

Sukuk and Inflation Dynamics in Indonesia: A Time Series Linear Model Investigation

Laila M. Pimada¹, Titis Miranti²

¹ Universitas Brawijaya, Indonesia; lailapimada@ub.ac.id

² UIN Maulana Malik Ibrahim, Indonesia; titis@uin-malang.ac.id

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Abstract

This study examines the impact of sukuk on inflation in Indonesia, considering the interplay of macroeconomic factors during the post-COVID-19 recovery period. Employing a time series linear model (TSLM) with monthly data from January 2019 to March 2024, we investigate the relationship between sukuk outstanding and inflation (Consumer Price Index), controlling for industrial production, exchange rate, interest rate, and Composite Leading Indicator (CLI). Results reveal a significant positive relationship between sukuk and inflation, suggesting that increased sukuk outstanding is associated with higher inflation rates. This finding contributes to the existing literature by providing empirical evidence of the inflationary impact of sukuk in Indonesia, especially in the context of post-pandemic recovery. The study also identifies significant positive relationships between inflation and interest rate, as well as inflation and CLI, highlighting their roles in driving inflation. While the exchange rate also exhibits a positive relationship with inflation, industrial production shows a negative association, suggesting a potential dampening effect on inflation. The model demonstrates strong explanatory power, with an adjusted R-squared of 0.9818, indicating that the included variables effectively capture the variation in inflation. These findings offer valuable insights for policymakers in formulating effective inflation management strategies and ensuring macroeconomic stability in Indonesia's post-pandemic recovery.

Keywords

Islamic Economic Development; Islamic Finance; Macroeconomic Policy

Corresponding Author

Laila M. Pimada

Universitas Brawijaya, Indonesia; lailapimada@ub.ac.id

1. INTRODUCTION

The COVID-19 outbreak triggered an unavoidable global economic downturn. In the initial stages of the pandemic, Indonesia experienced a decline in economic growth and inflation, coupled with increased unemployment (Istiyani et al., 2023; Pimada, 2021; Usman et al., 2023), liquidity issues, and a decline in performance of the banking industry (Miranti et al., 2022; Siregar et al., 2021; Wang et al., 2023). The National Economic Recovery Program (PEN) initiated by the government and Bank Indonesia yielded some progress. 2022, economic growth rebounded to 5.4%, and the unemployment rate decreased by 0.6% (The World Bank, 2022). However, inflation nearly tripled, rising from 1.86% to

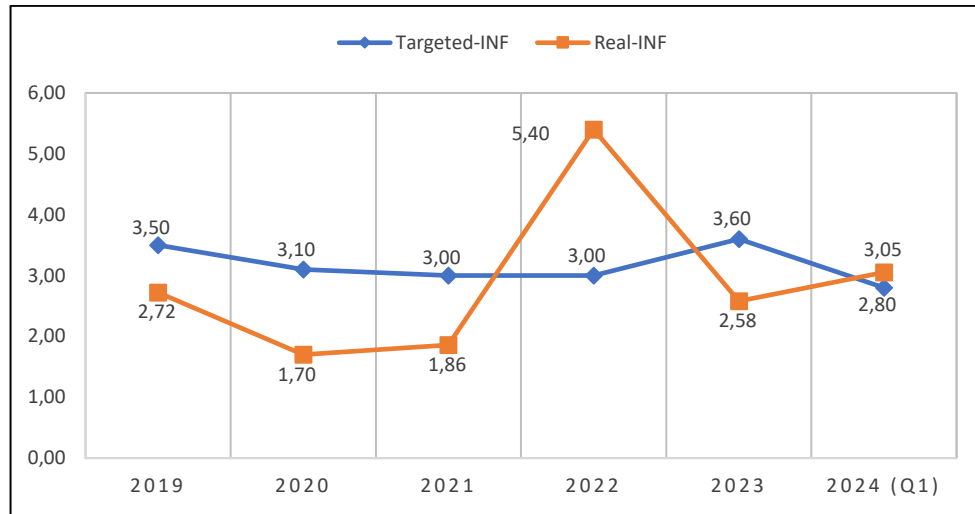


5.40% (BPS, 2023). The path to recovery has been further complicated by geopolitical tensions, disrupting global supply chains and driving up commodity prices (Abu-Sittah, 2020; Ahmad & Sahabuddin, 2023; Takavakoglou et al., 2022).

These challenges have presented significant obstacles for the Indonesian government in maintaining macroeconomic stability. Inflation, a key variable in this context, can balance price stability (Khan, 2023) and economic activity (Ajmal et al., 2021; Yang & Guo, 2021) when maintained at low levels. It is typically measured using various price indices such as the Consumer Price Index (CPI), Producer Price Index (PPI), and GDP deflator (Ha et al., 2019; Sajid et al., 2024). The stability of inflation is crucial for overall economic stability. John M. Keynes (1936) emphasized the role of aggregate demand in influencing economic growth and stability, advocating for expansionary fiscal policies during economic downturns to manage aggregate demand and maintain price stability (Asia Development Bank, 2020).

It also serves as a cornerstone for fiscal policy, informing the national budget formulation (Demir, 2023; Nauman, 2024; Ncanywa & Letsoalo, 2019). Furthermore, real inflation, as tracked by the consumer price index, acts as an anchor for setting targeted inflation, a fundamental basis for the central bank's monetary policy (Aginta & Someya, 2021; Baidoo & Yusif, 2019; Matthews & Ong, 2022). In contrast, monetarist economists like Milton Friedman (1977) posited that inflation is primarily a monetary phenomenon caused by excessive growth in the money supply. They emphasized the importance of controlling money supply through prudent monetary policy to ensure macroeconomic efficiency and political consensus (Granville, 2013; Hall et al., 2012). Duncan et al. (2019) research on the Phillips Curve in Kenya further underscores the significance of price stability for employment and economic growth, reinforcing the notion that inflation stability is a cornerstone of overall economic stability.

In recent years, Indonesia has experienced deviations between targeted and actual inflation rates (Figure 1). Between 2019 and 2021, and again in 2023, inflation underperformed relative to targets. This can weaken aggregate demand and delay business investment, potentially hindering overall economic growth (Atigala et al., 2022; Iefymenko et al., 2021). Conversely, inflation exceeding targets can erode purchasing power, increase interest rates, raise business costs, and exacerbate income inequality, ultimately disrupting overall economic stability (Bednarczyk & Brzozowska-Rup, 2019; Sanga et al., 2022; Zhang, 2021).

Picture 1. Targeted inflation vs real inflation (percentage)

Sources: Central Bureau of Statistics and State Budget Law (2018-2022)

The complexities arising from this gap between targeted and actual inflation underscore the need for policymakers to scrutinize the variables influencing inflation. Conventional and Islamic bonds (sukuk) can impact inflation through fiscal and monetary channels. Government bond issuance can finance budget deficits and facilitate fiscal stimulus (Nasir et al., 2020; Saungweme & Odhiambo, 2021). The relationship between sukuk (Islamic bonds) and inflation can be viewed through the role of sukuk as a monetary instrument. Central banks can utilize sukuk in open market operations to stabilize inflation expectations, signaling their commitment to price stability (Afonso & Jalles, 2019; Andolfatto & Spewak, 2018; Anwar & Okot, 2020; Islam, 2023; Matthews & Ong, 2022).

In some instances, governments may use debt monetization, where the central bank purchases government bonds, including sukuk, to finance public expenditure (Nasir et al., 2020). This practice, however, can increase the money supply and potentially fuel inflation (Bordo & Levy, 2021; Ybrayev, 2021). In corporate sukuk, issuance can provide business funding, support investment, and stimulate economic growth, which may impact inflation (Chun, 2024). However, sukuk issuance only sometimes directly increases the money supply. When used to refinance maturing debt or purchased by non-bank investors, it primarily involves the transfer of existing financial assets rather than creating new money, thus not necessarily leading to inflation.

Moreover, despite the significant role of both bond types in macroeconomic policy, sukuk offers distinct advantages over conventional bonds. Sukuk demonstrates lower risk and volatility, providing superior risk-adjusted returns for investors (Amin et al., 2022; Mezghani & Abbes, 2023; Owusu, 2022; Yusof et al., 2018). However, empirical evidence on the impact of Sukuk on macroeconomic variables remains limited. While some studies have found a significant effect of sukuk on economic growth (Ledhem, 2022; Metoui & Ghorbel, 2023; Mitsaliyandito et al., 2017; Sari & Widiyanti, 2018; Smaoui &

Nechi, 2017; Yildirim et al., 2020), research on their impact on inflation is scarce. Suriani et al. (2021), utilizing a monetary transmission approach through asset prices and exchange rates, found that sukuk directly affects exchange rates but not inflation.

Given this evidence gap, this study aims to examine the impact of sukuk on inflation in Indonesia over the past five years, employing a Time Series Linear Model Analysis (TSLM) to understand the dynamic interaction between sukuk and inflation. This research contributes to the existing literature on the relationship between sukuk and macroeconomic variables. Ultimately, the findings will inform policymakers in formulating accurate annual inflation targets, minimizing deviations in actual inflation, and maintaining Indonesia's economic stability.

2. METHODS

This study employs a quantitative approach, utilizing secondary data sourced from reputable platforms such as the Indonesia Stock Exchange (IDX), Statistics Indonesia (BPS), the World Bank, and the Organization for Economic Cooperation and Development (OECD) database. The dataset spans from January 2019 to March 2024, encompassing 63 monthly observations. Inflation, proxied by the Consumer Price Index (CPI), is the dependent variable, while outstanding sukuk is the independent variable. To account for potential confounding factors, the study incorporates several control variables: industrial production, exchange rate, interest rate, and the Composite Leading Indicator (CLI). The time series linear model (TSLM) is chosen as the primary analytical tool due to its suitability for analyzing relationships between variables over time (Scott, 2022). TSLM effectively accounts for autocorrelations and trends inherent in time series data (Hyndman, 2024), yielding more accurate and reliable estimates than traditional regression models.

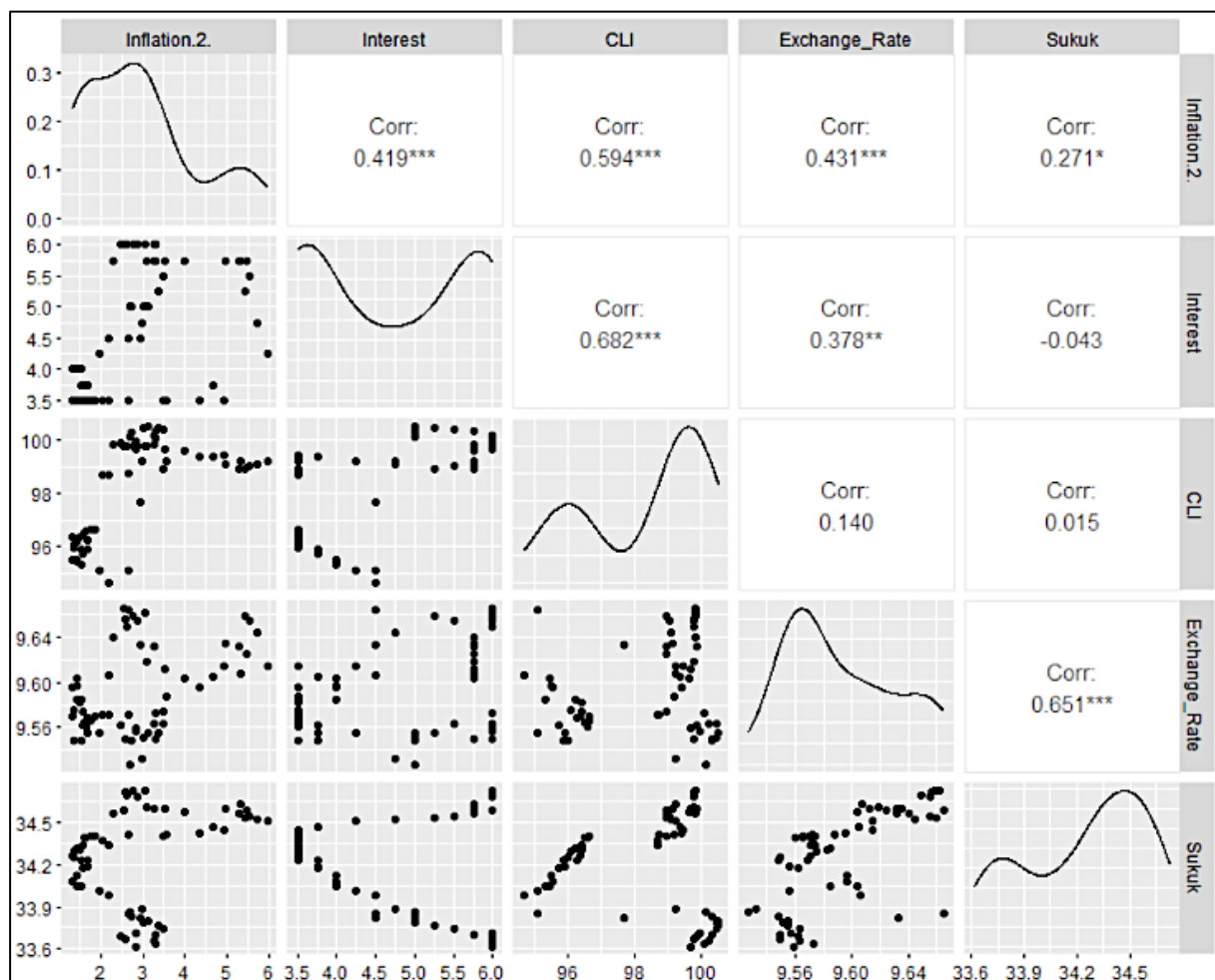
The analysis was conducted in several stages. A Pearson correlation analysis was initially performed to identify preliminary relationships between the variables. Subsequently, time series regression analysis was employed to test the research hypotheses. The time series regression utilized the TSLM (Time Series Linear Model) function available in the "dplyr" and "tseries" packages within the R software environment. To ensure the validity and unbiasedness of the estimated parameters, classical assumption tests were conducted, including tests for autocorrelation, multicollinearity, and normality. These tests are essential to ascertain the reliability of the model and the accuracy of the inferences drawn from it. Finally, based on the established model, ARIMA (Autoregressive Integrated Moving Average) forecasting was utilized to predict future inflation trends. This forecasting technique leverages the patterns and relationships in the time series data to project the future inflation trajectory, providing valuable insights for policymakers and stakeholders.

3. FINDINGS AND DISCUSSION

3.1. Pearson Correlation Result

The Pearson correlation (r) analysis was conducted to identify potential relationships between the variables included in the model. This analysis focused on measuring the strength and direction of the linear relationship between the outstanding sukuk variable, the Consumer Price Index (CPI), and the control variables. The analysis revealed a significant positive correlation between the CPI and interest rates ($r = 0.594$; $p\text{-value} < 0,001$), as well as between the CPI and the Composite Leading Indicator (CLI) ($r = 0.431$; $p\text{-value} < 0,001$). This indicates that increases in interest rates and CLI tend to be followed by a rise in the CPI.

Picture 2. The Pearson's Correlation Test Result



Furthermore, a moderate positive correlation of 0.271 was observed between the CPI and outstanding sukuk, suggesting a positive association, although not as strong as the relationship between interest rates and CLI. In contrast, the correlation between the CPI and exchange rates was relatively weak ($r = 0.140$; $p\text{-value} > 1$), as was the correlation between the CPI and industrial production (0.043;

p-value > 1). This implies that increases in the CPI are not necessarily associated with increases in exchange rates or industrial production. These initial findings provide a preliminary understanding of the relationships between the variables under investigation and will serve as a foundation for further analysis using a time series linear model.

3.2. Hypotheses Testing Results

Hypothesis testing was conducted to validate the research findings and ensure they were not merely random fluctuations in the data. The Time-Series Linear Model (TSLM) estimation results (Table 1) revealed that sukuk significantly influences the Consumer Price Index (CPI) at a 1% significance level, as evidenced by the very small p-value (<2e-16). The positive coefficient of Sukuk (16.5004) indicates that an increase in outstanding sukuk tends to increase inflation. All control variables also significantly influenced the CPI at a 1% level, except for industrial production (IP), which was significant at the 5% level.

Table 1. Result Estimations of Time-Series Linear Model (TSLM)

Residuals:	Min	1Q	Median	3Q	Max
	-1.8205	-0.6399	0.1914	0.6851	1.8458
Coefficients:	Estimate	Std. Error	t value	Pr(> t)	VIF
(Intercept)	-691.2856	56.4113	-12.254	< 2e-16 ***	
Sukuk	16.5004	0.5329	30.963	< 2e-16 ***	2.356730
Interest	0.9689	0.1982	4.888	8.67e-06 ***	2.971797
CLI	0.7033	0.1178	5.972	1.60e-07 ***	3.328829
ER	39.2858	5.4976	7.146	1.82e-09 ***	3.226029
IP	-4.7310	2.0984	-2.255	0.028 *	2.777028

Multiple R-squared: 0.9833

Adjusted R-squared: 0.9818

F-statistic: 670.1 on 5 and 57 df, p-value: < 2.2e-16

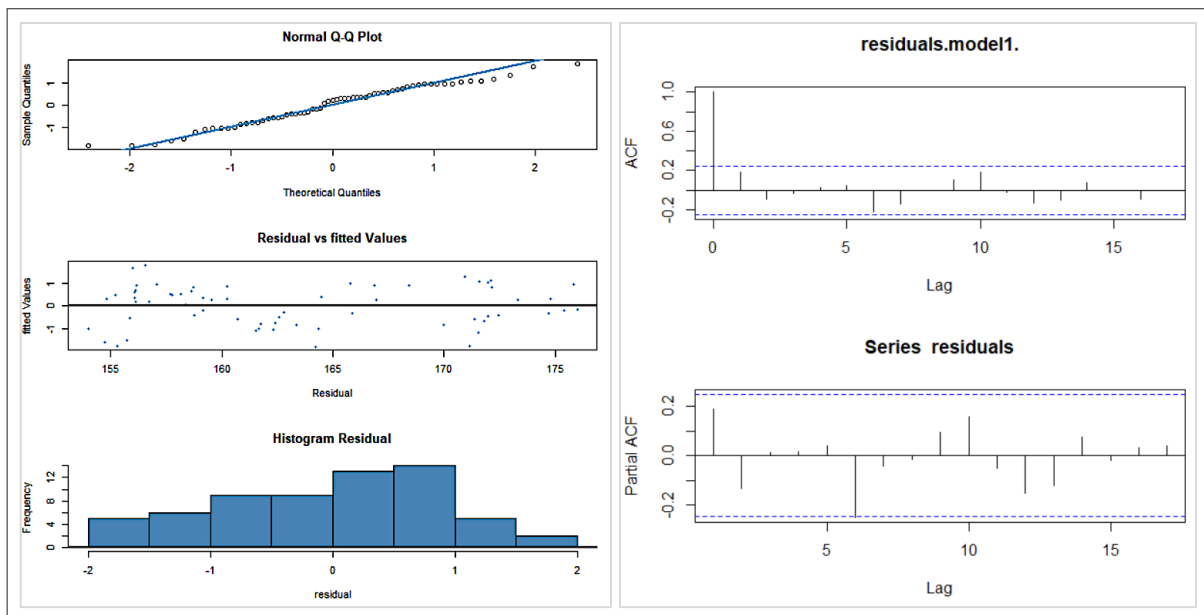
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Positive coefficients for interest rates (0.9689) and CLI (0.7033) indicate that increases in these variables lead to higher CPI. Similarly, the positive coefficient for the exchange rate (39.2858) suggests that depreciation of the Indonesian Rupiah against foreign currencies tends to increase inflation. In contrast, the negative coefficient for IP (-4.7310) implies that increased industrial production tends to decrease inflation. The model demonstrates a strong explanatory power, with an R-squared of 0.9833, indicating that the variables in the model can explain 98.33% of the variation in CPI.

3.3. The Result of the Classical Assumption Test

Classical assumption tests were conducted to ensure the validity of the estimation results. The normal Q-Q plot (Figure 3) revealed that the model residuals were not perfectly normally distributed, exhibiting slightly heavier tails. However, this deviation was minor, with most data points aligning with the diagonal line. Additionally, the Residual vs Fitted Values plot showed a random scatter of residuals around zero, and the residual histogram displayed a relatively symmetrical distribution, thus satisfying the normality assumption.

Picture 3. The normality and autocorrelation test results



The autocorrelation test, utilizing the Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) plots (Figure 3), indicated no significant autocorrelation in the model residuals. The absence of significant lags exceeding the confidence bounds in both plots confirms the validity of this study's time series linear model. Furthermore, the Variance Inflation Factor (VIF) analysis (Table 1) indicated no multicollinearity issues among the variables. All VIF values were below the commonly accepted thresholds (5-10), with the highest value being 3.328829 for the CLI variable, suggesting that each independent variable contributes unique information to the model

3.4. ARIMA Forecasting Result: Inflation

The Autoregressive Integrated Moving Average (ARIMA) forecasting projects a stable upward trend in Indonesia's CPI, or inflation, over the next year. Table 2 reveals that the CPI is expected to gradually increase from late 2024 to early 2025, with an average monthly increase of 0.2%. This forecast suggests that inflationary pressures will persist in the short term.

Table 2. The Forecasting Result of the Consumer Price Index (Inflation)

Month, Year	Point Forecast	Lo (95%)	Hi (95%)
Apr 2024	177.1496	176.2847	178.0144
Mei 2024	177.5337	176.3106	178.7568
Jun 2024	177.9178	176.4198	179.4157
Jul 2024	178.3019	176.5722	180.0316
Aug 2024	178.686	176.7521	180.6198
Sep 2024	179.0701	176.9516	181.1885
Okt 2024	179.4541	177.166	181.7423
Nov 2024	179.8382	177.3921	182.2844
Des 2024	180.2223	177.6278	182.8169
Jan 2025	180.6064	177.8715	183.3413
Feb 2025	180.9905	178.1221	183.8589
Mar 2025	181.3746	178.3787	184.3705

Sukuk, the most active Islamic financial instrument in the debt market, plays a significant fiscal and monetary role. This study found a consistent and significant positive effect of outstanding sukuk on the Consumer Price Index (CPI), indicating that an increase in sukuk is associated with a corresponding rise in inflation. This result contradicts Suriani et al. (2021) findings, which suggested no direct impact of sukuk on inflation. The inclusion of control variables from various sectors, including industrial production (real sector), exchange rate and interest rates (monetary sector), and the Composite Leading Indicator (CLI), which combines both sectors, enhances the reliability of this study's results with a low margin of error (Table 1).

In the fiscal context, during the study period, the government implemented numerous expansionary fiscal policies in response to the COVID-19 pandemic. These policies focused on managing the state budget by increasing spending, reducing state revenue, and implementing supporting policies. On the expenditure side, the Indonesian government prioritized health spending, social protection, incentives for Micro, Small, and Medium Enterprises (MSMEs), and fiscal stimulus. On the revenue side, the government provided tax incentives and delayed tax payments (Citra et al., 2022; Mukaromah, 2023; Prasasti et al., 2020; Syahputri et al., 2021). These policies were further supported by legislation governing the state budget during the pandemic (Law Number 2 of 2020).

The regulation allowing a state budget deficit of more than 3 percent of the Gross Domestic Product (GDP) necessitated additional financing sources, one of which was obtained from bonds. In response, Bank Indonesia, as the central bank, acted as a lender of last resort and purchased government bonds (both conventional and Sharia-compliant) in the primary and secondary markets (Masitoh & Perwitasari, 2024; Wiguna & Yulastuti, 2020). By 2024, Bank Indonesia's ownership of government

bonds reached 23.22% (Purnama, 2024). Bank Indonesia's role directly impacts increasing the money supply, making inflation difficult to avoid (Kurniawan, 2023).

These policies were necessary to respond to the COVID-19 pandemic. Furthermore, the pressure of global economic uncertainty arising from various geopolitical issues also contributed to increased inflation through supply chain disruptions and rising commodity prices (Ahmed & Sarkodie, 2021; Ma et al., 2021; Maurya et al., 2023). The government has implemented policy harmonization through reducing fiscal stimulus, structural reforms through the Omnibus Law on Job Creation and the Financial Sector Development and Strengthening Law (P2SK), industrial downstream, and green economic development. Meanwhile, in the monetary sector, Bank Indonesia has gradually raised interest rates, intervened in the foreign exchange market to maintain the stability of the rupiah, and tightened macroprudential policies. The success of this policy combination still needs to be analyzed, given that the inflation forecast is expected to continue to increase, at least in the coming year.

4. CONCLUSION

This study reveals a significant positive relationship between outstanding sukuk and inflation in Indonesia, particularly in the context of the post-COVID-19 economic recovery. The increase in outstanding sukuk is proven to increase inflation, aligning with the concept that issuing sukuk to finance budget deficits and purchases by the central bank can increase the money supply and trigger inflation expectations. This result provides valuable empirical evidence for policymakers to understand inflation dynamics and formulate effective inflation management strategies such as diversifying funding resources with more schemes of Sukuk, targeting the issuance of Sukuk, developing inflation-linked Sukuk, and enhancing transparency and communication regarding sukuk issuance and its potential impact on inflation to manage market expectations and maintain investor confidence.

Expansionary fiscal policies during the pandemic, including Bank Indonesia's role in purchasing government bonds, further strengthened the positive relationship between sukuk and inflation. Additionally, global economic uncertainty contributes to inflationary pressures. Although the government and Bank Indonesia have harmonized policies to address the impact of the pandemic and global uncertainty, forecasts indicate that inflation is expected to continue rising in the short term. Therefore, further attention from policymakers is needed to formulate more accurate annual inflation targets, manage inflation risks, and maintain Indonesia's macroeconomic stability. This study contributes to the growing literature on Islamic development economics and finance. However, further research is needed to explore the long-term implications of Sukuk issuance on inflation and to investigate the effectiveness of different policy measures in mitigating its potential inflationary impact.

Additionally, future research could examine the impact of different types of sukuk, such as green sukuk or sustainability sukuk, on inflation and other macroeconomic variables.

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