reveals a significant and positive effect on GDP. This result highlights the distinct shift in GDP trends after the crisis period, likely influenced by a combination of recovery policies, fiscal stimulus, and pent-up consumer demand. The significance of this dummy variable reinforces the importance of considering recovery dynamics separately from the crisis period itself, as economic conditions and responses differ substantially.

Further Discussions

The findings collectively reveal an interesting dynamic: while traditional drivers like interest rates may have limited direct impact, structural factors such as unemployment and trade openness significantly shape economic outcomes. The results suggest a nuanced interaction where external trade conditions and labor market health exert a more immediate influence on GDP than monetary policy alone. This implies that, for recovery efforts, focusing on internal economic factors—such as boosting employment and stabilizing key industries—might yield more effective results than relying solely on monetary adjustments.

The negative association between trade openness and GDP is a particularly unexpected outcome. This could reflect the vulnerabilities of an open economy during a global crisis, indicating that diversifying the economy and fostering resilience in domestic industries may help mitigate similar effects in future crises. Additionally, the limited effect of interest rates on GDP suggests a potential need for a broader policy toolkit that includes fiscal measures and structural reforms alongside interest rate adjustments. In summary, the analysis underscores the critical role of unemployment and trade openness in Indonesia's recovery from COVID-19, suggesting that policy emphasis on labor market stability and domestic economic resilience is vital. This approach may provide a more sustainable foundation for growth, particularly in emerging markets that face heightened risks from global economic fluctuations.

Summary

Conclusion

In conclusion, the analysis of Indonesia's GDP recovery post-COVID-19 highlights the critical roles of unemployment, trade openness, and interest rates in shaping economic resilience. The findings reveal that unemployment and trade openness significantly impact GDP, both exerting a negative effect on growth, underscoring the vulnerabilities of an open economy during global disruptions and the importance of stable employment. Although real interest rates showed a limited direct impact on GDP growth, the analysis using a post-2021 dummy variable points to a marked recovery phase, likely fueled by fiscal policies and a rebound in consumer demand.

This study contributes to the understanding of crisis recovery in emerging markets, emphasizing that domestic factors—such as labor market stability and reduced dependence on international trade—are vital for sustained recovery amid global

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economic shocks. The results support theories suggesting that, during extraordinary circumstances like the COVID-19 pandemic, traditional monetary policy alone may be insufficient to stimulate growth. What is instead called for is a delicate balance between fiscal measures, support for employment, and strategic trade policy. Indonesia may well find such a course preeminence given to job creation, strengthening of home industries, and resilience against external shocks-finding its way to a more sustainable economic recovery during the next crisis.

Limitations

This study has several limitations that must be acknowledged. First, the yearly nature of the dataset could not allow the analysis to capture intra-yearly fluctuations. Secondly, the consideration of only Indonesia as a case limits the generalizability of the findings to other emerging markets characterized by differing economic structures. Third, reliance on secondary data can be and have reporting inaccuracies. Finally, the inclusion of the post-2021 dummy variable enhances the capture of the COVID-19 crisis impact but does not consider other simultaneously employed policy measures or even exogenous factors that could influence such outcomes.

Recommendations

Based on the findings, several recommendations are proposed to support sustainable economic recovery in Indonesia:

Policy Recommendations

The government should establish job creation programs in sectors most drastically affected by the pandemic, including tourism and manufacturing, to ensure labor market stability. Policies that would make a country less dependent on international trade, such as promoting strong domestic industries and supporting local production, have contributed to greater resiliency in global economic shocks. Monetary policy interest rate adjustments are significant instruments, but these should be combined with selective fiscal policies that encourage domestic demand, in support of SMEs.

Recommendations for Future Research

Future studies should consider using more granular data (e.g., quarterly or monthly) to better capture short-term economic shifts that annual data may miss. This approach would improve understanding of the immediate effects of fiscal and monetary interventions during recovery phases. Additionally, sector-specific analysis could reveal how various industries respond to policy measures after a crisis. Expanding the range of control variables (e.g., government stimulus measures, and consumer confidence) could also deepen insights into economic resilience. Finally, comparative studies across emerging markets would shed light on whether Indonesia's recovery patterns are unique or shared with similar economies, thus informing more tailored policy strategies.

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Implications

Theoretical Implications:

This study contributes to the body of literature on economic resilience and crisis recovery in emerging markets. It underscores theories emphasizing domestic stability (e.g., labor market health and industrial resilience) over traditional monetary policy when addressing large-scale economic disruptions. The findings align with economic theories suggesting that, in extraordinary situations like a global pandemic, demand-side constraints can limit the effectiveness of interest rate adjustments in stimulating growth.

Policy Implications:

For policymakers, the results stress the importance of a balanced approach, combining monetary policy with robust fiscal and labor market interventions. The limited impact of interest rates on GDP growth during the recovery period suggests that relying solely on rate cuts may not be sufficient. Instead, policies should emphasize labor market stability and support for domestic industries to foster resilience. Promoting local production and intra-country trade can also reduce dependency on global markets, better shielding the economy from future external shocks. Such a comprehensive recovery strategy provides a sustainable foundation for Indonesia's economic growth in a post-crisis environment.

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