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The profitability of Indonesian infrastructure companies amid COVID-19: Quantile regression for stability testing

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Abstract: The COVID-19 pandemic has significantly impacted the global economy, including Indonesia, adversely affecting financial performance, particularly profitability, in sectors such as infrastructure, which are highly sensitive to macroeconomic conditions. This study aims to examine the profitability of Indonesian infrastructure companies during the COVID-19 crisis period. Using annual GDP growth (GDPG) as a proxy for macroeconomic conditions and return on assets (ROA) as a measure of profitability, the study incorporates control variables in an empirical model. A sample of 41 companies was selected through purposive sampling, and Quantile Regression was employed to test stability across various quantile distributions of the endogenous variable. The findings reveal that infrastructure companies experienced a decline in profitability during the crisis years of 2020 and 2021 compared to the pre-crisis period, with profitability improving in 2022 as GDP growth rebounded. Robustness checks confirm consistent results across quantiles 0.1 to 0.7, indicating stability in low (τ = 0.1–0.3) and medium (τ = 0.4–0.6) profitability levels. However, the relationship was unstable at higher quantiles (τ = 0.7–0.9), with significant effects observed only at τ = 0.7. These empirical findings suggest managerial implications for corporate executives and financial decision-makers within Indonesian infrastructure companies, emphasizing the need for operational strategy adaptations, including cash flow efficiency, revenue diversification, and risk mitigation, to navigate macroeconomic dynamics and capitalize on economic recovery opportunities.

Keywords: Crisis; COVID-19 Pandemic; Profitability; Indonesian Infrastructure Companies; Quantile Regression

JEL Classification: C31; G01; G30

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Introduction

The COVID-19 pandemic has triggered an unprecedented global economic shock, with widespread repercussions across various sectors and regions (Naseer et al., 2023). Declines in economic activity, driven by social restrictions, supply chain disruptions, and reduced aggregate demand, have resulted in a substantial contraction in GDP, marking it as one of the most severe economic crises in recent decades (Goel et al., 2021). Compared to the 2008 global financial crisis or the 1997-1998 Asian financial crisis, this pandemic is unique in nature, as it

simultaneously combines a health crisis with economic disruptions on both demand and supply sides (Miklian & Hoelscher, 2022). The cascading effects of GDP contraction have not only undermined macroeconomic performance but also exerted significant pressure on critical sectors such as infrastructure, which serves as a cornerstone for post-pandemic economic recovery (Samba & Abraham, 2022).

The economic impact of the COVID-19 pandemic, while distinct in nature, is comparable to the 2008 global financial crisis and the 1997-1998 Asian financial crisis, both of which highlighted the systemic effects of macroeconomic shocks on strategic sectors (Arner et al., 2022). The 1997-1998 crisis was characterized by the collapse of currency values and financial systems across several Asian countries, while the 2008 crisis stemmed from the failure of global financial institutions due to exposure to risky assets (Corsetti et al., 1999; Yeoh, 2010). In contrast, the COVID-19 pandemic introduced a unique challenge by simultaneously disrupting demand and supply, severely affecting global supply chains, and abruptly halting economic activity (Strange, 2020). Within this context, the infrastructure sector assumes a pivotal role as a primary driver of economic development and connectivity. Robust infrastructure not only facilitates business and trade activities but also serves as the cornerstone of economic recovery strategies in Indonesia by creating employment opportunities, enhancing productivity, and accelerating post-crisis economic growth (Ssenyonga, 2021).

Assessing the impact of macroeconomic shocks—specifically the decline in GDP during the COVID-19 pandemic—on the profitability of infrastructure companies is crucial, as this sector serves as a foundational pillar for long-term economic sustainability (Soto et al., 2021). A downturn in GDP indicates a contraction in overall economic activity, which can directly affect the revenues of infrastructure firms through decreased demand for new projects, postponements of both public and private investments, and heightened operational costs due to supply chain disruptions (Bennett, 2018; Zhu et al., 2020). Before the pandemic, Indonesia's GDP growth was steady at 5.02% in 2019, but it sharply declined to -2.07% in 2020, reflecting the severe consequences of social restrictions and global economic upheaval (Tinungki, Robiyanto, et al., 2022). A gradual recovery became evident in 2021 with GDP growth reaching 3.69%, increasing further to 5.31% in 2022 (Hartono, Robiyanto, et al., 2024), although the infrastructure sector continued to grapple with project delays and persistent financial pressures. An in-depth examination of these impacts is urgently needed to formulate robust risk mitigation strategies, ensure the sustainability of the infrastructure sector, and reinforce the foundations of the national economic recovery.

Numerous studies have explored the financial performance of companies affected by the COVID-19 pandemic. Purwanto et al. (2020) reported significant challenges in Indonesia, including declining sales, reduced production capacity, disruptions in distribution channels, and operational constraints such as reduced workforce hours, lower employee wages, and shift adjustments due to workforce restrictions. Devi et al. (2020) identified that, across publicly listed companies, there was an increase in debt levels and short-term activity ratios, while liquidity and profitability experienced a decline. Although no significant differences were observed in liquidity and leverage ratios, notable disparities

were found in profitability and short-term activity ratios between the periods before and during the pandemic. The consumer goods sector demonstrated improvements in liquidity, profitability, and short-term activity ratios, albeit with a reduction in leverage. In contrast, sectors such as property, agriculture, construction, finance, trade, services, and investment exhibited declines in both liquidity and profitability metrics.

Similarly, Anafia & Ulpah (2021) identified that COVID-19 had a detrimental impact on the performance of companies in Indonesia within the automotive trade, transportation and logistics, and construction sectors, although it positively affected the healthcare sector. Additionally, Sutrisno et al. (2020) reported that Islamic banking in Indonesia experienced a negative impact on profitability due to the pandemic, particularly reflected in declines in return on equity (ROE), net operating margin (NOM), and the financing-to-deposit ratio. Furthermore, Simanjuntak (2023) conducted a comprehensive study examining the effects of the COVID-19 crisis on profitability using causality tests. The analysis focused on return on assets (ROA) and return on equity (ROE), demonstrating that these profitability measures were influenced by the crisis through GDP growth metrics and dummy variables, specifically targeting real estate and property companies in Indonesia.

Although numerous studies have examined the impact of the COVID-19 pandemic on global and national economies, empirical research specifically focusing on Indonesia's infrastructure sector remains scarce. Previous studies suggest that the pandemic's effects on corporate profitability are heterogeneous, varying across sectors and company characteristics. To address this gap, the present study focuses on the infrastructure sector, which is pivotal for Indonesia's economic development. Unlike prior research that predominantly employs aggregate analysis, this study adopts a Quantile Regression approach to capture the heterogeneous impact of the COVID-19 crisis on infrastructure companies with varying levels of profitability. This method facilitates a deeper analysis, not only assessing average effects but also understanding how the crisis influences firms with low, medium, and high profitability levels (Linggadjaya et al., 2024; Thakur & Kannadhasan, 2018). Consequently, the study aims to provide a comprehensive perspective on the stability of infrastructure sector profitability across quantiles amidst macroeconomic shocks.

This study aims to examine the causal relationship between GDP growth, as a representation of the COVID-19 crisis's impact, on the profitability of infrastructure companies in Indonesia. GDP growth, as a fundamental indicator of macroeconomic dynamics, reflects changes in economic activity that significantly influence corporate financial performance, particularly in the infrastructure sector, which plays a strategic role in supporting national development (Hartono, Tinungki, et al., 2024; Tinungki, Hartono, et al., 2022). Additionally, the study employs Quantile Regression to assess the stability of this relationship across different levels of corporate profitability. This approach enables the identification of variations in firms' sensitivity to GDP contraction, revealing whether companies with lower profitability are more vulnerable compared to those with medium or high profitability.

The study contributes to the literature in several crucial ways. First, it enriches existing research on the effects of macroeconomic shocks on the profitability of Indonesia's infrastructure sector, a critical area that has been relatively underexplored. Second, by employing the Quantile Regression approach, this research captures the heterogeneous impact of GDP growth on firm profitability, providing deeper insights than traditional modelling methods. These findings offer a more comprehensive understanding of how infrastructure firms with varying profitability levels respond to economic crises, particularly within the context of the COVID-19 pandemic.

The COVID-19 Crisis from the Perspective of Gross Domestic Product

The COVID-19 crisis can be defined as an economic shock triggered by the global pandemic, significantly impacting national economic growth in Indonesia (Tinungki, Hartono, et al., 2022). In macroeconomic terms, this crisis is reflected through a sharp decline in Gross Domestic Product (GDP), a primary indicator of economic activity levels (Welfens, 2020). GDP growth measures the rate of economic change from one period to another, encompassing contributions from household consumption, investment, government expenditure, and international trade (Watanabe et al., 2018). In 2020, Indonesia recorded a GDP contraction of -2.07%, a drastic decline compared to the positive growth rate of 5.02% in 2019. This downturn underscores the direct impact of the pandemic on various economic sectors, including weakened domestic consumption, disrupted investment flows, and diminished export and import performance (Hartono & Raya, 2022).

GDP growth serves as a quantitative framework to evaluate the impact of the COVID-19 crisis on overall economic stability (Liu et al., 2020). In Indonesia, the contraction of GDP during the pandemic reflects a substantial decline in domestic consumption, driven by the implementation of large-scale social restrictions (PSBB) and heightened economic uncertainty (Olivia et al., 2020). Furthermore, the reduction in investment activity indicates diminished market confidence, with numerous businesses delaying or cancelling expansion plans due to increased risks. Additionally, disruptions in global supply chains exacerbated the performance of exports and imports, further pressuring GDP. Thus, GDP growth functions as a comprehensive aggregate indicator, capturing the cumulative impact of various economic stresses experienced during the COVID-19 pandemic (Halimatussadiah et al., 2020).

In recent economic literature, GDP growth is frequently employed to assess the impact of economic crises on a national scale (Dijkstra et al., 2014). During the COVID-19 pandemic, fluctuations in GDP growth reflect the intricate dynamics of a recession, including uneven patterns of economic decline and recovery across various sectors (Jomo & Chowdhury, 2020). This indicator is also critical for understanding both the short-term and long-term consequences of crises, particularly in identifying a nation’s resilience to external shocks (Alessi et al., 2020). By utilizing GDP growth as a measurement variable, analyses can provide more precise evaluations of the pandemic's effects on the overall economy, enabling a more comprehensive understanding of its impact (Simanjuntak, 2023).

Profitability: Measurement Through Return on Assets

Profitability refers to a company's ability to generate profits from its operational activities over a specific period, reflecting the efficiency and effectiveness of resource management (Kamasak, 2017). In corporate finance, profitability is considered a key indicator for evaluating a firm's financial performance and competitiveness in the market (Jordão & de Almeida, 2017). Generally, profitability is assessed using various financial ratios, such as Return on Assets (ROA), Return on Equity (ROE), and Net Profit Margin (NPM), each offering a distinct perspective on financial performance. ROA, in particular, measures the extent to which a firm can generate net income relative to its total assets, serving as a critical metric for analysing asset utilization efficiency (Zutter & Smart, 2019).

In the context of profitability measurement, Return on Assets (ROA) is one of the most commonly employed indicators, offering insights into a company's efficiency in utilizing its assets to generate profits. ROA is calculated by dividing net income by total assets, with the result typically expressed as a percentage. This ratio is widely applicable across various types of companies, as it reflects management's ability to optimize the use of physical and financial resources to create economic value (Kamasak, 2017). A higher ROA indicates greater efficiency in generating profits from the assets available, whereas a lower ROA suggests that the company's assets are underutilized or inefficiently managed (Alarussi & Alhaderi, 2018).

In Indonesia, Return on Assets (ROA) is widely utilized by financial analysts, investors, and regulators to assess the performance of companies listed on the Indonesia Stock Exchange (IDX) (Sari & Endri, 2019). This indicator provides critical insights into a company's operational sustainability, particularly when addressing external challenges such as economic fluctuations or regulatory changes (Whetman, 2017). Empirical studies frequently employ ROA as a proxy for profitability, as it encompasses net income while also accounting for the scale of a company's assets, offering a more comprehensive evaluation of financial performance (Jordão & de Almeida, 2017). Furthermore, ROA serves as a versatile analytical tool, enabling comparisons across companies with varying asset sizes, making it one of the most extensively used metrics in financial literature (Lassala et al., 2017).

Hypothesis Development

The COVID-19 crisis has caused significant disruptions to the global economy, reflected most notably in the decline of Gross Domestic Product (GDP) growth (Usman et al., 2024). Within economic literature, GDP is often used as a comprehensive indicator to represent a nation's economic activity, encompassing consumption, investment, government expenditure, and international trade (Dijkstra et al., 2014). A decline in GDP during the COVID-19 crisis indicates contractions in these components, subsequently diminishing companies' ability to sustain revenues and operational efficiency (Song & Zhou, 2020). Corporate profitability, frequently measured by ratios such as Return on Assets (ROA), serves as a primary metric for evaluating financial performance (Zutter & Smart, 2019). As GDP decreases, aggregate demand weakens, corporate revenues are pressured, and

the challenge of covering fixed costs intensifies, leading to a decline in profitability (Tomkiewicz, 2017).

In the infrastructure sector, the adverse effects of GDP contraction on corporate profitability are often more pronounced due to the sector's inherent characteristics, which involve substantial investments and long project payback periods. A decrease in GDP tends to reduce both public and private investments, which are primary funding sources for infrastructure projects (Tan & Zhao, 2019). Furthermore, reduced economic activity can slow project progress, elevate the risk of delays, and escalate project costs due to inefficiencies (Agyekum-Mensah & Knight, 2017). For instance, during periods of economic downturn, such as the COVID-19 crisis, reduced demand for transportation or energy facilities leads to a corresponding decline in revenue generated from infrastructure assets (Zakeri et al., 2022). This scenario exacerbates profitability margins, particularly for companies with high fixed-cost structures (Simanjuntak, 2023).

Moreover, a decline in GDP is often accompanied by heightened economic uncertainty, which can significantly impair the ability of infrastructure companies to secure new financing at competitive rates (Hoang et al., 2021). As macroeconomic conditions deteriorate, corporate cash flow pressures intensify, while investors and lenders adopt a more selective approach to funding projects with elevated risk levels (Alter & Elekdag, 2020). Consequently, the contraction in GDP during the COVID-19 crisis directly contributes to reduced profitability for infrastructure companies, driven by declining revenues and rising operational and financing costs (Didier et al., 2021). This observation aligns with arguments suggesting that GDP contraction exerts a broadly negative impact on corporate financial performance, particularly in sectors heavily reliant on macroeconomic stability.

Several prior studies have demonstrated the influence of GDP on profitability across various sectors. Ali et al. (2018) found a positive relationship between GDP and profitability, as measured by Return on Assets (ROA), in Sharia banking in Brunei Darussalam. Similarly, Yüksel et al. (2018) revealed a positive impact of GDP on banking profitability in post-Soviet countries. Fidanoski et al. (2018) provided further evidence of GDP's positive influence on the profitability of Croatian banks. Supporting these findings, Berhe & Kaur (2017) established that GDP positively affects the profitability of insurance companies in Ethiopia. Focusing on the context of the COVID-19 crisis, Simanjuntak (2023) demonstrated a positive relationship between GDP growth, used as a proxy for crisis variables, and the profitability of real estate and property companies in Indonesia. Building upon this rational foundation and empirical evidence, the hypotheses for this study are formulated as follows:

***H_0**: Annual GDP growth negatively affects profitability, or Annual GDP growth has no effect on profitability.*

***H_a**: Annual GDP growth positively affects profitability.*

Research Method

This study adopts a quantitative approach to test the formulated hypotheses. The hypothesis testing is conducted by examining the causal relationship between the COVID-19 crisis, measured through annual GDP growth, and profitability. The research period spans from 2018 to 2022, with the crisis period defined as 2020 and 2021, the pre-crisis period covering 2018 and 2019 (Hartono, Robiyanto, et al., 2024; Usman et al., 2024), and the post-crisis period identified as 2022 to assess the consistency of results across varying levels of annual GDP growth. The research population includes all infrastructure companies listed on the Indonesia Stock Exchange (IDX). The sample is selected using purposive sampling (Sekaran & Bougie, 2016) based on the following criteria: (1) the company must be listed under the infrastructure sector on the IDX; (2) it must have complete annual financial reports for the specified research period; (3) it must report the primary research variables; and (4) it must not have undergone delisting or an initial public offering (IPO) on the IDX during the research period. Out of the total population of 50 infrastructure companies listed on the IDX as of 2022, 41 companies met these criteria and were selected as the sample. Consequently, with 41 sampled companies over the 2018–2022 research period, the study comprises 205 panel data observations (Biørn, 2017).

Table 1 Variable and Measurement

Variable	Measurement	Formulation	Source
Profitability	Return on Assets (ROA)	$ROA = \frac{Earnings\ Available\ for\ Common\ Stock}{Total\ Asset}$	(Azhar & Ahmed, 2019; Saif-Alyousfi, 2022; Srbinoska, 2018; Tinungki et al., 2024; Warae et al., 2024).
Economic Growth	Annual Gross Domestic Product Growth (GDPG)	$GDPG = \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}}$	(Hartono, Robiyanto, et al., 2024; Hartono, Tinungki, et al., 2023; Santosa et al., 2023; Simanjuntak, 2023; Tinungki et al., 2025; Usman et al., 2024).
Liquidity	Current Ratio (CR)	$CR = \frac{Current\ Asset}{Current\ Liability}$	(Hartono et al., 2020; Hartono & Matusin, 2020; Hartono & Robiyanto, 2023; Srbinoska, 2018; Warae et al., 2024).
Leverage	Debt to Equity Ratio (DER)	$DER = \frac{Total\ Liability}{Total\ Equity}$	(Hartono, Robiyanto, et al., 2024; Hartono, Wijaya, et al., 2023; Hartono & Matusin, 2020; Tinungki et al., 2025; Warae et al., 2024).
Company Size	Total Asset (TA)	$TA = log(total\ assets)$	(Azhar & Ahmed, 2019; Hartono, Robiyanto, et al., 2024; Hartono, Tinungki, et al., 2023; Muchtar et al., 2020; Saif-Alyousfi, 2022; Tinungki et al., 2025).

The primary variables in this study are the COVID-19 crisis as the exogenous variable and profitability as the endogenous variable. The first robustness check incorporates control variables to test the consistency of the main variables within the complexity of the

empirical model. The selection of control variables is grounded in their hypothesized impact on the endogenous variable (Lu & White, 2014; Tinungki, Hartono, et al., 2022). The control variables included in the empirical model are liquidity, leverage, and firm size, as supported by empirical findings from studies conducted by Alarussi & Alhaderi (2018), Alarussi & Gao (2021), Alexander & Minnema (2018), Atmaja & Usman (2023), Ebimobowei et al. (2021), Hartono et al. (2020), Kanakriyah (2020), Wulandari, 2021, as well as by Yuliastuti & Merawati (2022).The measurements of the primary and control variables are detailed in Table 1.

This study employs Quantile Regression estimation as the primary analytical tool to evaluate the impact of the COVID-19 crisis, measured through GDP growth (GDPG), on the profitability (ROA) of infrastructure companies in Indonesia. Quantile Regression is selected due to its capability to analyze the heterogeneous effects of exogenous variables across different levels of the endogenous variable's distribution, offering a more comprehensive analysis compared to classical regression models (Wüthrich, 2020). The empirical econometric model is formulated as follows:

$$Q_{ROA_{i,t},(\tau)} = \beta_0 + \beta_{1(\tau)}GDPG_{i,t} + \beta_{2(\tau)}CR_{i,t} + \beta_{3(\tau)}DER_{i,t} + \beta_{4(\tau)}TA_{i,t} + \varepsilon_{(\tau)}$$

Where, $Q_{ROA_{i,t},(\tau)}$: Quantile τ of the conditional distribution of ROA for company i in year t; β_0: Constant term at quantile-τ; $GDPG_{i,t}$: GDP growth for all companies i in year t; $CR_{i,t}$: Current ratio for company i in year t; $DER_{i,t}$: Debt-to-equity ratio for company i in year t; $TA_{i,t}$: Total assets for company i in year t; $\beta_{n(\tau)}$: Vector of coefficients for predictor variables in the regression model at quantile τ; $\varepsilon_{(\tau)}$: Error term specific to quantile τ; $\tau = 0.1, 0.2, 0.3, \dots, 0.8, 0.9; n = 1, 2, 3, 4$.

In this quantile regression estimation, model specification tests are conducted. First, the Slope Equality Test is employed to evaluate the heterogeneity of the effects of independent variables across the distribution of the dependent variable. Second, the Symmetric Quantiles Test is utilized to determine whether the effects of the independent variables are symmetric around the median of the dependent variable's distribution (Waldmann, 2018). Parameter significance is assessed using the Quasi-Likelihood Ratio Test to examine the model's coefficient of determination and the Adjusted Pseudo R-squared for the simultaneous test of the model. Furthermore, partial tests are performed to evaluate the significance of predictor variables on the criterion, particularly in testing the research hypotheses (Huang et al., 2017). Data processing for this study was conducted using EViews version 10 software.

Subsequently, the second robustness check is performed using Quantile Process Estimates across various quantile levels to evaluate the relationship pattern between independent and dependent variables throughout the data distribution, rather than focusing solely on specific points such as the median or mean (Papacharalampous et al., 2019). This approach facilitates the examination of consistency and stability in the estimated parameters, $\beta_{n(\tau)}$, across different levels of the dependent variable's distribution (Benoit & Poel, 2017). As a robustness check, this method helps identify whether the relationship between exogenous and endogenous variables varies

significantly across quantiles or remains consistent (Kaplan & Sun, 2017; Lu & White, 2014). Significant changes in parameters at certain quantiles may indicate heterogeneity in effects or differing sensitivities among groups of the endogenous variable (Fitzenberger et al., 2022). By plotting parameter estimates against quantiles and comparing them with confidence intervals, quantile process estimates can reveal the stability of the model and determine whether the primary exogenous variable's influence is robust or susceptible to variations in the data distribution.

Result and Discussion

The descriptive statistical analysis for each variable is presented in Table 2. The average value of return on assets (ROA), as the criterion variable, indicates a negative mean, reflecting that the observed firms on average incurred net losses from asset utilization. The minimum value for GDP growth (GDPG), which is also negative, illustrates the contraction of GDP during the COVID-19 crisis, particularly in 2020 in Indonesia. Similarly, the negative minimum value of the debt-to-equity ratio (DER) highlights that certain firms experienced extreme levels of debt surpassing their equity during specific periods. Additionally, ROA, current ratio (CR), and DER exhibit overdispersion, whereas GDPG and total assets (TA) are equidispersed (Hartono et al., 2021). These findings underscore the high degree of heterogeneity in the data. Furthermore, the Jarque-Bera normality test reveals statistical significance at the 1% and 5% levels across all variables, confirming non-normal data distribution. Consequently, the application of quantile regression is deemed appropriate, as this method effectively accommodates datasets characterized by high heterogeneity (Huang et al., 2017).

Table 2 Descriptive Statistics

Statistics	ROA	GDPG	CR	DER	TA
Obs.	205	205	205	205	205
Mean	-0.003	0.034	5.541	1.534	29.359
St. Dev.	0.226	0.028	33.128	3.844	2.047
Max.	0.161	0.053	410.115	35.466	33.256
Min.	-3.095	-0.021	0.062	-34.930	23.431
Jarque-Bera	247951.4***	62.576***	110517.5***	38404.16***	8.544**

Note: The Jarque-Bera Test results are denoted by (***) indicating significance at the 1% level, (**) at the 5% level, and (*) at the 10% level.

Furthermore, the Slope Equality Test, employed as a model specification test, is presented in Table 3. The median estimation of the Slope Equality Test indicates statistical significance at the 5% level, suggesting that the regression slope coefficients differ across at least one quantile, thereby reflecting appropriate heterogeneity. Partial results demonstrate that most parameter coefficients exhibit non-uniform slopes, with deviations in equality observed only for GDPG at quantiles 0.2–0.3. This finding underscores the presence of heterogeneity or differences in the influence of independent variables (slope coefficients) on the dependent variable across the entire quantile distribution. Consequently, this validates quantile regression as an appropriate analytical

approach for this study, as it effectively captures the heterogeneity in variable relationships across various levels of the dependent variable distribution.

Table 3 Slope Equality Test

Est(τ)	Quant Level		Slope Equality Test			χ^2stat.	χ^2 d.f.	*p*-value
0.5	10		Wald Test			58.408	32	0.003
τ	**0.1-0.2**	**0.2-0.3**	**0.3-0.4**	**0.4-0.5**	**0.5-0.6**	**0.6-0.7**	**0.7-0.8**	**0.8-0.9**
GDPG	-0.053	0.425**	0.002	-0.002	0.004	0.028	0.220	-0.069
	(0.293)	(0.187)	(0.092)	(0.073)	(0.070)	(0.098)	(0.130)	(0.158)
CR	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DER	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
TA	0.002	0.002	-0.002	0.001	-0.000	-0.000	0.000	0.001
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)

Notes: The test values for each variable across all tested quantiles represent the restricted values, with their respective standard errors provided in parentheses. The significance levels for these tests are indicated as follows: (***) for 1% significance, (**) for 5% significance, and (*) for 10% significance.

Table 4 Symmetric Quantiles Test

Est(τ)	Quant Level	Test Sumary	χ^2stat.	χ^2 d.f.	*p*-value
0.5	10	Wald Test	8.491	20	0.988
τ	**0.1-0.9**	**0.2-0.8**	**0.3-0.7**	**0.4-0.6**	
C	-0.069	-0.039	0.021	-0.023	
	(0.130)	(0.090)	(0.065)	(0.042)	
GDPG	0.190	0.174	-0.032	-0.005	
	(0.379)	(0.296)	(0.170)	(0.104)	
CR	-0.000	-0.000	-0.000	0.000	
	(0.000)	(0.000)	(0.000)	(0.000)	
DER	-0.000	-0.000	-0.000	-0.000	
	(0.001)	(0.001)	(0.001)	(0.001)	
TA	0.002	0.001	-0.000	0.001	
	(0.004)	(0.003)	(0.002)	(0.001)	

Note: The test values for each variable across the quantiles display the restricted values, with the corresponding standard errors shown in parentheses. The significance levels of the tests are denoted as (***) for 1% significance, (**) for 5% significance, and (*) for 10% significance.

Furthermore, the results of the Symmetric Quantiles Test, presented in Table 4, serve as a model specification check. The simultaneous test indicates non-significance at the 5% level, suggesting that the influence of independent variables on the dependent variable is symmetric around the median. Partial results from the Symmetric Quantiles Test reveal that the causal relationship between exogenous variables—measured as GDPG, CR, DER, or TA—and the endogenous variable ROA lacks pronounced asymmetry around the median of the dependent variable's distribution. This implies that the effects of

independent variables on the profitability of infrastructure firms remain consistent and uniform around the middle quantiles (median), irrespective of whether the focus is on lower or higher quantiles. These findings underscore the robustness of the model in capturing relationships across the full data distribution, particularly at median quantiles, while still addressing heterogeneity at the extreme quantiles. Consequently, this highlights the stability of the model around the median, reinforcing the validity of quantile regression for further analysis.

The parameter significance test for the quantile regression estimation is presented in Table 5. The first goodness-of-fit measure reveals an adjusted pseudo-R-squared value of 1.8%, indicating the proportion of variability in the dependent variable explained by the exogenous variables. However, the Quasi-Likelihood Ratio (Quasi-LR) test, which is significant at the 1% level, confirms the simultaneous significance of the regression model, suggesting that at least one exogenous variable exhibits a significant causal relationship with the dependent variable. While the relatively low adjusted pseudo R-squared may imply limited explanatory power, it does not necessarily reflect poor model fit, particularly in quantile regression, where the focus lies in capturing the heterogeneity of effects across quantiles rather than an overall average fit. Furthermore, partial significance tests reveal that GDPG and TA positively influence ROA at the 1% significance level, while DER exerts a negative effect at the same significance threshold. Conversely, CR does not demonstrate any significant impact on ROA.

Table 5 Quantile Regression Model Estimation

τ	C	GDPG	CR	DER	TA	Adj. Pseudo R^2	Quasi-LR Stat.
Median Estimation	-0.143*** (0.046)	0.249*** 0.115	0.000 (0.000)	-0.004*** (0.001)	0.005*** (0.002)	0.018	20.524***
0.1	-0.296*** (0.106)	0.620** (0.347)	0.000 (0.000)	-0.003*** (0.001)	0.008** (0.004)		
0.2	-0.206*** (0.063)	0.674** (0.270)	0.000 (0.000)	-0.003*** (0.001)	0.006*** (0.002)		
0.3	-0.123*** (0.049)	0.248** (0.147)	-0.000 (0.000)	-0.003*** (0.001)	0.004*** (0.002)		
0.4	-0.166*** (0.048)	0.247** (0.123)	0.000 (0.000)	-0.004*** (0.001)	0.006*** (0.002)		
0.5	-0.143*** (0.046)	0.249** (0.115)	0.000 (0.000)	-0.004*** (0.001)	0.005*** (0.002)		
0.6	-0.141*** (0.049)	0.245** (0.116)	0.000 (0.000)	-0.004*** (0.001)	0.006*** (0.002)		
0.7	-0.141*** (0.064)	0.218* (0.160)	-0.000 (0.000)	-0.004*** (0.001)	0.006*** (0.002)		
0.8	-0.118* (0.074)	-0.002 (0.202)	-0.000** (0.000)	-0.005*** (0.001)	0.005*** (0.002)		
0.9	-0.057 (0.068)	0.067 (0.171)	-0.000** (0.000)	-0.005*** (0.000)	0.004** (0.002)		

Note: The test values for each variable represent the regression coefficients, with the values in parentheses indicating the respective standard errors. The significance of each test is denoted as follows: (***) for significance at the 1% level, (**) for significance at the 5% level, and (*) for significance at the 10% level.

The quantile regression estimates for each quantile reveal that the causal relationship between GDP growth (GDPG) as the primary variable and return on assets (ROA) varies across the quantile distribution. At low profitability levels (τ = 0.1–0.3), GDPG demonstrates a strong and significant positive impact, highlighting higher sensitivity among firms with limited financial performance. For medium profitability levels (τ = 0.4–0.6), the effect remains significant and relatively stable in a positive direction, indicating consistent support of GDPG for firms with moderate financial performance. However, at high profitability levels (τ = 0.7–0.9), the influence of GDP growth diminishes and becomes insignificant at several quantiles, except for quantile 0.7, where it remains significant. This could reflect greater resilience or reduced dependency on macroeconomic conditions for these firms. Overall, the findings underscore the heterogeneity of GDPG's effects on infrastructure firms, with more robust stability observed in the medium profitability group compared to others.

Furthermore, the parameter estimates for each exogenous control variable in the model reveal that total assets (TA) consistently exert a significant positive influence on return on assets (ROA) across all quantiles, reflecting the stability of firm size's contribution to profitability regardless of the profitability level. Conversely, the debt-to-equity ratio (DER) exhibits a consistently significant negative effect across all quantiles, underscoring the adverse impact of leverage on profitability for firms with low, medium, or high profitability. Meanwhile, the current ratio (CR) is significantly positive only at higher quantiles, indicating that liquidity becomes a critical factor influencing profitability primarily for firms with higher profitability levels. Statistically, the stable effects of TA and DER across quantiles highlight their consistent roles as control variables, whereas the significance of CR at higher quantiles underscores the heterogeneity of its impact based on a firm's profitability level.

The Quantile Process Estimates presented in Figure 1 illustrate distinct parameter distribution patterns across quantiles (τ = 0.1 to 0.9), indicating heterogeneity in the effects of independent variables on profitability (ROA). The parameter lines across quantiles reveal that most variables exhibit significant coefficients, as evidenced by their estimated lines falling outside the zero-confidence interval. GDPG demonstrates a relatively stable pattern across the majority of quantiles, with minimal fluctuations. In contrast, CR, DER, and TA display substantial variation, particularly at lower and higher quantiles, highlighting the differing sensitivities of these variables to ROA across the data distribution. The stability observed in parameters at certain quantiles supports the model's consistency, while variations at other quantiles provide evidence that the influence of exogenous variables on the dependent variable is not uniform throughout the distribution.

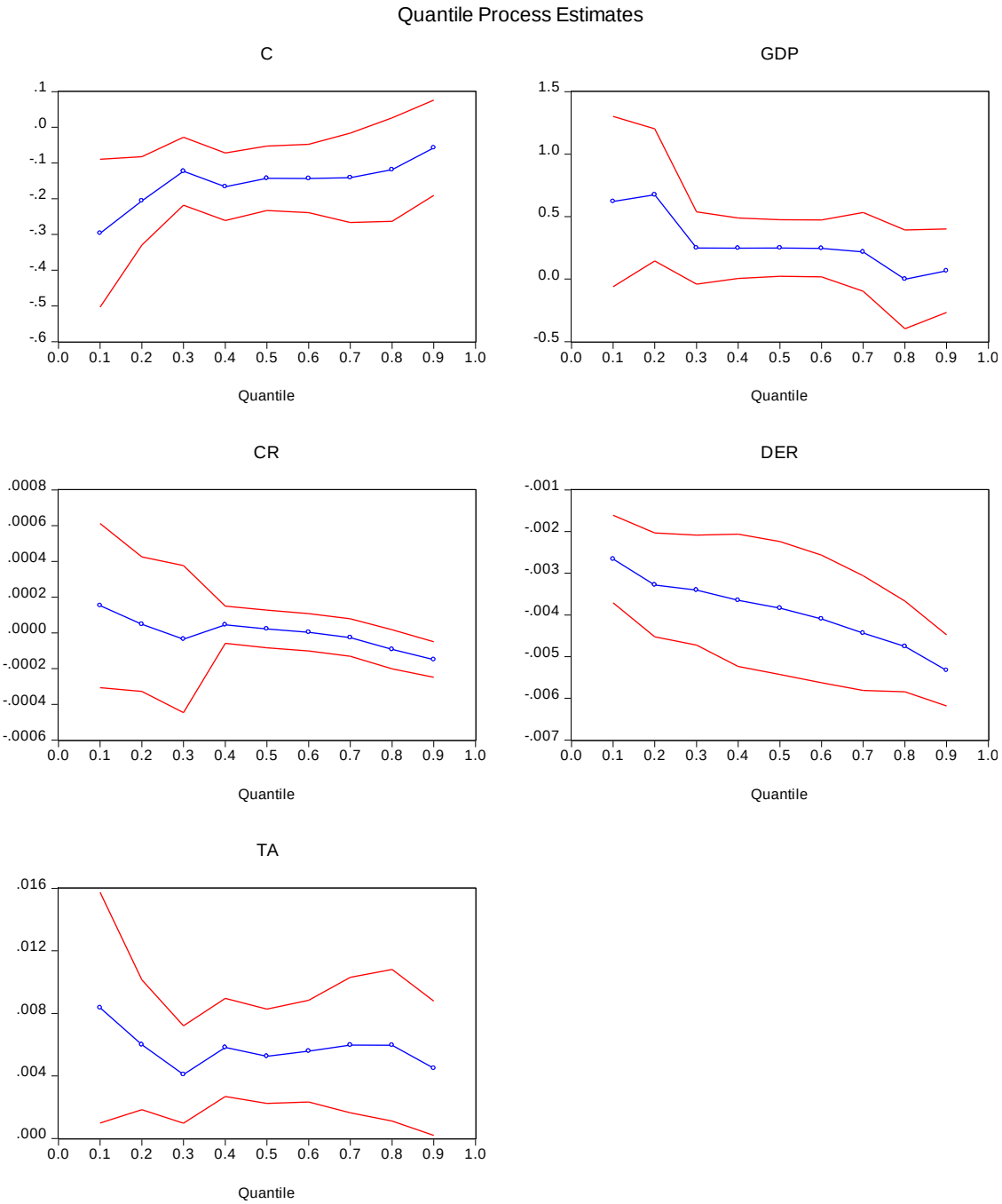

Figure 1 Quantile Process Estimates of Quantile Regression Model

The study's findings reveal a positive impact of GDP growth on profitability in the primary estimation, thereby supporting the acceptance of the alternative hypothesis. These results align with previous studies conducted by Ali et al. (2018), Yüksel et al. (2018), Fidanoski et al. (2018), and Berhe & Kaur (2017), which also established the positive causal relationship between GDP growth on corporate profitability. Within the context of the COVID-19 pandemic, the empirical evidence corresponds with Simanjuntak's (2023)

research on real estate and property companies in Indonesia. Unlike conventional financial crises, the COVID-19 pandemic represented a unique exogenous shock originating from a public health emergency. Its impact extended beyond demand-side contraction to include simultaneous supply chain disruptions, workforce immobilization, and regulatory shutdowns, which collectively distorted normal economic mechanisms (Kim et al., 2023).

The decline in GDP during the crisis reflects a contraction in aggregate economic activity, including reduced consumption, investment, and trade, adversely affecting cash flows and corporate profitability (Ahmad et al., 2022). During the COVID-19 pandemic, strict mobility restrictions, lockdown policies, and intermittent business shutdowns created unprecedented disruptions in operational continuity and capital flow, directly suppressing both GDP and corporate earnings potential (Zhang et al., 2021). For infrastructure firms, project delays, halted procurement, and disrupted supply chains were common, amplifying the effect of GDP contraction on ROA (Raj et al., 2022; Simanjuntak, 2023). Amid the sharp GDP contraction caused by the COVID-19 crisis, infrastructure firms experienced significant pressures, particularly on revenues derived from large-scale projects reliant on public and private investments (Dimitriou & Field, 2020). However, by 2022, as GDP recovered alongside improvements in global and domestic economic conditions, the positive effects became evident in improved corporate profitability. GDP recovery facilitated heightened investment activity and infrastructure development, acting as a catalyst for profitability enhancement (Ibn-Mohammed et al., 2021; Simanjuntak, 2023).

Subsequently, a robustness check was conducted for the estimates at each specified quantile. First, at the low profitability levels (quantiles 0.1–0.3), GDP growth exhibited a significant positive effect on ROA, indicating that firms with lower profitability are more sensitive to macroeconomic fluctuations. This heightened sensitivity stems from their heavy reliance on public and private capital expenditures during economic crises, which triggers sharper responses to GDP growth. At lower quantiles (0.1–0.3), the heightened sensitivity to GDP growth is amplified by the firms' dependency on government-backed infrastructure investments, many of which were deferred or reallocated during the COVID-19 response phase. The pandemic-induced fiscal reorientation from infrastructure to health and social spending disproportionately affected financially weaker firms (Agrawal & Bütikofer, 2022). Firms with limited financial capacity are more vulnerable to macroeconomic shifts as their revenues heavily depend on aggregate investment and consumption dynamics (Chang et al., 2019).

Second, at the medium profitability levels (quantiles 0.4–0.6), the impact of GDP growth remained significant and relatively stable across the distribution. This stability suggests that firms with moderate financial performance possess greater capacity to navigate crisis-induced challenges through operational efficiency and adaptive business strategies (Rapaccini et al., 2020). These findings bolster the argument that firms with sound financial structures are better equipped to leverage economic recovery opportunities (Song & Zhou, 2020), particularly in 2022 when GDP gradually rebounded. The stability test at this level further demonstrates that the estimated coefficients of GDP growth

remain robust across the medium profitability distribution, reinforcing the consistency of its influence in supporting the profitability of infrastructure firms. On the other hand, at high profitability levels (quantiles 0.7–0.9), the effect of GDP growth on ROA weakens and remains significant only at quantile 0.7, and even then, only at the 10% level. This may reflect the ability of highly profitable firms to be more resilient to economic shocks caused by crises (Peric & Vitezic, 2016). Their lower dependency on macroeconomic conditions enables these companies to sustain profitability despite GDP contractions.

Firms in the highest profitability quantiles (0.8–0.9) likely demonstrated greater resilience due to digital integration, diversified business models, or asset-light operations, enabling them to decouple profitability from the physical constraints and project delays that characterized the pandemic-induced downturn (Jha et al., 2022). However, the weaker relationship at higher quantiles also suggests that firms in this category may have diversified revenue streams or business models less reliant on infrastructure-related capital expenditures (Burger & Luke, 2017; Oliveira et al., 2018). Overall, the robustness check through quantile regression indicates that the effect of GDP growth on ROA remains robust, particularly among firms with low and medium profitability. Nevertheless, heterogeneity in the impact of GDP growth is evident across most quantiles, reflecting varying sensitivities among different groups of firms to macroeconomic variables. At quantiles 0.8 and 0.9, the effect of GDP growth is not significant, suggesting that the most profitable firms are less influenced by macroeconomic conditions compared to other groups. The pandemic highlighted the unequal impact of macroeconomic shocks on firms with varying structural resilience, emphasizing the need for tailored strategic responses to non-financial crises.

Conclusion

Based on a comprehensive analysis of the median estimation, the findings reveal that during the COVID-19 crisis in Indonesia, marked by a decline in GDP growth in 2020 and 2021 compared to pre-crisis levels in 2019, infrastructure companies experienced a significant drop in profitability. Furthermore, in 2022, as GDP growth recovered and recorded positive momentum, the profitability of infrastructure firms improved, aligning with pre-crisis conditions in 2018 and 2019. The stability tests indicate that the impact of GDP growth on profitability remains consistent across quantiles 0.1 to 0.6. This suggests that macroeconomic conditions, proxied by GDP growth, are particularly sensitive to firms with low to medium profitability levels. However, for firms with high profitability, the stability of the effect diminishes. Robustness checks reveal that companies in the high-profitability category are generally less sensitive to economic contractions, with the exception of quantile 0.7, where sensitivity is evident.

Thus, the managerial implications of this study emphasize the critical need for infrastructure companies to adapt their operational strategies amidst fluctuating macroeconomic conditions. During periods of economic contraction, as indicated by declining GDP growth, firms with low to medium profitability should prioritize efficient cash flow management and diversify revenue streams to mitigate the risks of declining

profitability. Firms with moderate profitability levels can capitalize on the stable relationship between GDP growth and profitability by strengthening investments in projects with the potential for long-term returns. Meanwhile, although highly profitable companies exhibit lower sensitivity to economic contractions, they should focus on risk mitigation strategies for specific quantiles, such as 0.7, to leverage economic recovery opportunities while accounting for potential macroeconomic volatility. Corporate managers should actively integrate macroeconomic data as key indicators in strategic decision-making, particularly to harness post-crisis economic recovery momentum and accelerate profitability growth.

This study acknowledges several limitations, which open avenues for future research. Firstly, its focus on the infrastructure sector restricts the generalizability of findings to other industries with distinct financial characteristics and sensitivities to macroeconomic dynamics, such as manufacturing, technology, or agribusiness. Secondly, while quantile regression, as a semi-parametric approach, effectively captures the heterogeneity of GDP growth effects across different profit distributions, it does not fully account for structural changes that may occur during crisis and recovery periods. Future research could address these gaps by employing cross-sectoral analyses to enhance generalizability and incorporating moderating variables such as government policies—tax incentives or subsidies for infrastructure firms, for instance—that might mitigate the adverse effects of GDP contraction on profitability. Additionally, advanced methodologies like time-varying quantile regression (Ye et al., 2017) could be applied to investigate firms' shifting sensitivities to macroeconomic conditions over time, enabling a more comprehensive assessment of adaptive strategies across diverse industries.

References

Agrawal, D. R., & Bütikofer, A. (2022). Public finance in the era of the COVID-19 crisis. *International Tax and Public Finance*, *29*(6), 1349–1372. https://doi.org/10.1007/s10797-022-09769-3

Agyekum-Mensah, G., & Knight, A. D. (2017). The professionals' perspective on the causes of project delay in the construction industry. *Engineering, Construction and Architectural Management*, *24*(5), 828–841. https://doi.org/10.1108/ECAM-03-2016-0085

Ahmad, M., Bashir, R., & Waqas, H. (2022). Working capital management and firm performance: are their effects same in covid 19 compared to financial crisis 2008? *Cogent Economics and Finance*, *10*(1). https://doi.org/10.1080/23322039.2022.2101224

Alarussi, A. S., & Alhaderi, S. M. (2018). Factors affecting profitability in Malaysia. *Journal of Economic Studies*, *45*(3), 442–458. https://doi.org/10.1108/JES-05-2017-0124

Alarussi, A. S., & Gao, X. (2021). Determinants of profitability in Chinese companies. *International Journal of Emerging Markets*. https://doi.org/10.1108/IJOEM-04-2021-0539

Alessi, L., Benczur, P., Campolongo, F., Cariboni, J., Manca, A. R., Menyhert, B., & Pagano, A. (2020). The Resilience of EU Member States to the Financial and Economic Crisis. *Social Indicators Research*, *148*(2), 569–598. https://doi.org/10.1007/s11205-019-02200-1

Alexander, A., & Minnema, J. (2018). *The relationship between leverage and profitability: A quantitative study of consulting firms in Sweden*. Sweden Umea School of Business, Economics and Statistics.

Ali, Q., Maamor, S., Yaacob, H., & Gill, M. U. T. (2018). Impact of Macroeconomic Variables

on Islamic Banks Profitability. *International Journal of Business Ethics and Governance*, *1*(2). https://doi.org/10.51325/ijbeg.v1i2.14

Alter, A., & Elekdag, S. (2020). Emerging market corporate leverage and global financial conditions. *Journal of Corporate Finance*, *62*(February), 101590. https://doi.org/10.1016/j.jcorpfin.2020.101590

Anafia, N. D., & Ulpah, M. (2021). Covid-19 Outbreak Impact on Sectoral Firm Performance Listed in Indonesia Stock Exchange in Various Sectors. *Iqtishaduna Jurnal Ekonomi Dan Keuangan Islam*, *12*(2), 286–293. https://doi.org/10.20414/iqtishaduna.v12i2.4469

Arner, D. W., Avgouleas, E., & Gibson, E. C. (2022). COVID-19, Macroeconomic and Sustainability Shocks, Moral Hazard and Resolution of Systemic Banking Crises: Designing Appropriate Systems of Public Support. In *European Business Organization Law Review* (Vol. 23, Issue 4). Springer International Publishing. https://doi.org/10.1007/s40804-022-00255-1

Atmaja, R., & Usman, B. (2023). The Factors Affecting Profitability of Manufacturing Company lister on the Indonesian Stock Exchange. *International Journal of Digital Entrepreneurship and Business*, *4*(2), 72–83. https://doi.org/10.52238/ideb.v4i2.112

Azhar, K. A., & Ahmed, N. (2019). Relationship Between Firm Size and Profitability: Investigation from Textile Sector of Pakistan. *International Journal of Information, Business and Management*, *11*(2), 62–74.

Bennett, D. L. (2018). Infrastructure investments and entrepreneurial dynamism in the. *Journal of Business Venturing*, *October*, 1–28. https://doi.org/10.1016/j.jbusvent.2018.10.005

Benoit, D. F., & Poel, D. Van den. (2017). bayesQR : A Bayesian Approach to Quantile Regression. *Journal of Statistical Software*, *76*(7). https://doi.org/10.18637/jss.v076.i07

Berhe, T. A., & Kaur, J. (2017). Determinants of insurance companies' profitability Analysis of insurance sector in Ethiopia. *Academic Research International*, *1*(3), 315–321.

Biørn, E. (2017). *Econometrics of Panel Data: Methods and Applications* (1st ed.). Oxford University Press.

Burger, S. P., & Luke, M. (2017). Business models for distributed energy resources: A review and empirical analysis. *Energy Policy*, *109*(June), 230–248. https://doi.org/10.1016/j.enpol.2017.07.007

Chang, X., Chen, Y., & Dasgupta, S. (2019). Macroeconomic conditions, financial constraints, and firms' financing decisions. *Journal of Banking and Finance*, *101*, 242–255. https://doi.org/10.1016/j.jbankfin.2018.10.016

Corsetti, G., Pesenti, P., & Roubini, N. (1999). What caused the Asian currency and financial crisis? *Japan and the World Economy*, *11*, 305–373. https://doi.org/10.1016/s0922-1425(99)00019-5

Devi, S., Warasniasih, N. M. S., Masdiantini, P. R., & Musmini, L. S. (2020). The Impact of COVID-19 Pandemic on the Financial Performance of Firms on the Indonesia Stock Exchange. *Journal of Economics, Business, and Accountancy Ventura*, *23*(2), 226–242. https://doi.org/10.14414/jebav.v23i2.2313

Didier, T., Huneeus, F., Larrain, M., & Schmukler, S. L. (2021). Financing firms in hibernation during the COVID-19 pandemic. *Journal of Financial Stability*, *53*, 100837. https://doi.org/10.1016/j.jfs.2020.100837

Dijkstra, L., Garcilazo, E., & McCann, P. (2014). The effects of the global financial crisis on European regions and cities. *Journal of Economic Geography*, *15*(5), 935–949. https://doi.org/10.1093/jeg/lbv032

Dimitriou, H. T., & Field, B. G. (2020). Mega infrastructure projects as agents of change: new perspectives on 'the global infrastructure gap' Harry. *Journal of Mega Infrastructure & Sustainable Development*, *1*(2), 116–150. https://doi.org/10.1080/24724718.2020.1786877

Ebimobowei, A., Uche, O. J., & Young-Arney, T. (2021). Liquidity and Profitability Ratios on Growth of Profits of Listed Oil and Gas Firms in Nigeria. *African Journal of Accounting and Financial Research*, *4*(3), 1–14. https://doi.org/10.52589/ajafr-6nhpayuo

Fidanoski, F., Choudhry, M., Davidović, M., & Sergi, B. S. (2018). What does affect profitability of banks in Croatia? *Competitiveness Review*, *28*(4), 338–367. https://doi.org/10.1108/CR-09-2016-0058

Fitzenberger, B., Koenker, R., Machado, J., & Melly, B. (2022). Economic applications of quantile regression 2.0. *Empirical Economics*, *62*(1), 1–6. https://doi.org/10.1007/s00181-021-02186-1

Goel, R. K., Saunoris, J. W., & Goel, S. S. (2021). Supply chain performance and economic growth: The impact of COVID-19 disruptions. *Journal of Policy Modeling*, *43*(2), 298–316. https://doi.org/10.1016/j.jpolmod.2021.01.003

Halimatussadiah, A., Widyasanti, A. A., Damayanti, A., Verico, K., Qibthiyyah, R. M., Kurniawan, R., Rezki, J. F., Rahardi, F., Sholihah, N. K., Budiantoro, S., Halimatussadiah, A., Cesarina, A., Siregar, A. A., Hanum, C., Wisana, D., Rahardi, F., Bintara, H., Rezki, J. F., Husna, M., … Sofiyandi, Y. (2020). *Thinking Ahead Indonesia's Agenda on Sustainable Recovery from COVID-19 Pandemic* (A. Halimatussadiah, A. A. Widyasanti, A. Damayanti, K. Verico, R. M. Qibthiyyah, R. Kurniawan, J. F. Rezki, F. Rahardi, N. K. Sholihah, & S. Budiantoro (eds.); 1st ed.). Institute for Economic and Social Research Faculty of Economics and Business, Universitas Indonesia (LPEM FEB UI) and Ministry of National Development Planning/National Development Planning Agency. https://lpem.org/thinking-ahead-indonesias-agenda-on-sustainable-recovery-from-covid-19-pandemic/

Hartono, P. G., & Matusin, A. R. (2020). The Determinants of Dividend Policy on Real Estate, Property, and Building Construction Companies Listed in IDX using Unbalanced Panel Data Approach. *TIJAB (The International Journal of Applied Business)*, *4*(2), 139. https://doi.org/10.20473/tijab.v4.i2.2020.139-156

Hartono, P. G., & Raya, M. Y. (2022). COVID-19 Pandemic, Dividend Policy, and Stock Market Reaction: Evidence from the Manufacturing Companies in Indonesia. *Jurnal Keuangan Dan Perbankan*, *26*(4), 758–778. https://doi.org/10.26905/jkdp.v26i4.8226

Hartono, P. G., & Robiyanto, R. (2023). Factors affecting the inconsistency of dividend policy using dynamic panel data model. *SN Business & Economics*, *3*(2), 53. https://doi.org/10.1007/s43546-023-00431-6

Hartono, P. G., Lestari, H. S., Wijaya, R., Hartono, A. B., & Tinungki, G. M. (2020). Likuiditas sebagai Prediktor Profitabilitas: Sebuah Studi Empiris pada Perusahaan Sektor Industri Manufaktur. *DERIVATIF: Jurnal Manajemen*, *14*(2), 126–137. https://doi.org/10.24127/jm.v14i2.475

Hartono, P. G., Robiyanto, R., Tinungki, G. M., Frensidy, B., Raya, M. Y., & Hidarto, A. (2024). Revisiting Dividend Policy and Stock Market Reaction of Indonesian Manufacturing Enterprises amidst the COVID-19 Crisis: A Series of Robustness Checks. *Scientific Papers of the University of Pardubice, Series D: Faculty of Economics and Administration*, *32*(1), 1773. https://doi.org/10.46585/sp32011773

Hartono, P. G., Tinungki, G. M., & Susanto, K. P. (2023). COVID-19, Profitability, and Dividend Policy: A Robustness Test for Mediation Model using Covariance-Based SEM. *International Journal of Digital Entrepreneurship and Business*, *4*(1), 1–13. https://doi.org/10.52238/ideb.v4i1.106

Hartono, P. G., Tinungki, G. M., Jakaria, J., Hartono, A. B., Hartono, P. G., & Wijaya, R. (2021). Overcoming Overdispersion on Direct Mathematics Learning Model Using the Quasi Poisson Regression. *Advances in Social Science, Education and Humanities Research*, *550*, 442–449. https://doi.org/10.2991/assehr.k.210508.102

Hartono, P. G., Tinungki, G. M., Suade, Y. K. M., Rahardja, L., Triany, N. A., Tyas, I. W., & Hartono, P. G. (2024). Did investment opportunity moderate the influence of the COVID-19 crisis on dividend policy? *Jurnal Manajemen Dan Pemasaran Jasa*, *17*(2), 261–276. https://doi.org/10.25105/v17i2.20006

Hartono, P. G., Wijaya, R., Hartono, A. B., Dizar, S., Magetsari, O. N. N., Anggara, I. S., & Sujono, M. I. (2023). Factors affecting stock price of maritime companies in Indonesia. *AIP Conference Proceedings*, *2675*(February). https://doi.org/10.1063/5.0116974

Hoang, A. T., Sandro Nižetić, Olcer, A. I., Ong, H. C., Chen, W. H., Chong, C. T., Thomas, S., Bandh, S. A., & Nguyen, X. P. (2021). Impacts of COVID-19 pandemic on the global energy system and the shift progress to renewable energy: Opportunities, challenges, and policy implications. *Energy Policy*, *154*(October 2020). https://doi.org/10.1016/j.enpol.2021.112322

Huang, Q., Zhang, H., Chen, J., & He, M. (2017). Quantile Regression Models and Their Applications: A Review. *Journal of Biometrics & Biostatistics*, *08*(03). https://doi.org/10.4172/2155-6180.1000354

Ibn-Mohammed, T., Mustapha, K. B., Godsell, J., Adamu, Z., Babatunde, K. A., Akintade, D. D., Acquaye, A., Fujii, H., Ndiaye, M. M., Yamoah, F. A., & Koh, S. C. L. (2021). A critical review of the impacts of COVID-19 on the global economy and ecosystems and opportunities for circular economy strategies. *Resources, Conservation and Recycling*, *164*(September 2020), 105169. https://doi.org/10.1016/j.resconrec.2020.105169

Jha, A., Sindhwani, R., Dwivedi, A., & Saddikuti, V. (2022). Sustainable recovery for digital entrepreneurs with shared resources: enablers, challenges and solutions. *Journal of Asia Business Studies*, *16*(3), 515–537. https://doi.org/10.1108/JABS-05-2021-0214

Jomo, K. S., & Chowdhury, A. (2020). COVID-19 Pandemic Recession and Recovery. *Development (Basingstoke)*, *63*(2–4), 226–237. https://doi.org/10.1057/s41301-020-00262-0

Jordão, R. V. D., & de Almeida, V. R. (2017). Performance measurement, intellectual capital and financial sustainability. *Journal of Intellectual Capital*, *18*(3), 643–666. https://doi.org/10.1108/JIC-11-2016-0115

Kamasak, R. (2017). The contribution of tangible and intangible resources, and capabilities to a firm's profitability and market performance. *European Journal of Management and Business Economics*, *26*(2), 252–275. https://doi.org/10.1108/EJMBE-07-2017-015

Kanakriyah, R. (2020). Dividend Policy and Companies' Financial Performance. *Journal of Asian Finance, Economics and Business*, *7*(10), 531–542. https://doi.org/10.13106/jafeb.2020.vol7.no10.531

Kaplan, D. M., & Sun, Y. (2017). Smoothed estimating equations for instrumental variables quantile regression. *Econometric Theory*, *33*(1), 105–157. https://doi.org/10.1017/S0266466615000407

Kim, E., Jin, D., Lee, H., & Jiang, M. (2023). The economic damage of COVID-19 on regional economies: an application of a spatial computable general equilibrium model to South Korea. *Annals of Regional Science*, *71*(1), 243–268. https://doi.org/10.1007/s00168-022-01160-8

Lassala, C., Apetrei, A., & Sapena, J. (2017). Sustainability matter and financial performance of companies. *Sustainability (Switzerland)*, *9*(9), 1–16. https://doi.org/10.3390/su9091498

Linggadjaya, R. I. T., Atahau, A. D. R., Shinta S. Ugut, G., & Sung Suk, K. (2024). Faktor Penentu Profitabilitas Bank Tercatat di Indonesia: Pendekatan dengan Regresi Kuantil. *Jurnal Proaksi*, *11*(1), 1–18. https://doi.org/10.32534/jpk.v11i1.5246

Liu, D., Sun, W., & Zhang, X. (2020). Is the Chinese Economy Well Positioned to Fight the COVID-19 Pandemic? the Financial Cycle Perspective. *Emerging Markets Finance and Trade*, *56*(10), 2259–2276. https://doi.org/10.1080/1540496X.2020.1787152

Lu, X., & White, H. (2014). Robustness checks and robustness tests in applied economics. *Journal of Econometrics*, *178*(PART 1), 194–206. https://doi.org/10.1016/j.jeconom.2013.08.016

Miklian, J., & Hoelscher, K. (2022). SMEs and exogenous shocks: A conceptual literature review and forward research agenda. *International Small Business Journal: Researching Entrepreneurship*, *40*(2), 178–204. https://doi.org/10.1177/02662426211050796

Muchtar, S., Hartono, P. G., & Sari, W. R. (2020). The Quality of Corporate Governance and Its Effect on Sharia Bank Financial Performance in Indonesia. *Advances in Economics, Business and Management Research*, *151*, 192–196. https://doi.org/10.2991/iac-17.2018.49

Naseer, S., Khalid, S., Parveen, S., Abbass, K., Song, H., & Achim, M. V. (2023). COVID-19 outbreak: Impact on global economy. *Frontiers in Public Health*, *10*, 1009393. https://doi.org/10.3389/fpubh.2022.1009393

Oliveira, M., Mendes, G. H. S., Albuquerque, A., & Rozenfeld, H. (2018). Lessons learned from a successful industrial Product Service System business model: emphasis on financial aspects. *Journal of Business & Industrial Marketing*, *33*(3), 365–376. https://doi.org/10.1108/JBIM-07-2016-0147

Olivia, S., Gibson, J., & Nasrudin, R. (2020). Indonesia in the Time of Covid-19. *Bulletin of Indonesian Economic Studies*, *56*(2), 143–174. https://doi.org/10.1080/00074918.2020.1798581

Papacharalampous, G., Tyralis, H., Langousis, A., Jayawardena, A. W., Sivakumar, B., Mamassis, N., Montanari, A., & Koutsoyiannis, D. (2019). Probabilistic Hydrological Post-Processing at Scale: Why and How to Apply Machine-Learning Quantile Regression Algorithms. *Water*, *11*, 2126. https://doi.org/10.3390/w11102126

Peric, M., & Vitezic, V. (2016). Impact of global economic crisis on firm growth. *Small Business Economics*, *46*(1), 1–12. https://doi.org/10.1007/s11187-015-9671-z

Purwanto, A., Fahlevi, M., Zuniawan, A., Kusuma, R. D. P., Supriatna, H., & Maryani, E. (2020). The COVID-19 Pandemic Impact on Industries Performance: An Explorative Study of Indonesian Companies. *Journal of Critical Reviews*, *7*(15), 1965–1972. https://doi.org/10.31838/jcr.07.15.265

Raj, A., Mukherjee, A. A., de Sousa Jabbour, A. B. L., & Srivastava, S. K. (2022). Supply chain management during and post-COVID-19 pandemic: Mitigation strategies and practical lessons learned. *Journal of Business Research*, *142*(January), 1125–1139. https://doi.org/10.1016/j.jbusres.2022.01.037

Rapaccini, M., Saccani, N., Kowalkowski, C., Paiola, M., & Adrodegari, F. (2020). Navigating disruptive crises through service-led growth: The impact of COVID-19 on Italian manufacturing firms. *Industrial Marketing Management*, *88*(May), 225–237. https://doi.org/10.1016/j.indmarman.2020.05.017

Saif-Alyousfi, A. Y. H. (2022). Determinants of bank profitability: evidence from 47 Asian countries. *Journal of Economic Studies*, *49*(1), 44–60. https://doi.org/10.1108/JES-05-2020-0215

Samba, M., & Abraham, E. (2022). The impact of fiscal dominance on macroeconomic performance in Sierra Leone: a DSGE simulation approach. *West African Journal of Monetary and Economic Integration*, *22*(1), 1–33.

Santosa, P. B., Rini, I., Pangestuti, D., & Wahyudi, S. (2023). Dividend policy in Indonesian banking sector during COVID-19 pandemic period. *Cogent Social Sciences*, *9*(2). https://doi.org/10.1080/23311886.2023.2272657

Sari, F. N., & Endri, E. (2019). Determinants of Return on Assets (ROA) On Conventional Banks Listed On Indonesian Stock Exchange (IDX) Period 2013-2017. *IOSR Journal of Business and Management*, *21*(4), 52–62. https://doi.org/10.9790/487X-2104025262

Sekaran, U., & Bougie, R. (2016). *Research Methods for Bussiness A Skill-Bulding Approach* (7th ed.).

John Wiley & Sons.

Simanjuntak, L. R. (2023). Dampak Krisis Akibat Pandemi COVID-19 Terhadap Kinerja Perusahaan: Kajian Profitabilitas Perusahaan Riil Estat dan Properti di Indonesia. *Jurnal Proaksi*, *10*(4), 450–464. https://doi.org/10.32534/jpk.v10i4.4781

Song, L., & Zhou, Y. (2020). The COVID-19 Pandemic and Its Impact on the Global Economy: What Does It Take to Turn Crisis into Opportunity? *China and World Economy*, *28*(4), 1–25. https://doi.org/10.1111/cwe.12349

Soto, J. H. de, Sánchez-Bayón, A., & Bagus, P. (2021). Principles of Monetary & Financial Sustainability andWellbeing in a Post-COVID-19World: The Crisis and Its Management. *Sustainability (Switzerland)*, *13*, 4655. https://doi.org/10.3390/su13094655

Srbinoska, D. S. (2018). Liquidity and Profitability Analysis of Non-Financial Entities Listed on the Macedonian Stock Exchange. *Business and Management Horizons*, *6*(2), 34–46. https://doi.org/10.5296/bmh.v6i2.13723

Ssenyonga, M. (2021). Imperatives for post COVID-19 recovery of Indonesia's education, labor, and SME sectors. *Cogent Economics and Finance*, *9*(1), 1–51. https://doi.org/10.1080/23322039.2021.1911439

Strange, R. (2020). The 2020 Covid-19 pandemic and global value chains. *Journal of Industrial and Business Economics*, *47*, 455–465. https://doi.org/10.1007/s40812-020-00162-x

Sutrisno, S., Panuntun, B., & Adristi, F. I. (2020). The Effect of COVID-19 Pandemic on the Performance of Islamic Bank in Indonesia. *Equity*, *23*(2), 125–136. https://doi.org/10.34209/equ.v23i2.2245

Tan, J., & Zhao, J. Z. (2019). The Rise of Public–Private Partnerships in China: An Effective Financing Approach for Infrastructure Investment? *Public Administration Review*, *79*(4), 514–518. https://doi.org/10.1111/puar.13046

Thakur, B. P. S., & Kannadhasan, M. (2018). Determinants of dividend payout of Indian manufacturing companies: A quantile regression approach. *Journal of Indian Business Research*, *10*(4), 364–376. https://doi.org/10.1108/JIBR-02-2018-0079

Tinungki, G. M., Hartono, P. G., Frensidy, B., Robiyanto, R., Dorkas, A., Atahau, R., Maria, G., Hartono, P. G., & Frensidy, B. (2025). Revisiting dividend policy in Indonesian green investment firms and associated market reaction: an in-depth analysis over crises period. *Cogent Business & Management*, *12*(1), 1–36. https://doi.org/10.1080/23311975.2025.2467229

Tinungki, G. M., Hartono, P. G., Robiyanto, R., Hartono, A. B., Jakaria, J., & Simanjuntak, L. R. (2022). The COVID-19 Pandemic Impact on Corporate Dividend Policy of Sustainable and Responsible Investment in Indonesia: Static and Dynamic Panel Data Model Comparison. *Sustainability (Switzerland)*, *14*(10), 6152. https://doi.org/10.3390/su14106152

Tinungki, G. M., Hartono, P. G., Robiyanto, R., Masnita, Y., & Tikupadang, W. K. (2024). *Matematika Keuangan* (M. Monalisa & M. Y. Raya (eds.); 2nd ed.). Reads Media Corps.

Tinungki, G. M., Robiyanto, R., & Hartono, P. G. (2022). The Effect of COVID-19 Pandemic on Corporate Dividend Policy in Indonesia: The Static and Dynamic Panel Data Approaches. *Economies*, *10*(1), 11. https://doi.org/10.3390/economies10010011

Tomkiewicz, J. (2017). The social consequences of income distribution-Are increasing company profits a threat to economic and social stability? *Polish Sociological Review*, *198*(2), 203–218.

Usman, B., Lestari, H. S., Syofyan, S., & Esya, L. (2024). Exploring the relationship between dividend policy, the COVID-19 crisis, and stock market reaction: empirical insights from Indonesian real estate and property firms. *Cogent Business and Management*, *11*(1). https://doi.org/10.1080/23311975.2024.2302204

Waldmann, E. (2018). Quantile regression: A short story on how and why. *Statistical Modelling*,

18(3–4), 203–218. https://doi.org/10.1177/1471082X18759142

Warae, Y., Hartono, P. G., Suade, Y. K. M., Widiastuti, M. C., Rahayu, D. H., & Tinungki, G. M. (2024). *Buku Ajar Manajemen Keuangan* (Sepriano, Efitra, & W. Gustiani (eds.); 1st ed.). PT. Sonpedia Publishing Indonesia.

Watanabe, C., Naveed, K., Tou, Y., & Neittaanmäki, P. (2018). Measuring GDP in the digital economy: Increasing dependence on uncaptured GDP. *Technological Forecasting and Social Change*, *137*(July), 226–240. https://doi.org/10.1016/j.techfore.2018.07.053

Welfens, P. J. J. (2020). Macroeconomic and health care aspects of the coronavirus epidemic: EU, US and global perspectives. *International Economics and Economic Policy*, *12*, 295–362. https://doi.org/10.1007/s10368-020-00465-3

Whetman, L. L. (2017). The Impact of Sustainability Reporting on Firm Profitability. *Undergraduate Economic Review Volume*, *14*(1), 1–19. https://digitalcommons.iwu.edu/uer/vol14/iss1/4

Wulandari, D. (2021). Pengaruh Perputaran Modal Kerja, Ukuran Perusahaan, Pertumbuhan Penjualan, Likuiditas, Dan Struktur Modal Terhadap Profitabilitas. *Jurnal Ekonomi Mahasiswa (JEKMa)*, *1*(2), 1–12. http://jurnalmahasiswa.stiesia.ac.id/index.php/jira/article/view/267/272

Wüthrich, K. (2020). A Comparison of Two Quantile Models With Endogeneity. *Journal of Business and Economic Statistics*, *38*(2), 443–456. https://doi.org/10.1080/07350015.2018.1514307

Ye, W., Luo, K., & Liu, X. (2017). Time-varying quantile association regression model with applications to financial contagion and VaR. *European Journal of Operational Research*, *256*(3), 1015–1028. https://doi.org/10.1016/j.ejor.2016.07.048

Yeoh, P. (2010). Causes of the global fi nancial crisis: Learning from the competing insights. *International Journal of Disclosure and Governance*, *7*(1), 42–69. https://doi.org/10.1057/jdg.2009.18

Yüksel, S., Mukhtarov, S., Mammadov, E., & Özsarı, M. (2018). Determinants of profitability in the banking sector: An analysis of post-Soviet countries. *Economies*, *6*(3). https://doi.org/10.3390/economies6030041

Yuliastuti, I. A. N., & Merawati, L. K. (2022). Pengaruh Investment Opportunity Set (Ios), Likuiditas, Leverage, Ukuran Perusahaan Dan Intangible Asset Terhadap Kinerja Perusahaan. *Kumpulan Hasil Riset Mahasiswa Akuntansi (KHARISMA)*, *4*(3), 236–245.

Zakeri, B., Paulavets, K., Barreto-Gomez, L., Echeverri, L. G., Pachauri, S., Boza-Kiss, B., Zimm, C., Rogelj, J., Creutzig, F., Ürge-Vorsatz, D., Victor, D. G., Bazilian, M. D., Fritz, S., Gielen, D., McCollum, D. L., Srivastava, L., Hunt, J. D., & Pouya, S. (2022). Pandemic, War, and Global Energy Transitions. *Energies*, *15*(17), 1–23. https://doi.org/10.3390/en15176114

Zhang, L., Li, H., Lee, W. J., & Liao, H. (2021). COVID-19 and energy: Influence mechanisms and research methodologies. *Sustainable Production and Consumption*, *27*, 2134–2152. https://doi.org/10.1016/j.spc.2021.05.010

Zhu, G., Chou, M. C., & Tsai, C. W. (2020). Lessons Learned from the COVID-19 Pandemic Exposing the Shortcomings of Current Supply Chain Operations: A Long-Term Prescriptive Offering. *Sustainability (Switzerland)*, *12*, 5858. https://doi.org/10.3390/su12145858

Zutter, C. J., & Smart, S. B. (2019). *Principles of Managerial Finance* (15th ed.). Pearson.