A MULTIFACTOR MODEL APPROACH TO THE EFFECT OF MACROECONOMIC INDICATORS AND MARKET RETURNS ON THE STOCK RETURN OF PT TELKOM INDONESIA (PERSERO) TBK, WITH COVID-19 AS A MODERATING VARIABLE

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A THESIS

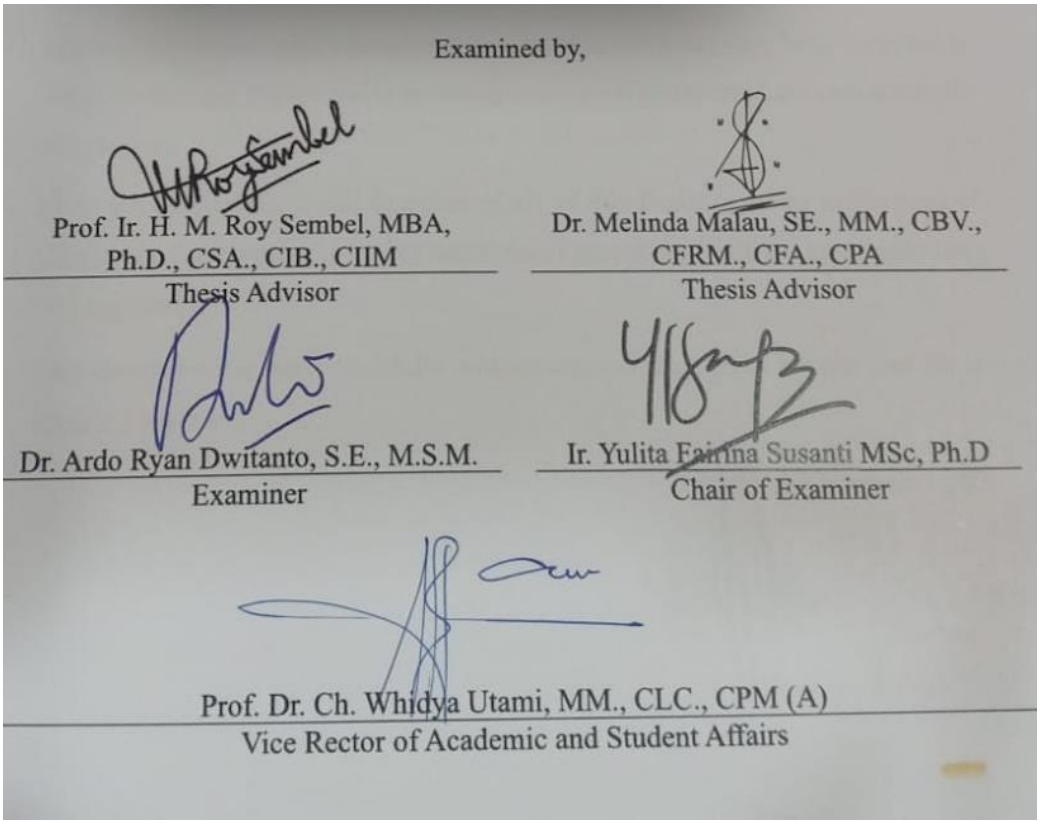
Submitted in partial fulfilment of the requirements for the degree of Master of Business Administration

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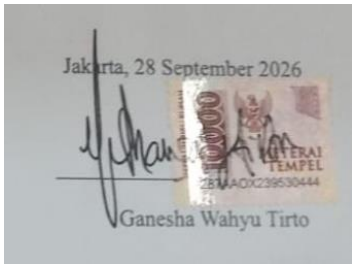


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Jakarta, 28 September 2026

Ganesha Wahyu Tirto

ABSTRACT

Over twenty million Indonesians (7.12% of the population) have been exposed to capital market instruments by 2025. However, based on national survey data findings, only around 20 percent of them are literate about capital market instruments. Although stock investment is beneficial in the long-term, investors first have to understand the key factors associated with stock price movements before participating in the capital market. This study examines the association between macroeconomic indicators, market return, and the stock return of PT Telkom Indonesia (Persero) Tbk within an APT-inspired multifactor time-series framework, using monthly data from 2017 to 2025, and investigates whether the COVID-19 pandemic moderates this association. As this study employs an observational time-series regression design rather than a randomized or experimental design, all reported relationships are interpreted as statistical associations rather than causal effects. Findings indicate that macroeconomic indicators and market return were not significantly associated with stock return under the direct-effect model. However, a parsimonious moderated model, incorporating COVID-19 dummy variables and interaction terms, was found to be statistically significant, revealing that BI Rate is negatively associated with stock return, and that the association between exchange rate and stock return differs significantly during the acute phase of the pandemic compared to non-crisis periods. This study is limited to a single-firm analysis and should therefore be interpreted as exploratory evidence rather than a generalizable or causal finding

Keywords: capital market, stock return, macroeconomic, moderated regression, COVID-19

CHAPTER 1
INTRODUCTION

1.1. Research Background

In recent years, public awareness in Indonesia has shifted increasingly toward exploring investment options as a means of achieving long-term financial goals. Figure 1.1 below reflected the increase in the number of new investors over the past decade. According to the Indonesian Central Securities Depository (KSEI), an entity that acts as a central custodian, providing settlement services for securities transactions in the Indonesian capital market, the number of investors in the Indonesian capital market reached 20.3 million in 2025, up from just 364,000 in 2014. It was a 44.1% annual growth rate over the-11-year period.



Figure 1.1 Indonesia Capital Market Investors Growth 2014 - 2025
Source: Kustodian Sentral Efek Indonesia, 2026

While the growth of the investors in the Indonesian capital market, which includes the number of investors in mutual funds, stocks, and government/corporate bonds, was astonishing, it accounted for only 7.12% of the Indonesian total population (285 million in 2025). In contrast, several other markets, including the United States, China, Hong Kong, and Malaysia, exhibit investor participation rates exceeding 15%. Among these, the United States, as a mature and developed capital market, records the highest level of participation, with approximately 62% of the population—equivalent to around 210 million investors—actively participating in the capital market. This finding is consistent with the generally low level of

financial literacy in Indonesia. According to the 2025 National Survey on Financial Literacy and Inclusion described in figure 1.2 below, capital market literacy index in Indonesia only reached 17.78%, which is a quarter of the country's overall financial literacy index (66.46%).

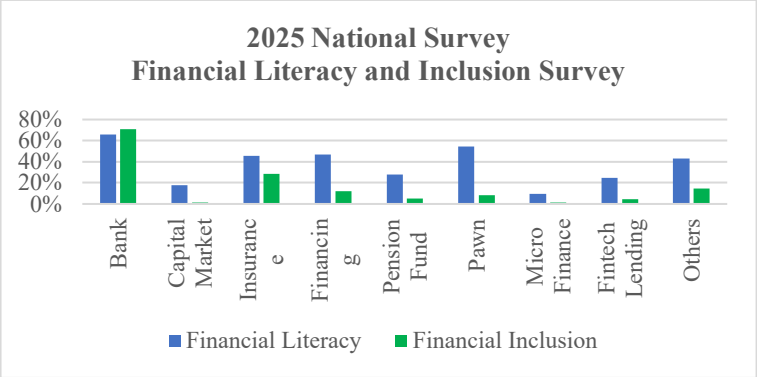


Figure 1.2 National Survey on Financial Literacy and Inclusion
Source: OJK Indonesia, 2026

It is plausible that the predominant concern among the remainder of the population who have not entered the capital market is the fear of losing their funds. Conversely, a single stock in the stock market demonstrated a cumulative price appreciation of about 150% or more during the last ten years. In the long run, stock investments tend to yield favourable outcomes when future market movements can be anticipated, and financial metrics are thoroughly analysed. However, the ability to determine which stock to invest in and understanding the financial indicators constitutes a higher-order competency that investors should cultivate before deciding to invest in a stock.

Meanwhile, the early 2000s marked the onset of the internet era, coinciding with the emergence of social media platforms (e.g., Facebook, YouTube, Twitter) and the transformation of the mobile phone industry, exemplified by the launch of the iPhone in 2007 and the Android operating system in 2008. By the mid-2010s, the proliferation of streaming services, on-demand content, and e-commerce had begun to redefine consumer behaviour. The COVID-19 pandemic in 2020 further accelerated digital adoption, as remote work and online learning became institutionalized across both developed and emerging economies. These developments collectively reinforced the indispensability of the internet and

positioned the telecommunications sector as the backbone of global digital infrastructure. Amid the transformation of consumer behaviour driven by enhanced digital engagement, investing in telecommunication stocks draws more attention from investors as it becomes more promising in the long run to provide the internet infrastructure in Indonesia.

The telecommunication industry in Indonesia is predominantly dominated by three major corporations with the largest market capitalization on the Indonesia Stock Exchange. As of 2025, PT Telkom Indonesia (Persero) Tbk, a state-owned enterprise, stands out with a total of USD 20 billion market capitalization, followed by its two main competitors operate as privately owned entities: PT Indosat Tbk (USD 4.5 billion) and PT XL Axiata Tbk (USD 3.8 billion). The composition underscores a balanced market structure characterized by both state participation and private sector competitiveness in advancing Indonesia's digital and communication infrastructure. Established in 1965, the government of Indonesia owns 52.09% of PT Telkom Indonesia (Persero) Tbk shares and has the largest customer base among the three companies by the end of 2025. It reported approximately 159.4 million mobile subscribers while PT Indosat Tbk and PT XL Axiata have around 94.7 million and 58.8 million subscribers, respectively. Nevertheless, the return of PT Telkom Indonesia (Persero) Tbk since its public offering in November 1995 has grown 15 times or +1,400%, based solely on the price return.

However, despite the remarkable narrative of the internet emerging as the next major technological revolution, the performance of related stock returns did not consistently exhibit positive relationship. Figure 1.3 presents the stock performance of PT Telkom Indonesia (Persero) Tbk from 2006 to December 2025, illustrating that its price volatility was associated not only by the company's fundamental factors but also by various external determinants, including macroeconomic conditions and investor sentiment. This study investigates the relationship between stock returns and two independent variables-macroeconomic factors and market returns-with the COVID-19 pandemic serving as a moderating variable.

While this study draws upon the logical framework of the Arbitrage Pricing Theory (APT) formulated by Ross (1976), it is not intended to empirically test the cross-sectional validity of the APT across an asset portfolio. Instead, this research focuses on the factor exposure approach adapted by Chen et al. (1986). Consequently, this study is strictly positioned as an APT-based multifactor model analysis designed to evaluate how time-series variations of macroeconomic indicators and market returns affect the stock return of a single specific entity, namely PT Telkom Indonesia (Persero) Tbk, with the moderating effect of the COVID-19 pandemic.

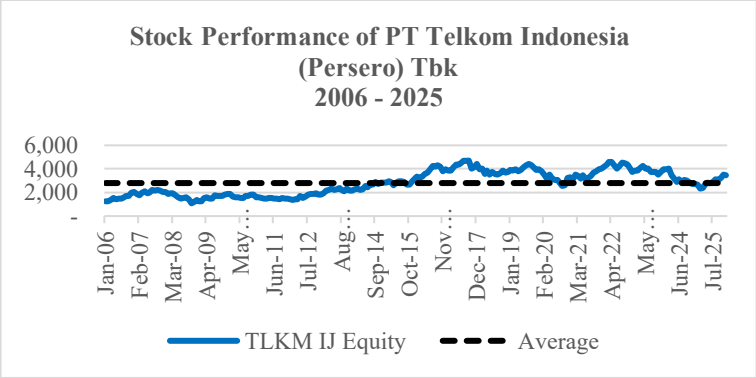


Figure 1.3 The Stock Performance of PT Telkom Indonesia (Persero) Tbk
Source: Bloomberg (February 24th, 2026)

Investing in the stock market gained more popularity, especially in Indonesia, during and after the COVID-19 period, where youth investors started to invest in local equities or domestic stocks as their investment vehicle to achieve their financial objectives or even to try to invest in the stock market for the first time. The pandemic period prompted a shift in household behaviour, with individuals exhibiting a greater propensity to save rather than spend, to safeguard their financial stability under uncertain economic conditions.

Establishing a stock is one of the multiple available mechanisms for a corporation to raise capital from the public to expand its business or improve its financial structure. As perceived by investors, a stock is one of the various investment options that can accelerate wealth accumulation and help achieve long-term financial goals. Essentially, investors will get two benefits when investing in a stock: capital gain and dividends.

However, capital gain could turn into capital loss if the sale price of the stock is lower than its original price. Meanwhile, a dividend is a distribution of profits by a corporation to its shareholders (Nguyen, 2021). A stock exchange serves as a regulated marketplace that facilitates the buying and selling of equity securities (stock) among investors. According to Gelderblom and Jonker (2004), the world's first stock exchange was established in Amsterdam in 1602, marking the inception of organized equity trading. The Indonesian Capital Market Law (Undang-Undang No. 8 Tahun 1995) defines the capital market (pasar modal) as activities concerned with public offerings and securities trading, public companies related to the securities they issue, and institutions and professions associated with securities.

In Indonesia, the stock exchange began to gain greater prominence in the early 2000 following the modernization of its trading infrastructure, which enabled the transition to digital trading platforms. This development enhanced market accessibility and efficiency. The Indonesian stock market further evolved with the consolidation of the Surabaya Stock Exchange and the Jakarta Stock Exchange, culminating in the formation of the Indonesia Stock Exchange (IDX) in the late 2000, which strengthened the nation's capital market framework and investor base. The stock exchange provides a transparent platform that enables investors to access and evaluate the trading activity of publicly listed companies. The aggregate performance of a stock exchange over a specific period of time is called market return. Market return serves as a fundamental indicator for financial professionals and investors in assessing risk-adjusted returns, comparing the asset or security underlying, and identifying patterns that signal potential upward or downward trends.

Eventually, understanding the market return provides a fundamental foundation for forecasting future stock movement and portfolio optimization. Market return is typically evaluated using a market index, which serves as a benchmark for overall market returns. Each market index exhibits distinct market returns, influenced by the composition and classification of its listed equities. These classifications are commonly reflected in various stock indices, which serve as benchmarks for market performance. In Indonesia, multiple indices have been developed to enable investors to monitor and evaluate different market segments

effectively. Table 1.1 displays the classification of the top five out of various indices in the Indonesian stock market. Three of the five market indices reflect two variables frequently employed by investors to assess the securities underlying these indices, namely liquidity and market capitalization.

Table 1.1 Market Indices in Indonesian Stock Exchange

No	Market Indices	Definition
1	IHSG	The Indonesia Harga Saham Gabungan (IHSG) or Jakarta Composite Index (JCI) is an index that measures the price performance of all stock listed on the Indonesia Stock Exchange.
2	IDX80	The IDX80 is an index that measures the price performance of 80 stocks characterized by high liquidity and large market capitalization, supported by strong company's fundamental.
3	LQ45	The LQ45 is an index that measures the price performance of 45 stocks characterized by high liquidity and large market capitalization, supported by strong company's fundamental.
4	IDX30	The IDX30 is an index that measures the price performance of 30 stocks characterized by high liquidity and large market capitalization, supported by strong company's fundamental.
5	ISSI	The Indonesia Sharia Stock Index (ISS) is an index that measures the price performance of all stocks in Indonesia Stock Exchange classified as Sharia-compliant securities according to Sharia Securities List (DES) established by the Financial Service Authorities (OJK).

Source: Indonesia Stock Exchange, 2026

Stock liquidity denotes the ease with which stocks can be converted into cash, and conversely, how readily cash can be used to acquire the stock. Market capitalization serves as a key financial metric used to assess the total value of a publicly traded company. Higher liquidity and market capitalization generally suggest a company's strong financial ground and stable market presence. Higher liquidity indicates that its shares are actively traded, allowing investors to buy or sell large volumes without significantly affecting the stock price. Higher market capitalization signifies that the company has a large market value, often associated with established, financially sound, and less volatile firms.

Together, higher liquidity and higher market capitalization of a stock imply lower investment risk, greater stability, and higher investor trust. The total market capitalization of all stocks in Indonesia (JCI) in 2025 was USD 1 trillion, from 956 listed companies. During the same period, the United States leads with approximately 4,010 listed firms and a market capitalization of around USD 61.1 trillion, reflecting its dominant position in the global market. In contrast, China hosts roughly 5,477 listed companies with a market capitalization of USD 17.52 trillion, while Hong Kong maintains 2,686 listings with a market capitalization of USD 6.08 trillion. Meanwhile, Malaysia is home to approximately 1,032 listed companies, with an estimated market capitalization of USD 496.41 billion. Indonesia remains in an early stage of developing competitiveness within global equity markets.

Nevertheless, the considerable growth potential of Indonesia's stock market offers significant opportunities for listed companies to strengthen and expand their market positions. While substantial opportunities for further growth persist in the Indonesian stock market, the increasing trend continues to reinforce the positive momentum, indicating sustained long-term growth potential within the telecommunication industry. Consequently, the combination of favourable market conditions and robust investor participation may continue to drive the upward trend in telecommunication stocks. Figure 1.4 illustrates the movements of JCI (market movement) and PT Telkom Indonesia (Persero) Tbk's stock price (stock movement) from December 31st, 2016, to December 31st, 2025.

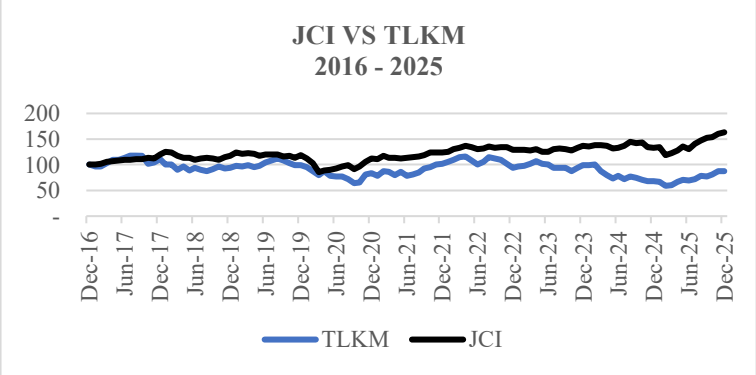


Figure 1.4 Market and stock movement from 2016 to 2025
Source: Bloomberg, rebase to 100 (February 24th, 2026)

Figure 1.4 illustrates the structural relationship between aggregate market movements and the individual stock performance of PT Telkom Indonesia (Persero) Tbk from 2016 to 2025. While historical baseline periods show a synchronized trend—suggesting that broader market momentum can be associated on individual equity performance—the longitudinal data reveal a notable decoupling in the latter half of the timeline. Specifically, from late 2021 through 2025, a stark divergence emerges where the broader market return experiences a sustained upward trajectory, whereas PT Telkom Indonesia (Persero) Tbk's stock return exhibits a prolonged downward trend. This divergence underscores that while macro-level market movements provide essential context, individual stock performance remains heavily driven by unique sector-specific dynamics, internal corporate operational shifts, and varying macroeconomic conditions.

In empirical financial literature, macroeconomic indicators are widely analysed to evaluate and forecast systemic movements within the stock market. These variables are structurally classified into leading, coincident, or lagging indicators depending on their temporal relationship with the broader economic cycle. Within the framework of capital market analysis, evaluating these indicators allows investors to make informed asset allocation decisions and optimize the timing of equity transactions. Leading indicators, such as the Treasury yield curve, assist market participants in anticipating near-term market inflections.

Coincident indicators, such as the Industrial Production Index, reflect real-time economic output to confirm the current stage of the business cycle, which frequently aligns with aggregate equity benchmarks. Conversely, lagging indicators—including inflation metrics and central bank policy interest rates—serve as vital ex-post measures that validate long-term structural economic trends and structural regime shifts.

According to Indonesia’s Central Bureau of Statistic (Badan Pusat Statistik) the Industrial Production Index (IPI) tracks the real output of manufacturing, mining, and utility sectors compared to a designated base year. The industrial sector is a key driver of job creation, consumption, and economic growth. A higher IPI indicates expansion in a nation’s industrial sector, suggesting potential economic growth as its effects ripple across various layer of the economy. Rising economic

growth may boost stock performance, as investors anticipate higher consumption and strong economic activity.

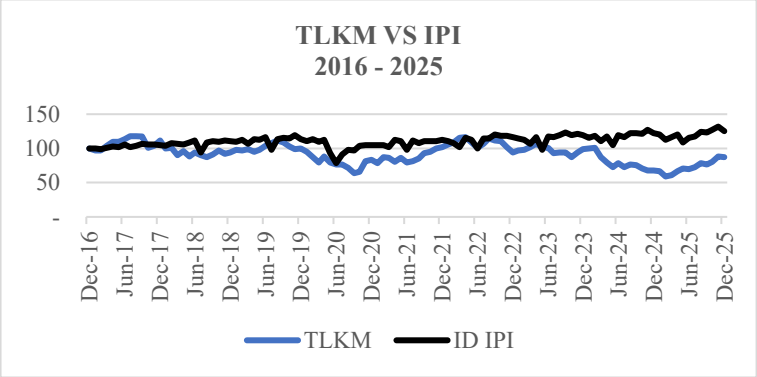


Figure 1.5 Stock and IPI movement from Dec 31st, 2016 to Dec 31st, 2025
Source: Bloomberg, rebase to 100 (February 24th, 2026)

Figure 1.5 illustrates the movement of the Industrial Production Index (IPI) alongside the stock performance of PT Telkom Indonesia (Persero) Tbk (TLKM) from 2016 to 2025. The historical data show that during major macroeconomic shocks, such as the initial onset of the COVID-19 pandemic in early 2020, both the industrial sector and TLKM's stock experienced a synchronized contraction as market-wide liquidity dried up. However, a stark structural divergence emerges in the latter half of the timeline, particularly from mid-2023 through 2025. During this period, the broader Indonesian industrial sector (IPI) underwent a sustained expansionary phase, whereas PT Telkom Indonesia (Persero) Tbk's stock return trended heavily downward. This prolonged decoupling underscores that traditional physical industrial output growth does not automatically guarantee positive momentum for digital infrastructure equities, which remain highly sensitive to sector-specific market saturation, rising capital expenditure requirements, and shifting institutional investor sentiments.

On the other hand, over the past decade, Indonesia has sustained an average annual inflation rate of approximately 3.0% to 3.5%. The aggregate shift in the price levels of goods and services within an economy, which encompasses volatile components such as food and energy, is formally classified as headline inflation. In contrast, core inflation excludes these transitory items to deliver a more stable

measure of underlying price trends. Consumer price metrics serve as vital indicators for central banks in evaluating structural inflationary pressures and formulating monetary policy, reflecting broader demand and supply dynamics rather than short-term market shocks. Figure 1.6 illustrates the trajectory of Indonesia's core inflation rate alongside the stock performance of PT Telkom Indonesia (Persero) Tbk from 2016 to 2025.

The historical data reveal a pattern where periods of moderating consumer prices frequently coincide with compressed stock returns. A decline in the inflation rate generally mirrors sluggish domestic demand and contracting production costs, indicating a broader deceleration in macroeconomic activity. For instance, during early 2017, the observed decrease in inflation occurred alongside a downward adjustment in the company's stock performance, pointing to a substantial diminishment in its explanatory power at conventional significance levels. However, in 2019, an upward shift in the inflation rate was accompanied by a notable recovery in stock returns, though this relationship experienced some divergence during the macro shocks of 2022.

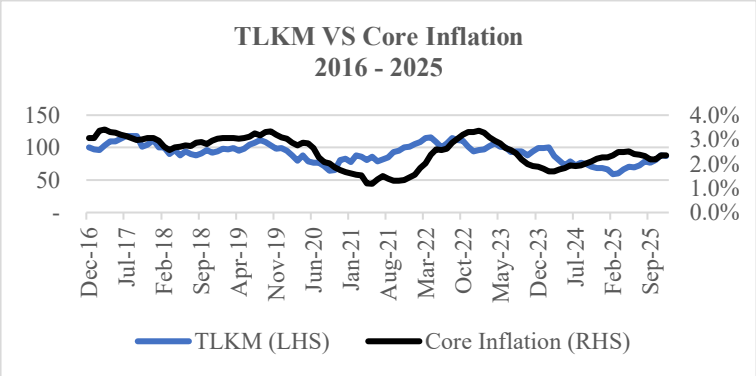


Figure 1.6 Core Inflation Rate and Stock Movement, 2016 – 2025
Source: Bloomberg, rebase to 100 (February 24th, 2026).
Note: TLKM stock performance plotted on LHS, core inflation plotted on RHS.

An increase in the core inflation rate typically prompts the central bank to implement monetary tightening measures, such as raising policy interest rates, to moderate inflationary pressures. Conversely, when core inflation declines, the central bank may adopt a more accommodative stance by lowering interest rates.

Higher interest rates are often associated with downward adjustments in capital market instruments, including equities and bonds, as borrowing costs rise and investors reassess risk premiums.

Figure 1.7 depicts the relationship between Indonesia's policy interest rate and the stock performance of PT Telkom Indonesia (Persero) Tbk over the period 2016 – 2025, highlighting the potential interaction between monetary policy dynamic and capital market response. A dovish interest rates often encourage investors to seek alternative investment opportunities that offer higher returns, rather than holding their funds in low-yield bank deposits. This portfolio reallocation reflects investors' pursuit of enhanced yield in response to a declining risk-free rate, which can stimulate increased participation in capital market instruments such as equities, corporate bonds, or higher-risk assets.

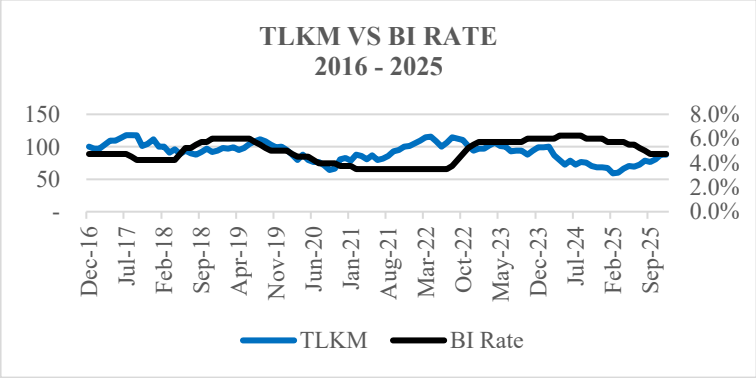


Figure 1.7 Interest rate and stock movement, 2016 – 2025
Source: Bloomberg, rebase to 100 (February 24th, 2026).
Note: TLKM stock performance plotted on LHS, BI Rate plotted on RHS.

The exchange rate fluctuations exert a pronounced structural influence on domestic equity returns due to the ownership architecture of the Indonesian capital market. According to statistical data from the Indonesia Stock Exchange (IDX), foreign institutional investors historically command a substantial presence, maintaining approximately 41% to 46% of total domestic equity ownership, while the remaining share is tightly held by domestic retail and institutional entities. This structural equilibrium implies that while domestic participants stabilize baseline market liquidity, the high concentration of cross-border institutional capital renders the exchange highly sensitive to international macroeconomic shifts. Consequently,

sharp fluctuations in the USD/IDR exchange rate can rapidly alter the risk-return calculations of foreign asset managers, triggering systemic capital reallocations that directly associated individual blue-chip equities like PT Telkom Indonesia (Persero) Tbk.

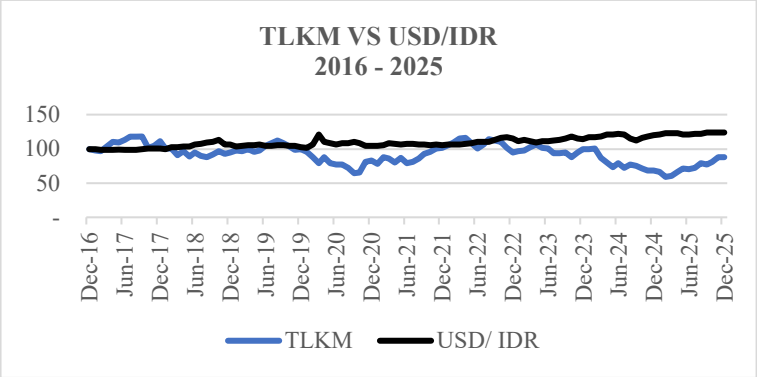


Figure 1.8 Indonesia currency and stock movement, 2016 – 2025
Source: Bloomberg, rebase to 100 (February 24th, 2026).

Figure 1.8 illustrates the dynamic interplay between the USD/IDR exchange rate and the stock performance of PT Telkom Indonesia (Persero) Tbk. Econometrically, a rising USD/IDR index signifies a depreciation of the Indonesian Rupiah, whereas a declining trajectory reflects currency appreciation. The visual data reveal that over certain horizons—particularly from late 2023 through 2025—periods of gradual Rupiah weakness (represented by the upward movement of the USD/IDR baseline) coincided with a significant expansion in Telkom's stock valuation.

This counter-intuitive trend raises the possibility that, as a domestic telecommunications giant with potentially inelastic demand, the firm's sensitivity to currency depreciation may differ from that of export-oriented or import-dependent firms — although this study does not test this mechanism directly and it should be treated as one plausible explanation rather than an established fact. Prolonged currency weakness nonetheless remains a relevant structural risk to monitor; a depreciating Rupiah may increase currency exposure risk for international fund managers, which could incentivize foreign institutional capital outflows as converting localized proceeds back into home currencies yields diminished net returns.

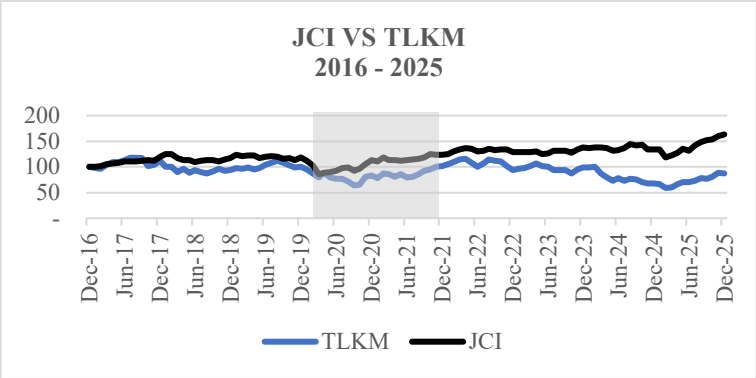


Figure 1.9 Market and stock movement from 2016 to 2025
(COVID-19 Period Highlighted)
Source: Bloomberg, rebase to 100 (February 24th, 2026).

Figure 1.9 illustrates the comparative performance of the broader Indonesian equity market and the rebased stock price dynamics of PT Telkom Indonesia (Persero) Tbk from 2016 to 2025. Benchmarked at a baseline of 100 in December 2016, the visual data reveal a structural underperformance of TLKM relative to the aggregate market index across the longitudinal timeline.

During the initial onset of the COVID-19 pandemic in early 2020, both variables suffered synchronous contractions due to systemic market panic. However, while the JCI demonstrated a robust and steady recovery trend from late 2020 onward, TLKM's trajectory was marked by prolonged volatility, hitting a severe localized trough around September 2020. This indicates that the pandemic disruptions posed intense operational headwinds for the firm that outweighed any temporary spikes in data demand.

A prominent macroeconomic decoupling occurred from 2023 through 2025. While the JCI experienced a secular bull run—surging to a rebased level of nearly 160 by late 2025—PT Telkom Indonesia (Persero) Tbk diverged sharply, declining to a trough near 60 in early 2025. This variance underscores that despite a supportive macroeconomic environment lifting the broader market, company-specific headwinds severely depressed PT Telkom Indonesia (Persero) Tbk's equity returns independent of market momentum.

A comprehensive evaluation of multiple factors is essential prior to making informed investment decisions. Investors should conduct thorough analyses of various influencing factors before arriving at sound investment decisions. Before

making investment decisions, investors should conduct a further assessment of their risk tolerance and clearly define their financial objectives, including their investment time horizon. This process enables investors to identify investment products that align with their financial objectives and risk profiles.

Throughout this study, terms such as "effect" and "affect" are used descriptively, following conventional phrasing in empirical finance research, to refer to the estimated statistical association between variables within the regression model. Given the observational, non-experimental nature of the time-series design employed in this study, these terms should not be interpreted as claims of causal effect in the experimental sense; all reported relationships reflect estimated associations rather than established causal mechanisms.

1.2. Research Problem

The stock market in Indonesia faces a gap between accelerated digital growth and low financial literacy. While the shift toward the digital economy has made telecommunications as essential part of everyday life, many individual investors still make decisions based on market sentiment, herd behaviour, or a fear of missing out (FOMO) rather than objective analysis. This reliance on speculative behaviour highlights a clear need to study how structured fundamental and technical analysis can guide better investment option in this sector. Fundamental analysis relies on macroeconomics to seek stock's value and market return to compared the stock's value is overvalued or undervalued.

Concurrently, empirical literature regarding the direct impact of macroeconomic forces on individual equity performance remains limited. Specifically, a clearer understanding is needed on how macroeconomic indicators and broader market returns systematically associated the stock returns of Indonesia's primary telecommunications provider, PT Telkom Indonesia (Persero) Tbk. Prior academic research offers constrained insights into these dynamics, particularly through the lens of an APT- derived multifactor framework tailored for single-asset sensitivity. Furthermore, major economic shocks that can disrupt market relationships, add to the complexity of the problem. The global disruption caused by COVID-19 crises introduced widespread volatility, yet we still lack a

clear understanding of how this event changed or sustained the sensitivity of PT Telkom Indonesia (Persero) Tbk stock return to macroeconomic factors. Therefore, research is needed to analyses how these economic relationships move during times of stability versus times of major crisis.

1.3. Research Questions

1. How do macroeconomic indicators systematically affect the stock returns of PT Telkom Indonesia (Persero) Tbk within a multifactor framework?
    a. How does industrial production affect stock returns of PT Telkom Indonesia (Persero) Tbk?
    b. How does inflation affect stock returns of PT Telkom Indonesia (Persero) Tbk?
    c. How does interest rate affect stock returns of PT Telkom Indonesia (Persero) Tbk?
    d. How does exchange rate affect stock returns of PT Telkom Indonesia (Persero) Tbk?
2. How do market returns affect the stock returns of PT Telkom Indonesia (Persero) Tbk within this multifactor framework?
3. How does COVID-19 pandemic moderate the effect of macroeconomic indicators on the stock returns of PT Telkom Indonesia (Persero) Tbk?
    A. How does COVID-19 moderate the effect of industrial production on the stock returns of PT Telkom Indonesia (Persero) Tbk?
    B. How does COVID-19 moderate the effect of inflation on the stock returns of PT Telkom Indonesia (Persero) Tbk?
    C. How does COVID-19 moderate the effect of interest rate on the stock returns of PT Telkom Indonesia (Persero) Tbk?
    D. How does COVID-19 moderate the effect of exchange rate on the stock returns of PT Telkom Indonesia (Persero) Tbk?
4. How does the COVID-19 pandemic moderate the effect of market returns on the stock returns of PT Telkom Indonesia (Persero) Tbk?

1.4. Research Objectives

1. To analyse the systemic effect of macroeconomic indicators (industrial production, inflation, interest rate, and exchange rate) on the stock return of PT Telkom Indonesia (Persero) Tbk using a multifactor model framework.
    A. To evaluate the specific impact of industrial production on the stock return of PT Telkom Indonesia (Persero) Tbk.
    B. To assess the specific impact of inflation on the stock return of PT Telkom Indonesia (Persero) Tbk.
    C. To determine the specific impact of interest rate on the stock return of PT Telkom Indonesia (Persero) Tbk.
    D. To examine the specific impact of exchange rate on the stock return of PT Telkom Indonesia (Persero) Tbk.
2. To analyse the effect of market returns on the stock return of PT Telkom Indonesia (Persero) Tbk within this multifactor framework.
3. To investigate whether COVID-19 pandemic moderates the effect of macroeconomic indicators on the stock return of PT Telkom Indonesia (Persero) Tbk.
    A. To investigate whether COVID-19 pandemic moderates the effect of industrial production on the stock return of PT Telkom Indonesia (Persero) Tbk.
    B. To investigate whether the COVID-19 pandemic moderates the effect of inflation on the stock return of PT Telkom Indonesia (Persero) Tbk.
    C. To investigate whether COVID-19 pandemic moderates the effect of the interest rate on the stock return of PT Telkom Indonesia (Persero) Tbk.
    D. To investigate whether COVID-19 moderates the effect of the exchange rate on the stock return of PT Telkom Indonesia (Persero) Tbk.
4. To investigate whether the COVID-19 pandemic moderates the effect of market returns on the stock return of PT Telkom Indonesia (Persero) Tbk.

1.5. Research Scope

The scope of the study include:

1. This study focuses on PT Telkom Indonesia (Persero) Tbk, which recorded a market capitalization of USD 20 billion, representing approximately 2.18% of the Jakarta Composite Index as of December 2025, while communication service sector (which include major telecommunication and media companies) accounted for approximately 7-8% for the Indonesian Stock Exchange (Jakarta Composite Index). This positions the company as the largest market capitalization entity within the communication services sector on the index. PT Telkom Indonesia (Persero) Tbk, also available on a global indices-MSCI Emerging Markets Index, FTSE Global Equity Index Series, and FTSE All-World Index- which position the company as a benchmark stock for Indonesia's telecommunication sector in global portfolios where it could facilitate passive investment flows through ETF-s and index funds.
2. The macroeconomic indicators employed in this study include the growth of the Industrial Production Index (IPI), Indonesia's core inflation rate, the Indonesia's interest rate, and the currency exchange rate of Indonesia Rupiah, relative to the U.S. Dollar.
3. The market returns referenced in the study is represented by the performance of Jakarta Composite Index (JCI), which comprises of 956 constituents from Indonesia by the end of 2025, administered by the Indonesia Stock Exchange (IDX).
4. To capture shifting market dynamics, the study's longitudinal timeline (January 1, 2017 – December 31, 2025) is decomposed into distinct operational phases:
    - Baseline Non-Crisis Periods: January 1, 2017 – February 28, 2020, and July 1, 2023 – December 31, 2025.
    - Acute COVID-19 Crisis Phase: March 1, 2020 – December 31, 2021 (capturing initial economic shocks and intense volatility).
    - Pandemic Recovery Phase: January 1, 2022 – June 30, 2023 (evaluated independently as an econometric robustness check).

5. The delineation of the Acute Crisis phase (March 2020 – December 2021) corresponds to the period of Indonesia's large-scale social restrictions (PSBB) and subsequent stricter mobility restrictions (PPKM), beginning with the government's first officially confirmed COVID-19 case announcement and mobility restriction policies in March 2020 (Kementerian Kesehatan RI, 2020), while the Recovery phase (January 2022 – June 2023) reflects the period following Indonesia's transition toward endemic status and the relaxation of mobility restrictions, culminating in the formal revocation of pandemic status (Keputusan Presiden Republik Indonesia, 2023; Kementerian Kesehatan RI, 2022)

1.6. Research Novelty and Significance

This study provides distinct theoretical and empirical contributions by extending the multi-factor Arbitrage Pricing Theory (APT) framework to evaluate equity return dynamics under macroeconomic stress. While existing Indonesian literature heavily favors market-wide or sector-level aggregates, this research pivots to a granular, firm-specific APT application focused exclusively on PT Telkom Indonesia (Persero) Tbk. By doing so, it isolates how systemic macroeconomic shocks transmit to a singular, capital-intensive digital infrastructure proxy. Furthermore, this study addresses a critical gap in emerging-market literature by introducing the COVID-19 pandemic timeline as an explicit structural moderating variable. This approach econometrically captures how structural health crises warp traditional asset-pricing mechanisms, shifting the baseline sensitivities of corporate equity to macroeconomic fundamentals before, during, and after a global crisis.

1.7. Research Structure

The study entitled "A Multifactor Model Approach to the Effect of Macroeconomic Indicators and Market Returns on the Stock Return of PT Telkom Indonesia (Persero) Tbk, with COVID-19 as a Moderating Variable." The study consisted of five chapters as follows:

1. Chapter 1 – Introduction: The first chapter described the background of the main topic of this study, towards the formulation of the research problems, research questions, and the research objectives that this study attempts to achieve. The benefits of the study, the scope and limitations, and the organization of the thesis are also provided in the first chapter.
2. Chapter 2 – Literature Review: The second chapter covers relevant theoretical concepts and the hypothesis development of the study. Previous research is also provided in the second chapter as study references.
3. Chapter 3 – Methodology: The third chapter explained the research design of the study, variable measurements, data collection procedures, data analysis techniques, hypothesis, and research process.
4. Chapter 4 – Finding, Analysis, and Discussion: The fourth chapter of the study examined the overview of companies that were included in the study. The chapter comprised findings, analysis, and results from the tested hypothesis. The highlight of this chapter is the analysis and discussion of the results.
5. Chapter 5 – Conclusion and Recommendation: The fifth chapter concluded the findings and analysis of the research on the study. Readers can find the study beneficial for future academic study or investment decisions.

1.8. Research Benefit

This study provides several valuable contributions. First, it narrows the empirical understanding of how macroeconomic indicators and overall market movements are associated with stock return behaviour through Arbitrage Pricing Theory (APT)-derived multifactor approach, thereby enriching the existing body of financial economics literature. Second, the insights generated from the analysis can help investors, financial practitioners, and portfolio managers make better-informed decision by identifying which economic variables exert the strongest associated on stock returns. Third, the outcomes of this study may assist policymakers in understanding how changes in the macroeconomic environment are transmitted to financial markets, supporting the development of policies that foster market resilience.

Lastly, the study offers knowledge that can be incorporated into financial education initiatives, helping to strengthen investor's analytical capabilities and improve the quality of investment decisions.

CHAPTER 2
LITERATURE REVIEW

2.1. Theoretical Framework

2.1.1. Arbitrage Pricing Theory

Stephen Ross (1976) developed the Arbitrage Pricing Theory (APT) to offer a broader theoretical alternative to the Capital Asset Pricing Model (CAPM). It is important to clarify that the objective of this study is not to empirically test or validate the underlying equilibrium mechanics of Ross's theory. Instead, this thesis utilizes the APT purely as a foundational framework to guide the empirical design. Equation 2.1 below depicts the mathematical formulation of the APT.

$$E(R)_i = R_f + \beta_1\big(E(I_1) - R_f\big) + \beta_2\big(E(I_2) - R_f\big) + \cdots$$

Where:

- $E(R)_i$ = Expected return of investment asset
- Rf = risk-free rate
- $\beta_1\big(E(I_1) - R_f\big) + \beta_2(E(I_2) - R_2) + \cdots$ = systematic factors

Equation 2.1 Arbitrage Pricing Theory Formula
Source: Ross (1976)

Unlike the CAPM, which simplifies systematic risk down to a single market portfolio, the APT assumes that asset returns are driven by multiple systematic forces, representing its primary theoretical advantage. Even so, Ross's original model is highly abstract, leaving these systematic factors unnamed and unspecified in a purely mathematical form. To make this abstract theory applicable for empirical analysis, modern researchers bridge the gap by replacing these latent factors with observable macroeconomic indicators. This transition from theoretical mathematical forces to concrete economic data allows for the examination of specific market channels. Rather than employing latent statistical factors, empirical applications of the APT model regularly use measurable variables—such as

inflation, policy interest rates, exchange rates, and industrial production indices—as proxies for systematic risk. Consequently, this thesis builds upon this APT-derived multifactor approach. This study does not evaluate the cross-sectional validity of the APT itself; rather, it utilizes its structured framework to investigate how specific macroeconomic forces and broader market trends jointly associated individual stock returns. This approach aligns with Fama (1996) perspective on multifactor pricing models. While the original theoretical APT was designed to predict returns for perfectly diversified portfolios under strict arbitrage assumptions, its conceptual blueprint remains highly adaptable. Furthermore, it serves as a robust foundation for the practical, factor-based empirical models utilized to analyse the complexities of contemporary financial markets today.

To maintain academic precision, this paper treats the framework as an APT-inspired multifactor model rather than an absolute asset-pricing test. It is also important to address a structural detail regarding the market return (JCI), because PT Telkom Indonesia (Persero) Tbk is a major component of the index, the regression includes a partially mechanical correlation. The estimated coefficient therefore mirrors both actual market exposure and index composition dynamics.

2.1.2. Capital Asset Pricing Model

The Capital Asset Pricing Model is a formula developed by a Nobel prize-winning American economist, William Sharpe. Sharpe (1964) calculate the expected return of an investment asset and assess its risk of the investment asset itself. The formula description as follows:

$$ER_i = R_f + \beta_i \left(ER_m - R_f\right)$$

Where:

- ER_i = the expected return of an investment
- R_f = risk-free rate
- β_i = beta of the investment
- $\left(ER_m - R_f\right)$ = market risk premium

Equation 2.2 Capital Asset Pricing Model Formula
Source: Sharpe (1964)

Further examination explained that the formula established a linear relationship between the expected return of an investment and the risk of the investment. Meaning that a higher beta (sensitivity) of the investment asset should align with the expected return of the investment asset itself. The popular terminology in day-to-day language is high-risk, high-return, low-risk, low-return, where a lower risk investment asset will produce a lower potential return, compared to a higher risk investment asset will produce an even higher potential return. For example, a stock with lower beta will have lower risk and lower potential return compared to a stock with higher beta that has higher risk and higher potential return. However, in the formula of CAPM renowned by Sharpe in 1964 only suggest a single linear factor that could change the expected return of an investment asset. Later in his book published in 1970, Sharpe further extended the treatments of the CAPM, including the multi-index and multi-factor generalizations and applications. Nevertheless, early multi-factor frameworks do not delineate a predetermined set of economically motivated factors-such as size, value or momentum- in the manner the subsequent models explicitly prescribe. In the years that followed, numerous theories enhanced it, notably the Arbitrage Pricing Theory, which posits that expected returns are shaped by multiple factors, including macroeconomic indicators.

2.1.3. The Factor Exposure Approach and Single-Asset Sensitivity

Originally introduced by Ross (1976), the foundational Arbitrage Pricing Theory (APT) was designed as a cross-sectional market equilibrium model where portfolio returns are driven by shared systematic risks and balanced out by arbitrage. Consequently, traditional validations of the theory require a vast asset universe to test this market-wide equilibrium. However, the framework's practical utility evolved through the benchmark research of Chen et al. (1986). Their findings proved that external macroeconomic shocks—such as unexpected changes in industrial production, inflation, interest rates, and currency values—wield a widespread, systematic impact on equity yields, validating a factor exposure framework to isolate how specific macroeconomic innovations register on asset performance. For market practitioners, corporate managers, and investors holding

concentrated positions in an industry leader, verifying global market equilibrium is secondary to mapping asset-specific risk sensitivities. Pragmatically, evaluating the time-series factor loadings of a single corporate entity—such as PT Telkom Indonesia (Persero) Tbk—provides strategic insights into how vulnerable or resilient its operations are to broader macroeconomic business cycles.

Measuring single-asset time-series sensitivity to macroeconomic indicators and systemic market shocks is therefore highly justifiable, effectively shifting the empirical lens from general pricing equilibrium to an applied risk exposure model.

2.1.4. The Efficient Market Hypothesis

Eugene F. Fama, often regarded as a foundation figure in modern financial theory, introduced the Efficient Market Hypothesis (EMH). The framework assert that asset prices incorporate and adjust to available information with great speed, thereby limiting the possibility of consistently achieving returns that outperform the overall market. According to Fama's Efficient Market Hypothesis, financial markets operate efficiently when security prices fully incorporate all known information, such as past price movements, public information disclosures, and insider information. Fama (1970) categorised market efficiency into three distinct forms: weak, semi-strong, and strong. Under the weak form, security prices are assumed to fully incorporate historical price data, rendering past trends ineffective for predicting future movements. The semi-strong form extends this by asserting that prices reflect all publicly available information, such as earnings announcements and stock splits. Finally, the strong form posits that prices even embed private or insider information. According to Fama, asset prices embody all accessible information, thereby limiting the possibility of consistently achieving abnormal returns. Therefore, market return (weak form) and macroeconomic indicators (semi-strong form) data should quickly price in the price of the security.

2.1.5. Macroeconomic

Davis and Powell (2012) argue that macroeconomic conditions constitute external forces that can significantly shape a firm's operational strategies. Similarly, Gunarto and Sembel (2019) emphasise that macroeconomic indicators exhibit a strong correlation with stock market performance. They further contend that these variables serve as explanatory factors for fluctuations in stock returns.

In this study, the selected macroeconomic indicators include the growth of the industrial production, core inflation rate, interest rate, and exchange rate between the U.S Dollar and Indonesia Rupiah.

2.1.5.1. Industrial Production Index

The Industrial Production Index measures the nation's actual production output from manufacturing, mining, and utilities (electricity and gas) industries. The index explained the real economy in the period and is used as one of the macroeconomic indicators. The macroeconomic indicators, such as industrial output, significantly affect asset pricing by influencing corporate earnings and investor expectations (Chen et al., 1986). Tangara et al. (2025) define the industrial production index as an indicator of economic activity that captures output levels across various industrial sectors, making it an important variable in explaining stock market movements.

2.1.5.2. Core Inflation Rate

Inflation represents a sustained increase in the aggregate price level of goods and services over time, typically measured on a year-on-year percentage basis. While headline inflation captures total price movements across an economy, central banks and economists utilize core inflation to deliver a more stable measure of underlying price trends by explicitly excluding highly volatile, transitory components such as food and energy. In macroeconomic theory, elevated inflation rates erode the purchasing power of money and dampen aggregate domestic demand. Empirically, Fischer (1993) demonstrated that high inflation is negatively associated with economic growth, showing that an inflation rate of 10% or above

systematically impairs productivity and capital investment. Similarly, Bruno and Easterly (1998) established that while moderate inflation (below 10%) remains manageable, higher inflation thresholds undermine capital market performance, savings, and overall growth. Within the Indonesian equities framework, Fredyansyah et al. (2023) incorporate inflation as a vital macroeconomic indicator reflecting fundamental economic health to evaluate its transmission mechanism onto stock returns. For capital-intensive firms like PT Telkom Indonesia (Persero) Tbk, analyzing core inflation rather than headline inflation isolates systemic structural demand pressures from short-term market supply shocks.

2.1.5.3. Interest Rate

Essentially, the interest rate is the percentage of interest relative to the capital or fund. In a simple banking scheme, an interest rate is something that investors seek in return for placing their funds with the bank. It might be the safest place to save your funds because it's considered a risk-free instrument. Meaning, investors will seek this option whenever they sense volatility in the financial market. According to Thamrin and Sembel (2020), the interest rate is included as a macroeconomic indicator reflecting monetary policy conditions and is used to analyse its effect on stock returns in the Indonesia Stock Exchange. The interest rate applied by the bank is usually the same interest rate applied by the current central bank policy in each country. For example, the U.S. central bank, now has an interest rate range of 4.25% - 4.50%, which means that the bank could give an interest rate to its client between 4.25% to 4.50% in return for their time-deposit products for a USD placement.

2.1.5.4. Exchange Rate

An exchange rate is a rate that indicates one nation's currency to another nation's currency. For example, the exchange rate of the US dollar to the Indonesian Rupiah is 1:16,500, which means that every 1 U.S. dollar is equivalent to 16,500 Indonesian Rupiah. A currency depreciation is a situation where a nation's currency decreases against another nation's currency, while a currency appreciation is a situation where a nation's currency increases against another nation's currency. The

causes of the situation vary, depending on the financial market conditions during the period. An export-oriented company should gain benefits if the currency of its nation is weaker, while an import-dependent corporation should be challenged due to increasing costs caused by currency depreciation. Dornbusch and Fischer (1980) highlighted that exchange rate shocks affect investor expectations, capital flows, and corporate earnings. According to Kosnandar (2025), the exchange rate is utilized as a macroeconomic indicator reflecting economic conditions and external sector dynamics, and it is analysed to determine its effect on stock returns in the Indonesia Stock Exchange.

2.1.6. Market Return

In financial terms, a return is what investors receive in exchange for their investment in an investment instrument. The investors either receive a positive return or a negative return, depending on the performance of the investment instrument they choose. However, a market return is a return that captures the performance of a specific market over a certain period. Usually, we can use an index to see how the market performs for a particular criterion. For example, in an equity market in each country, there are several equity indexes that are usually used by investors as their benchmark for their equity portfolio strategy. The US has its SNP500 that captures around 500 leading companies (stocks) listed on the US stock exchange. On the other hand, Indonesia also has its equity indexes to measure the performance of its equity market. *Indonesia Harga Saham Gabungan* (IHSG), established in 1982 also internationally known as Jakarta Composite Index (JCI). Fama and French (1992) confirmed that in more developed countries, market return significantly explains stock return variation.

2.1.7. Stock Return

There are many ways for a corporation to raise funds to accelerate business expansions. Corporate issuing stock is a common method used in the modern world to raise funds from the public. In return, the public will get what we call a stock return, based on the performance of the company over some time. Stock return refers to the total income from a security over a given period, including dividends

and capital gains (Bodie et al., 2014). In the efficient market, Fama (1970) emphasized that stock returns should fully incorporate all available information, thereby making abnormal returns are difficult to achieve. The information comprises historical data, corporate announcements or actions, and insider insights obtained from individuals within the organisation.

According to Ihsan (2023), stock return is employed as an indicator of investment performance that reflects how external macroeconomic conditions, market movements, and firm fundamentals affect companies listed on the Indonesia Stock Exchange.

2.2. Conceptual Framework

This study suggests that the expected return of an asset is influenced by macroeconomic indicators, which represent underlying investment risk. The research adopts the Arbitrage Pricing Theory (APT), providing a multi-factor approach to explaining variations in asset returns. Unlike the single-factor Capital Asset Pricing Model (CAPM), this study utilizes the Arbitrage Pricing Theory framework to model how Telkom's stock returns are shaped simultaneously by several systemic risk factors, where each factor determines a portion of the expected returns. For this study, macroeconomic indicators—including industrial production, core inflation, interest rates, and currency exchange rates—are treated as primary sources of systematic risk. In addition, market return reflects overall market movements and investor sentiment, serving as another influential factor. Consistent with the APT, these variables are expected to exert a linear effect on stock returns, as changes in economic conditions and market performance alter the risk compensation investors require.

Accordingly, the framework positions stock return as the dependent variable, influenced by market return and one-period lagged macroeconomic indicators as independent variables. This conceptual structure aligns with the Arbitrage Pricing Theory (APT), which posits that multiple economic forces collectively determine asset pricing, while accounting for reporting lags to eliminate look-ahead bias.

Furthermore, the model evaluates how the sensitivities of these multi-factor drivers shift when moderated by the structural shocks across different pandemic regimes. To capture these shifting market dynamics accurately, the study's longitudinal timeline (January 1, 2017 – December 31, 2025) is decomposed into distinct operational regimes:

- Baseline Non-Crisis Periods: Spanning from January 1, 2017, to February 28, 2020 (the baseline pre-crisis phase), and from July 1, 2023, to December 31, 2025 (the post-pandemic baseline).
- Acute COVID-19 Crisis Phase: Covering March 1, 2020, to December 31, 2021, capturing the initial economic shocks and intense market volatility.
- Pandemic Recovery Phase: Covering January 1, 2022, to June 30, 2023, evaluated independently within the data analysis to serve as an econometric robustness check.

Figure 2.1 below illustrates the relationship relevant to this study.

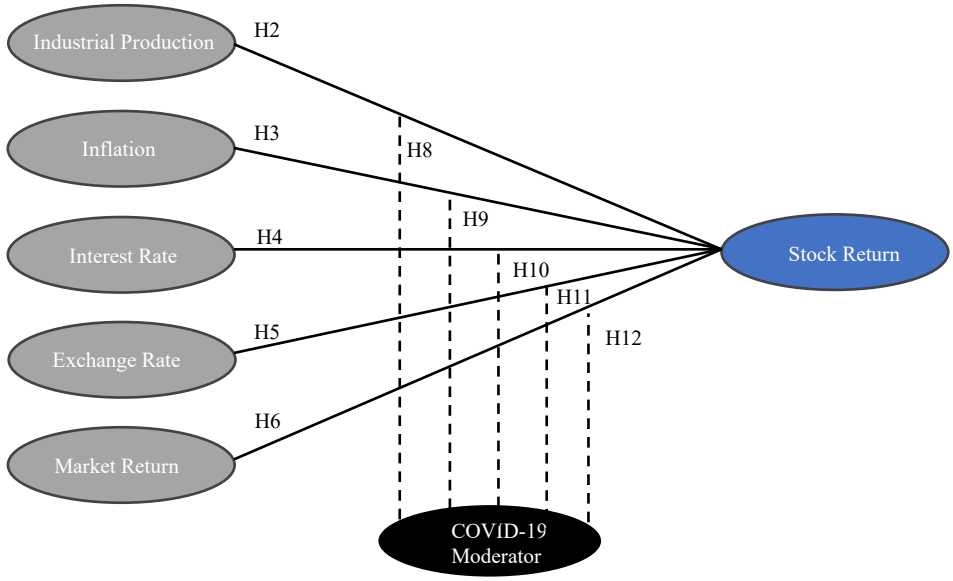


Figure 2.1 Research Framework
Noted: COVID-19 as the moderator variable presenting acute crisis and recovery
Source: Author, 2026

2.3. Hypothesis Development

Rooted in the central problem identified in Chapter 1, the formal hypotheses were formulated to directly address this primary inquiry, creating an analytical structure for the subsequent empirical tests.

2.3.1. The effect of macroeconomic indicators on stock returns of PT Telkom Indonesia (Persero) Tbk

Arbitrage Pricing Theory (APT) propose that an asset's return depends on various systematic risk factors, particularly macroeconomic indicators. Movement in variables like inflation, interest rates, and exchange rates modify corporate cash flows and investor discount rates, ultimately altering market valuations. In Indonesia, empirical evidence macroeconomic reinforces this APT framework. Gunarto and Sembel (2019) confirmed that macroeconomic factors significantly influence the stock performance of LQ45 companies on the Indonesia Stock Exchange (IDX). As a major LQ45 constituent with extensive capital requirements, PT Telkom Indonesia (Persero) Tbk is highly sensitive to these broader economic movements. Similarly, Fredyansyah et al. (2023) proved that macroeconomic shifts are critical drivers of stock returns specifically within the Indonesian telecommunications sector. This indicates that the industry's market performance is highly bound to national economic health. Furthermore, Sembel and Malau (2022) demonstrated that macroeconomic indicators remain robust determinants of stock returns, even when evaluated alongside corporate level governance and financial performance metrics.

H1: Macroeconomic indicators jointly associate with the stock returns of PT Telkom Indonesia (Persero) Tbk.

2.3.2. The effect of industrial production on stock return

A higher industrial production index typically reflects robust economic conditions, characterised by increased aggregate demand and the corresponding need for greater output to satisfy that demand. Empirical evidence suggest that the Industrial Production has a significant negative effect on the stock's return on

Jordanian stock market (Elshqirat, 2019). However, industrial production index does not exert a statistically significant influence on the stock returns of Indonesian telecommunication tower firms (Fredyansyah et al., 2023).

In addition, stock markets in the U.S. tend to move in the same direction as industrial production, confirming that both are strongly tied to the business cycle (Vatsa et al., 2024). Therefore, the hypothesis statement is as follows:
H2: Industrial production positively associated on stock returns.

2.3.3. The effect of inflation on stock return

According to Gunarto and Sembel (2019), inflation rate was insignificant in explaining the stock performance within the LQ45 index during 2008 – 2018. Fauziah (2020), found that the inflation rate had a negative effect on stock returns within telecommunication companies in Indonesia before the internet of things period (2012-2015). In addition, Fredyansyah et al. (2023) inflation has been proven to have a highly significant influence on stock returns within telecommunication tower companies. Accordingly, the hypothesis is as follows:
H3: Inflation rate negatively associated on stock returns.

2.3.4. The effect of interest rate on stock return

In recent years, many studies have explored how interest rates affect the economic growth. Fischer (1993), in a cross-country study involving over 100 nations, found that inflation coupled with elevated interest rates tends to suppress investment and productivity, ultimately leading to slower economic growth. However, Thamrin and Sembel (2020) reported that interest rates have an insignificant effect on stock returns within the consumer goods sector, suggesting that interest rates are not a critical determinant of stock performance in this industry. In addition, Kosnandar (2025) concluded that the interest rate has a negative and not significant effect on the stock return of the consumer cyclical industry in Indonesia period 2014-2023. Hence, the statement for the hypothesis is as follows:
H4: Interest rate negatively associated on stock returns.

2.3.5. The effect of exchange currency rate on stock return

Research conducted in Indonesia indicates that depreciation of the exchange rate (IDR against USD) has an adverse impact on overall stock returns (Gunarto and Sembel, 2019). This aligned with study from Ihsan (2023) where he determined that exchange rate has a negative and insignificant effect on the stock return of cellular operator companies listed in the IDX.

This suggests that the depreciation of the Indonesian Rupiah (IDR) is generally associated with a negative correlation to stock market performance. Therefore, the statement for the hypothesis is as follows:

H5: Exchange currency rate negatively associated on stock returns.

2.3.6. The effect of market return on stock return

A market return comprises many stocks traded within the respective market. This means the overall performance of these stocks will align with the market return. Therefore, Thamrin and Sembel (2020) suggesting market return positively and significantly affects the stock return in consumer goods sector. In addition, Ihsan (2023), concluded that market returns have a positive and significant effect on the stock returns of mobile operators' companies. This means that an increase in market returns, such as JCI returns, will significantly lead to an increase in these companies' stock returns. However, market return has no significant effect on stock returns of telecommunication tower companies (Fredyansyah et al., 2023). Therefore, the hypothesis is as follows:

H6: Market return positively associated on stock returns.

2.3.7. COVID-19 moderates the effect of macroeconomic indicators and stock returns of PT Telkom Indonesia (Persero) Tbk

The baseline relationship between macroeconomic indicators and stock returns can be altered or amplified by severe external shocks. The COVID-19 pandemic serves as a major moderating variable because it fundamentally disrupted traditional economic system, increased market volatility, and altered operational environments. From APT perspective, a systemic crisis reshapes investor risk

premiums and changes how sensitive a stock is to standard economic signals. The shock of COVID-19 changed investors risk perceptions and market pricing dynamics, a shift conceptually similar to how market pricing behaviours adjust during periods of heightened financial distress or uncertainty (Malau and Murwaningsari, 2018). Furthermore, Fredyansyah et al. (2023) specifically examined Indonesian telecom infrastructure ecosystem, concluding that the COVID-19 pandemic deeply affected and altered the drivers of stock returns. During the pandemic, typical macroeconomic signals interacted differently with capital markets due to social restrictions and sudden digitalization.

H7: COVID-19 jointly moderates the effect of macroeconomic indicators on the stock returns of PT Telkom Indonesia (Persero) Tbk.

2.3.8. COVID-19 moderates the impact of industrial production on stock return

Kamin and Kearns (2021) found that readings on the number of COVID-19 deaths has a statistically significant by small effect on industrial production in the aggregate sample, though it was more important in wealthier countries. Lebedeva and Moskalenko (2021) showed that COVID-19 hit the industrial sectors mainly in April 2020, leading to a 16.1% declined in industrial production in Ukraine and an 18.6% decline in the EU. Hassan et al. (2024) revealed significant negative relationships between interest rates, exchange rates, the industrial production index, and the movement of the stock market index from the ASEAN-5 nation-Malaysia, Indonesia, Singapore, Thailand, and Philippines- during COVID-19. The declined in the industrial production index leads to reduced output and revenue from industrial companies, consequently causing a decrease in their profits. This reduction in corporate earnings can generate pessimistic sentiment among investors, prompting them to sell off stocks and ultimately leading to a decline in the stock market index. Hence, the hypothesis is as follows:

H8: COVID-19 moderates the impact of industrial production on stock return.

2.3.9. COVID-19 moderates the impact of inflation rate on stock returns

Research on U.S. and European markets indicates that, during the COVID-19 period, conventional macroeconomic indicators such as inflation became less effective in explaining stock return movements. Investor behaviour was largely shaped by pandemic-related uncertainty and government interventions, which overshadowed the influence of inflation (Thorbecke, 2025).

According to International Monetary Fund (2021), the report indicates that COVID-19 strengthened the trend of failing inflation, thereby diminishing the typical influence of inflation on economic activity and stock market performance. Therefore, the hypothesis is as follows:

H9: COVID-19 moderates the impact of inflation rate on stock returns.

2.3.10. COVID-19 moderates the impact of interest rate on stock returns

Kosnandar (2025) concluded COVID-19 positively moderating the interest rate impact on the stock return within the consumer goods sector. Hassan et al (2024) found strong negative correlations between interest rates, exchange rates, the industrial production index, and stock market movements across the ASEAN 5 nations-Malaysia, Indonesia, Singapore, Thailand, and the Philippines- during the COVID-19 period. Therefore, the hypothesis is as follows:

H10: COVID-19 moderates the impact of interest rate on stock returns.

2.3.11. COVID-19 moderates the impact of exchange currency rate on stock returns

Hussain et al. (2024) identified that foreign exchange and stock markets are connected and volatility spillover occurred during pandemic-induced crises. Similarly, the evidence of volatility connectedness and spillover across BRICS-Brazil, Russia, India, China, and South Africa- countries are also significant. Kosnandar (2025) found COVID-19 positively moderating the exchange rate impact on the stock return in consumer cyclical sector.

Ihsan (2023), showed COVID-19 significantly moderated the effect of the exchange rate on the companies' stock return in a negative direction. Hence, the hypothesis is as follows:

H11: COVID-19 moderates the impact of exchange currency rate on stock returns.

2.3.12. COVID-19 moderates the impact of market return on stock returns

Herwany et al. (2021), found the stocks on the Indonesia Stock Exchange (IDX) were affected by the COVID-19 pandemic with a cumulative negative value of the average abnormal return sample. Ihsan (2023), determined that COVID-19 does not moderate the effect of market return on the stock returns within the cellular operator companies listed on the IDX. Kosnandar (2025), also showed COVID-19 was not moderating the market return impact on the stock return within the consumer cyclical sector in Indonesia. Therefore, the hypothesis is as follows:

H12: COVID-19 moderates the impact of market return on stock returns.

2.4. Previous study

Table 2.1 Previous Studies

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
1	Tangara et al. (2025) Revisiting Arbitrage Pricing Theory (APT) In Emerging Markets: Evidence from the Indonesia Stock Exchange	• Stock Market Index • Inflation • Interest rate • Exchange rate • Economic growth • Industrial production index	• This study examines the applicability of the Arbitrage Pricing Theory (APT) in the Indonesia Stock Exchange (IDX) by analysing its relationship with macroeconomic factors. • The results show a long-term relationship between stock returns and variables such as industrial production, inflation, and exchange rates, with Granger causality indicating that these macroeconomic factors influence stock market movements.	• While Tangara et al. (2025) successfully validate the long-term equilibrium and causal relationships between macroeconomic factors and stock returns within the broad Indonesia Stock Exchange (IDX), the analysis was strictly limited to the aggregate market level. • Consequently, a research gap exists as the study fails to examine asset pricing dynamics at an individual corporate entity level. • Furthermore, the research does not

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
			• However, the positive Error Correction Term (ECT) suggests that stock returns do not quickly return to equilibrium, challenging the practical validity of APT in the Indonesian market. • Overall, the findings highlight the complexities of applying APT in emerging markets and suggest the need for further research.	incorporate market returns or account for the disruptive capacity of external structural shocks, such as the COVID-19 pandemic, as a moderating variable within their Arbitrage Pricing Theory (APT) framework. • The current study addresses this oversight by narrowing the analytical scope to PT Telkom Indonesia (Persero) Tbk and evaluating the interaction effects of the pandemic.
2	Shen (2025) Beyond CAPM: The Rise and Relevance of Arbitrage Pricing Theory in Modern Investment Strategies	• Inflation • Interest rate • GDP Growth Rate • Market Index • Exchange Rate • Commodity Prices	• The Arbitrage Pricing Theory (APT) explains risk–return relationships using multiple economic factors, offering more comprehensive risk evaluation and portfolio alignment than the single-factor CAPM. • APT offers flexibility allows it to adapt to changing economic conditions, making it relevant for modern investment strategies. • With advancements in data analytics and machine learning, APT has the potential to become an even more robust framework for analysing asset risk and return in increasingly complex financial markets.	• The primary of the study by Shen (2025) stems from its purely conceptual and theoretical nature, which focuses on the qualitative relevance of the Arbitrage Pricing Theory (APT) in modern investment strategies. • The study lacks empirical execution, leaving a distinct gap regarding how multi-factor macro indicators and market returns operationally interact to affect a specific corporate entity's stock return. • Additionally, it provides no empirical framework to assess how these theoretical relationships are altered during global economic crises. • This research fills this empirical void by applying a

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
				quantitative asset pricing model to real-world financial and macroeconomic data.
3	Sari and Sumarto (2025) The Influence of Macroeconomic Variables on Stock Returns through the Arbitrage Pricing Theory Approach	• Stock Prices • IPI (industrial production index) • Inflation • Exchange Rates • Interest Rate	• The study finds that surprise changes in the Industrial Production Index (IPI) and the rupiah exchange rate significantly affect stock returns in the SRI-KEHATI Index, particularly after the pandemic, while inflation, BI interest rates, and Brent oil prices show no significant impact. • The results suggest that investors are increasingly making more rational, fundamentals-based decisions, and that sustainability-oriented stocks are becoming more responsive to macroeconomic conditions. • The study also recommends combining quantitative asset pricing models with qualitative ESG analysis and expanding future research to include other major stock indices for broader market insights.	• Sari and Sumarto (2025) offer valuable insights into the post-pandemic macroeconomic sensitivities of sustainability-oriented stocks; however, their empirical focus is confined to a portfolio index level, specifically the SRI-KEHATI Index. • This leaves a significant gap in literature regarding the macroeconomic vulnerabilities of individual, critical-infrastructure corporate entities. • Moreover, while they acknowledge a post-pandemic shift in investor rationality, they do not statistically test external global crises as an explicit moderating variable within the macro-to-stock-return transmission mechanism. • The present study bridges this gap by positioning COVID-19 as an empirical moderator for a singular corporate case.
4	Vatsa et al. (2024) Stock Markets Cycles and Macroeconomic Dynamics	• Stock market index • The industrial production index (IPI) • Total non-farm employment (NFE)	• The study shows that the relationship between U.S. stock markets and macroeconomic	• Although Vatsa et al. (2024) provide a robust evaluation of the shifting cyclicality between

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
		• The consumer price index (CPI)	cycles changed between 1980 and 2020. • Stock markets shifted from being countercyclical in the 1980s–1990s to procyclical in the 2000s–2010s, generally lagging business cycles by 1–3 months, while the correlation with inflation also turned from negative to positive. • The findings suggest that the S&P 500 may no longer serve as a reliable leading indicator of economic activity, and that results depend strongly on the filtering method used, with the Hamilton filter and random walk models providing more consistent outcomes than the Hodrick–Prescott filter.	macroeconomic cycles and stock markets, their empirical boundaries are restricted to the United States macro-environment and aggregate index behavior (S&P 500). • A geographic and structural research gap remains, as their broad market-level findings cannot be readily generalized to individual corporate equities within emerging markets like Indonesia. • This research addresses this limitation by contextualizing the asset pricing dynamics within the Indonesian telecommunications sector, evaluating a firm-specific equity rather than an aggregate market index.
5	Hussain, Bashir, & Rehman (2024) Exchange Rate and Stock Prices Volatility Connectedness and Spillover during Pandemic Induced-Crises: Evidence from BRICS Countries	• Exchange rates • Stock prices	• This study analyses volatility connectedness between exchange rates and stock markets in BRICS countries during the COVID-19 crisis. • The results show significant volatility spillovers between these markets and across countries, particularly between Russia–India and Brazil–South Africa, while China shows weaker connections. • These findings highlight the importance of considering cross-market and cross-country volatility when designing	• Hussain, Bashir, and Rehman (2024) investigate financial market interconnectedness during crisis periods, yet their methodological scope is limited to cross-border volatility spillovers and exchange rate linkages across the BRICS economic block. • The study exhibits a clear gap as it does not map these macroeconomic shocks down to firm-level stock returns, nor does it adopt a comprehensive, multi-factor Arbitrage Pricing

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
			portfolio diversification strategies and financial policies, especially during crisis periods like pandemics.	Theory (APT) approach. • This study differentiates itself by shifting the focus to the Indonesian equity landscape, executing an individual asset pricing analysis under multi-factor conditions.
6	Hassan et al. (2024) Analysing The Impact of Macroeconomic Factors on Stock Market Performance in Asean-5 Countries	• Stock Market Index • INT (interest rate) • CPI (Consumer Price Index) • EXR (exchange rate) • IPI (industrial production index)	• This study examines the impact of macroeconomic variables on ASEAN-5 stock markets during the COVID-19 pandemic using monthly data from 2012–2022. The results show that interest rates, exchange rates, and the industrial production index negatively affected stock market indices, while the consumer price index had a positive effect. • The findings highlight how crises reduce corporate performance and increase investor risk aversion, leading to stock market declines. • The study suggests investors and policymakers closely monitor macroeconomic stability and recommends future research include additional variables and broader country comparisons.	• The research effectively demonstrates the adverse impacts of macroeconomic volatility on the broad stock market performance of ASEAN-5 countries during the pandemic. • However, by maintaining a regional and aggregate index focus, their study creates a gap regarding how individual defensive or essential corporate sectors, such as telecommunications, responded to these regional macroeconomic pressures. • This paper resolves this gap by providing a micro-level, company-specific examination of PT Telkom Indonesia (Persero) Tbk within the ASEAN macroeconomic climate.
7	Alfredo (2023) Analysis Of Expected Stock Returns In 2020 - 2022 Using Arbitrage Pricing Theory (Study on Stocks Incorporated	• Stock Prices • Inflation • USD exchange rate • BI-7 Days Repo Rate • Bonds • Interest Rate	• The study concludes that, based on the Arbitrage Pricing Theory (APT) model, new mining sector issuers are expected to generate	• While the research utilizes the Arbitrage Pricing Theory (APT) framework on the IDX-30 index during a timeline heavily marked by

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
	with The IDX-30 Index on The Indonesia Stock Exchange)		high returns in 2021 and 2022. • The USD exchange rate is the most influential factor affecting expected stock returns during 2020–2022, while in 2021–2022 the Jakarta Composite Index (JCI) had a stronger impact on the expected returns of IDX-30 stocks than inflation.	the pandemic, the study's conclusions and sector-specific focus are heavily skewed toward the mining sector. • Different industries exhibit distinct structural sensitivities to macro shocks and market returns, a research gap exists concerning the applicability of these findings to non-commodity, infrastructure-heavy industries like telecommunications. • This study directly addresses this sectoral gap by examining PT Telkom Indonesia (Persero) Tbk
8	Akel & Cisse (2023) Test Of Arbitrage Pricing Theory on Stock Indices: An Empirical Study on Bist100	• Stock Market Index • Interest Rate • Inflation Rate • Gross Domestic Product • Exchange Rate • Industrial Production Rate	• This study tests the validity of the Arbitrage Pricing Theory (APT) in Türkiye using data from 2009–2020, with the BIST100 index and five macroeconomic variables (interest rate, exchange rate, inflation, industrial production, and GDP). • The results show both long- and short-term relationships between macroeconomic factors and the stock market, with a negative error correction term indicating market adjustment over time. • Overall, the findings suggest relatively lower investment risk and limited chances of earning abnormal	• Akel and Cisse (2023) confirm the empirical validity of the APT model; however, their study is geographically and contextually bound to the Turkish equity market via the BIST100 index. • A notable research gap emerges from their reliance on broad market index variations, and their omission of firm-specific market returns and external health-induced global crises as interactive components. • The present research fills this gap by testing the empirical consistency of the APT model within the unique structural framework of the Indonesian telecom industry.

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
			returns in the long run.	
9	Ihsan (2023) The Impact of Macroeconomics, Market Return, and Financial Performance with Moderating Variable of COVID-19 Pandemic on Mobile Operator Companies Stock Return Listed on IDX	• GDP growth • Exchange rate • Market return • ROE • NPM • CR • TATO • DER • COVID-19	• Through t-test results in the study showed that in partially GDP growth and exchange rate has no significant effect on stock return of mobile operator companies listed in IDX during 2012 to 2021. • The COVID -19 pandemic also does not moderate the partial effect of GDP growth and market return.	• Ihsan (2023) evaluates mobile operator stock returns during the pandemic era by blending corporate internal financial performance metrics with select macroeconomic variables. • However, this study exhibits a theoretical gap as it fails to employ the structured multi-factor framework of the Arbitrage Pricing Theory (APT). • Furthermore, the study concluded that COVID-19 failed to significantly moderate the effects of market returns and GDP growth. • This research aims to address these conflicting empirical findings by utilizing a strict APT model to re-examine the moderating influence of COVID-19 on a dominant market leader.
10	Kosnandar (2025) Financial Performance, Macro Economy, and Market Return Impact on Stock Return: Study of Consumer Cyclical Indonesia Period 2014-2023	• Asset efficiency • Liquidity • Profitability • Exchange rate • Interest rate • Market return • COVID-19	• Foreign exchange rate has a positive and not significant impact on the stock return of the consumer cyclical industry in Indonesia. • Interest rate has a negative and not significant impact on the stock return of the consumer cyclical industry in Indonesia. • COVID-19 positively moderating the exchange rate and	• The literature contribution of Kosnandar (2025) is explicitly constrained to the Consumer Cyclical industry, which traditionally displays highly elastic sensitivities to economic downturns. • Consequently, a sectoral gap is identified, as these findings cannot be theoretically superimposed onto consumer-essential,

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
			interest rate on the stock return. • COVID-19 is not moderating the market return impact on the stock return.	non-cyclical infrastructure providers. • Additionally, the study conflates internal accounting ratios with macroeconomic indicators. • The current study fills this gap by utilizing a dedicated, external-variable APT framework applied to a vital telecommunication giant.
11	Halim (2023) The effect of fundamental and macroeconomic factors on the financial performance of PT Adaro energy Indonesia Tbk and the impact of COVID-19 pandemic on its stock return	• Leverage (Debt to Equity) • Liquidity (Current Ratio) • Asset Turnover (Total Asset Turnover) • Cash Conversion Cycle (Cash Conversion Cycle days) • Forex Return • Market Return • Coal Price Return (ICE Futures Coal Return)	• ADRO stock returns were found to be positively associated with market return and coal price return and were highly significant. • COVID -19 moderated the effect of market return and forex return to the ADRO's stock return was positive significant.	• Halim (2023) examines the interaction of fundamental and macroeconomic factors on stock returns during the pandemic. • However, the empirical scope is restricted to the energy and mining sector through a case study on PT Adaro Energy Indonesia Tbk. • Consequently, a significant sectoral and theoretical gap exists, as Halim's framework relies heavily on sector-specific commodity benchmarks—namely coal price returns—and internal corporate financial ratios. • These findings cannot be theoretically generalized to non-commodity, essential service industries. The current study addresses this gap by removing corporate accounting ratios and commodity dependencies, applying a strict Arbitrage Pricing

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
				Theory (APT) framework to evaluate how general macroeconomic indicators and market returns affect a vital telecommunications infrastructure asset (PT Telkom Indonesia Persero Tbk) under the moderating influence of COVID-19.
12	Fredyansyah, Sembel, & Malau (2023) The Impact Of Macroeconomics, Market Return, Financial Performance, Market Perception, And COVID-19 On Stock Returns on Telecommunication Tower Companies in Indonesia	• Return on Equity (ROE) • Current Ratio (CR) • Total Assets Turnover Ratio (TATO) • Debt to Equity Ratio (DER) • Price-to-earnings ratio (PER)	• The results indicate that inflation and the price-earnings ratio (PER) have a highly significant effect on stock returns. • In contrast, other variables including industrial production index (IPI), exchange rate, market return, ROE, CR, TATO, DER, and COVID-19 do not significantly influence the stock returns of telecommunication tower companies.	• Fredyansyah, Sembel, and Malau (2023) focus their empirical efforts on telecommunication tower companies, concluding that the majority of macroeconomic indicators, market returns, and the pandemic context yielded statistically insignificant effects on stock returns. • A critical research gap remains regarding whether these factors become highly significant when shifting the unit of analysis from auxiliary tower leasing utilities to the primary network operator. • This study resolves this ambiguity by testing the model directly on the principal operator, PT Telkom Indonesia (Persero) Tbk.
13	Garnia et al. (2024) The Impact of the Last Two Presidential Periods on the Performance of the Indonesia Stock Exchanges: An	• Stock Index Return • Government Leadership Period • Market Index Return • Exchange Rate • Reference Interest Rate • Crude Oil Price	• This study finds that macroeconomic factors significantly influence stock returns, with global stock indices being the most dominant factor during both	• Garnia et al. (2024) present an APT approach that categorizes macroeconomic and stock index shifts across political milestones,

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
	Approach of Arbitrage Pricing Theory	• Brent Oil Futures Price • Commodity Prices • Gross Domestic Product • Money Supply • Inflation • Corruption Perception Index	the SBY and JKW presidencies. • Other variables such as China and Arab indices, oil prices, and inflation also affect returns, though their impacts vary across periods. • The findings suggest investors should closely monitor global market performance and macroeconomic conditions when making investment decisions.	specifically the Indonesian presidential administrations. • While this addresses institutional and policy shifts, it leaves a structural gap concerning how non-political, black-swan biological crises, such as the COVID-19 pandemic, disrupt asset pricing dynamics. • The current inquiry fills this gap by shifting the analytical lens from political eras to an explicit pandemic-moderated timeline.
14	Nyanga and Qutieshat (2022) Progress Made towards Consensus on Arbitrage Pricing Theory Macroeconomic Factors: A Brief Review of Literature	• Interest Rate • Inflation • Exchange Rates • GDP • Industrial Production • CPI • Money Supply • Oil Prices • Market Index • Reserves	• This study reviews progress in identifying macroeconomic factors for the Arbitrage Pricing Theory (APT). While interest rates show a consistent positive relationship with stock returns, there is still no full consensus on other factors. • The study suggests further testing of additional variables, industrial production, exchange rates, money supply, and inflation, across different economies.	• Nyanga and Qutieshat (2022) provide a comprehensive review of existing literature, highlighting a persistent global lack of empirical consensus regarding which exact macroeconomic factors definitively formulate the APT model. • Given that their study is entirely secondary and qualitative, a distinct empirical gap persists. This research directly services this gap by answering the authors' explicit academic call to run localized empirical tests of multi-factor asset pricing models within specific developing market contexts.
15	Chen and Zhang (2022)	• Stock Prices	• This study finds that pairs trading strategies in the energy market	• The work of Chen and Zhang (2022) focuses on the operational

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
	COVID-19 Effects on Arbitrage Trading in the Energy Market		performed significantly worse during the COVID-19 pandemic, with lower returns and Sharpe ratios compared to the pre-pandemic period. • The results indicate that strategies effective before the pandemic became less reliable afterward, highlighting the disruptive impact of COVID-19 on trading performance. • The study suggests that adapting models and incorporating new analytical approaches is necessary to improve trading strategies in crisis conditions.	performance of short-term pairs trading and arbitrage strategies strictly within energy commodity markets during the pandemic. • Thus, a significant gap exists regarding equity-based asset pricing models within consumer service fields. This study addresses this literature deficit by shifting the focus from commodity-based transaction arbitrage to equity risk-return modelling via the Arbitrage Pricing Theory framework.
16	Ginting (2022) The Impact of Macroeconomics on Stock Performance with Moderating Variable of COVID-19 on Healthcare Companies Listed on Indonesia Stock Exchange 2018-2021.	• GDP growth • Inflation rate • Interest rate • Exchange rate • Stock return • COVID-19	• GDP growth and interest rate do not affect the stock return in healthcare industry during period 2018-2021. • Inflation rate and exchange rate negatively affect the stock return in healthcare industry during period 2018-2021. • COVID-19 does not moderate the effect of GDP growth to the stock return in healthcare industry during period 2018-2021. • COVID -19 moderates the effect of inflation rate and exchange rate to the stock return in healthcare industry during period 2018-2021.	• Ginting (2022) successfully utilizes COVID-19 as an empirical moderating variable but restricts the study's dataset exclusively to listed Healthcare companies. • Because healthcare firms experienced immediate, unique medical demand shocks during a health crisis, a research gap exists regarding how other pandemic-impacted industries behaved. • Furthermore, Ginting's model omits the integration of market returns and an APT structure. • The current study bridges this gap by exploring the telecommunications sector under a

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
				unified APT and market return framework.
17	Herwany et al. (2021) The Influence of the COVID -19 Pandemic on Stock Market Returns in Indonesia Stock Exchange	• Average Stock Return	• The COVID-19 outbreak negatively affected several sectors on the Indonesia Stock Exchange. • Financial, property, real estate, and construction sectors experienced declining abnormal returns, while infrastructure, utilities, and transportation remained relatively stable and some other sectors saw increases. • Overall, the financial sector was the most impacted, followed by trade, service, and investment sectors, largely due to reduced economic activity and investor uncertainty. • Event study results confirm that COVID-19 caused significantly negative market returns, with declines lasting up to 22 days after the event.	• Herwany et al. (2021) utilize a short-term event study methodology to map immediate, post-outbreak market abnormal returns across various sectors on the IDX. • While their findings provide crucial short-term shock insights, their design leaves a long-term research gap regarding how prolonged pandemic conditions continuously interacted with systemic macroeconomic indicators. • This study resolves this gap by constructing a longitudinal APT model that treats the pandemic era as a sustained statistical moderator rather than a brief event window.
18	Fauziah (2020) The Effect of Financial Ratios, Market Return, and Macroeconomic Factors on The Stock Return in Indonesia Telecommunication Companies During The Period Before and After The Internet of Things (IoT) Services From 2012 to 2019.	• Net Profit Margin (NPM) • Return on Asset (ROA) • Return on Equity (ROE) • Current Ratio (CR) • Total Assets Turnover Ratio (TATO) • Debt to Equity Ratio (DER) • Market Return • GDP growth rate • Inflation rate • Interest rate • Exchange rate	• Market return does not affect the stock return before and after IoT service period. • GDP growth rate does not affect the stock return before and after IoT period. • Inflation rate is negatively and significantly affect the stock return before IoT period while inflation rate does not affect the stock return after IoT period.	• Fauziah (2020) evaluates the stock returns of Indonesian telecommunications companies against market and macro factors, but caps the longitudinal data scope at 2019 to observe the structural impact of Internet of Things (IoT) services. • Consequently, an era-specific research gap is evident, as the study completely predates the

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
				unprecedented economic realities brought forth by the pandemic. • This research directly updates and expands upon Fauziah's work by extending the timeline into the COVID-19 era and implementing a crisis-moderation design.
19	Thamrin and Sembel (2020) The Effect of Company's Fundamental, Market Return and Macroeconomic to Stock Return: A Case Study of Consumer Goods Companies Listed in BEI Period 2009-2018.	• Current Ratio (CR) • Total Asset Turnover Ratio (TATO) • Return on Assets (ROA) • Debt to Equity Ratio (DER) • EPS Yield • Market Return • GDP • Interest rate • Exchange rate	• Market return positively and significantly affects the stock return. • GDP and interest rate insignificantly affect the stock return. • Exchange rate affects the stock return with negative correlation. • Company's fundamental, market return and macroeconomic collectively affect the stock return.	• The empirical boundaries of the study conducted by Thamrin and Sembel (2020) are restricted to Consumer Goods companies and are bound to a pre-pandemic historical timeline from 2009 to 2018. This leaves a clear research gap concerning both industry sector relevance and temporal alignment with modern macroeconomic crises. • By removing internal fundamental metrics and focusing strictly on an APT-aligned macro framework during a pandemic-moderated timeline, this study presents a necessary update to asset pricing literature.

No	Author and year	Research variables relevant this study	Conclusion	Research Gap
20	Elshqirat (2019) An Empirical Examination of the Arbitrage Pricing Theory: Evidence from Jordan.	• GDP • Exports • Unemployment • Industrial Producers' price index (IPPI)	• GDP, Exports, and unemployment variables were insignificant to stock's return. • IPPI had a significant negative relationship with stocks' returns.	• Elshqirat (2019) provides an empirical examination of the APT model, but the dataset is entirely bound to the Middle Eastern economic climate of Jordan and utilizes pre-crisis variables such as localized national export figures and unemployment rates. • A geographic and contextual gap is apparent. The present study addresses this gap by localizing the multi-factor APT framework within a major Southeast Asian emerging market (Indonesia) and modifying the model to account for modern, globally integrated health-crisis disruptions.

CHAPTER 3
METHODOLOGY

3.1. Research Design

The study aims to test how macroeconomic indicators and market return are associated with the stock return of PT Telkom Indonesia (Persero) Tbk. In addition, the study investigates whether COVID-19 moderates the strength of this association. This design is based on an Arbitrage Pricing Theory (APT) inspired multifactor time-series model, which posits that asset returns are systematically affected by multiple economic factors. This study employs a quantitative, observational research design. Previous studies have emphasized the importance of quantitative approaches when examining relationships between economic variables and corporate outcomes (Sembel and Malau, 2022; Malau and Murwaningsari, 2018). International studies also highlight the relevance of causal research designs in finance, noting their ability to identify the impact of macroeconomic shocks on asset returns (Kumar et al., 2023; Hoffman et al., 2024). These precedents reinforce the suitability of the chosen methodology for this study.

The macroeconomic factors adopted in this study are industrial production, core inflation, interest rate, and exchange rate. These variables are selected because they represent fundamental sources of systematic risk that influence corporate performance and investor expectations, as suggested in the APT framework. Industrial production is used as a proxy for overall economic activity and reflects the level of real sector productivity that can affect corporate revenues and market confidence. Inflation captures changes in purchasing power and cost structures, which may influence profit margins and valuation. The interest rate represents the cost of capital and the attractiveness of alternative investments, thereby affecting portfolio allocation decisions and stock demand. Meanwhile, the exchange rate reflects external sector conditions and currency risk, which are particularly relevant for firms with exposure to international transactions and foreign-denominated inputs or revenues (Fischer & Merton, 1984; Vatsa et al., 2024).

These macroeconomic indicators are widely employed in prior APT-based studies because they capture broad economic conditions that cannot be diversified away by investors. Changes in these indicators signal shifts in economic stability, monetary policy stance, and market expectations, which are transmitted into stock price movements through investors' risk assessment and return requirements. By incorporating these factors, this study aligns with the APT assumption that stock return is influenced by multiple economic factors. Furthermore, this study acknowledges that the market return proxy (JCI) inherently includes PT Telkom Indonesia (Persero) Tbk as a constituent representing approximately 2,18% of the index's market capitalization weighting as of December 2025. Because the dependent variable is partially embedded within the independent variable by construction, the estimated coefficient on market return is expected to be mechanically inflated relative to its true economic association, independent of any genuine risk-pricing relationship. This constitutes a structural limitation of the study rather than a testable hypothesis, and is addressed further in Chapter 5.



Figure 3.1 Research Design
Source: Author, 2026

3.2. Research Procedure

This study follows a quantitative, observational using time series regression analysis within the framework of the Arbitrage Pricing Theory (APT) inspired framework. The procedure begins with the identification of variables and the specification of the research model based on the research questions and theoretical foundation. The dependent variable in this study is the stock return of PT Telkom Indonesia (Persero) Tbk, while the independent variables consist of industrial production, core inflation, interest rate, currency exchange, and market return. COVID-19 is incorporated as a moderating variable represented by a dummy variable. Two regression models are specified to examine both the direct effects of macroeconomic factors and the moderating role of COVID-19.

The next stage involves the collection of secondary data with monthly frequency from reliable sources. Stock price data are obtained from the Indonesia Stock Exchange, and Bloomberg while macroeconomic data such as industrial production, core inflation, interest rate, and exchange rate are collected from Bank Indonesia and the Central Statistics Agency (BPS). Market return data are collected from the Indonesia Stock Exchange. All data are aligned to the same period and frequency to ensure consistency in analysis.

After data collection, the data are transformed into appropriate forms for regression analysis. Stock prices and market index values are converted into returns, while macroeconomic indicators are expressed in growth rates or percentage changes when necessary. The COVID-19 variable is transformed into two separate binary dummy variables to prevent blending distinct economic phases: one representing the Acute Crisis phase and another representing the post-pandemic Recovery phase, with the pre-pandemic period serving as the baseline (coded as 0).

Since the study employs time-series data, a stationarity test using the Augmented Dickey-Fuller (ADF) method is conducted for all variables to avoid spurious regression. If any variable is found to be non-stationary, differencing is applied until stationarity is achieved. After ensuring stationarity, and prior to final model interpretation, classical assumption tests are conducted on both specified models. These include tests for normality, heteroskedasticity, autocorrelation using the Durbin-Watson statistic, and multicollinearity using Variance Inflation Factor

(VIF) and tolerance values. Multicollinearity diagnostics are applied to both models, whereas mean-centering is applied specifically to Model 2, in which interaction terms between the independent variables and the COVID-19 dummy are constructed, in order to mitigate the structural multicollinearity inherent to interaction effects in Moderated Regression Analysis (MRA). The Durbin-Watson statistic is used as an initial diagnostic to detect the presence of first-order autocorrelation; if autocorrelation or heteroskedasticity is detected, the regression models are re-estimated using Heteroskedasticity and Autocorrelation Consistent (HAC) or Newey-West robust standard errors, with the Durbin-Watson statistic serving solely as a diagnostic indicator rather than a basis for re-estimation. Furthermore, to ensure the validity of the Durbin-Watson test, both models are specified without lagged dependent variables, and the computed d value is evaluated against the lower (d_L) and upper (d_U) critical bounds at a 5% significance level to confirm the absence of first-order autocorrelation.

The first regression model is then estimated to examine the direct influence of macroeconomic indicators and market return on the stock return of PT Telkom Indonesia (Persero) Tbk. The results are evaluated using the F-test to assess the simultaneous effect of all variables, the t-test to assess the partial effect of each variable, and the adjusted R^2 to measure the explanatory power of the model. This model addresses the first research question.

Subsequently, a moderated regression model is estimated by creating interaction terms between each stationary independent variable and the COVID-19 dummy variable. The inclusion of these interaction terms allows the study to assess whether COVID-19 strengthens or weakens the relationship between macroeconomic factors, market return, and stock return. The significance of these interaction terms provides evidence of the moderating role of COVID-19, thereby addressing the second research question. To ensure the robustness and parsimony of the moderated model, a joint significance (F-) test is subsequently conducted on interaction terms exhibiting weak individual significance; if this test indicates that a subset of interaction terms does not contribute meaningfully to the model, a more parsimonious specification is adopted for final interpretation.

Finally, the regression results are interpreted within an APT-inspired multifactor framework rather than as a direct test or validation of the Arbitrage Pricing Theory, given that this study examines a single firm using a limited set of macroeconomic variables. It should also be noted that market return, as a regressor, partially incorporates the stock return of PT Telkom Indonesia (Persero) Tbk by construction, as the firm is a constituent of the Jakarta Composite Index; accordingly, the association between market return and stock return may reflect, in part, this mechanical relationship rather than a purely economic one. The study concludes by summarizing the findings and discussing their theoretical implications for asset pricing in emerging markets, as well as practical implications for investors and policymakers.

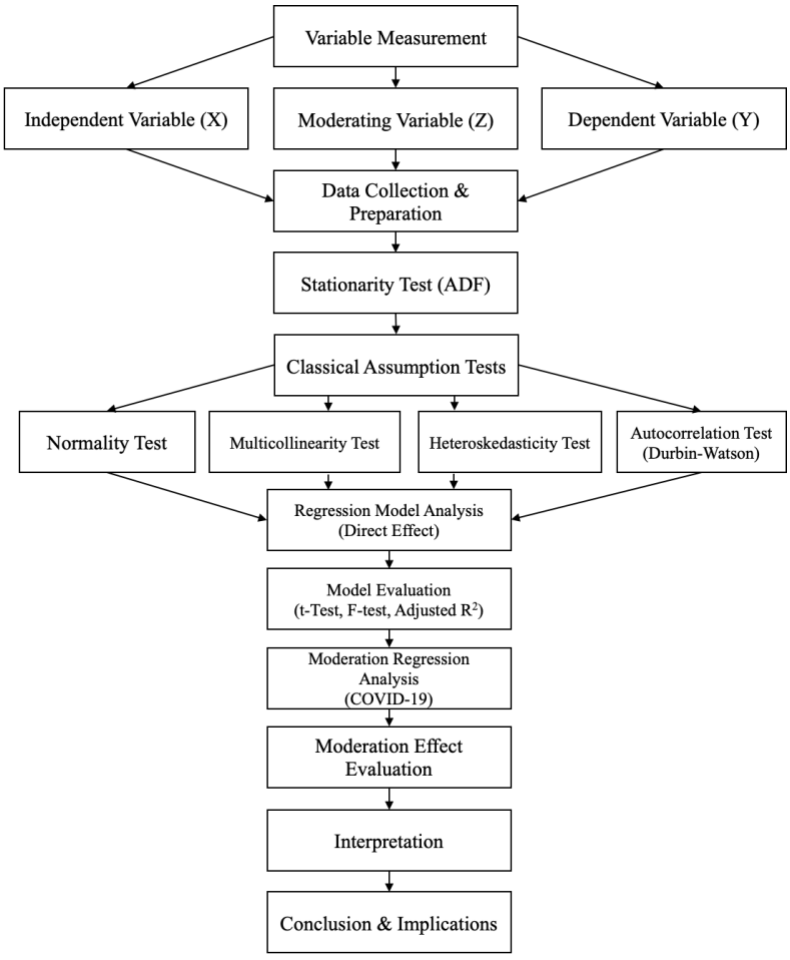


Figure 3.2 Research Procedure
Source: Author, 2026

3.3. Data Collection

The data used in this study are secondary data obtained from reliable and publicly accessible sources. Stock price data of PT Telkom Indonesia (Persero) Tbk are collected from the Indonesia Stock Exchange (IDX) to calculate stock returns. Macroeconomic data, including industrial production, inflation, interest rate, and exchange rate, are obtained from official publications of Bank Indonesia, the Central Statistics Agency (BPS), from Bloomberg. JCI index data are collected from IDX to calculate the market. All data are gathered with consistent monthly frequency and aligned within the same observation period to ensure comparability and accuracy in the time series analysis. The use of secondary data is appropriate for this study because the variables examined are macroeconomic and market indicators that are officially recorded, widely recognized, and regularly published by authoritative institutions.

3.4. Operational Variable

To empirically test the proposed hypotheses within the Arbitrage Pricing Theory (APT) framework, the variables in this study are operationalized into dependent, independent, and moderating categories. These operational definitions ensure that each theoretical concept is translated into measurable, quantitative data.

3.4.1 Dependent Variable

A dependent variable represents the primary outcome of the research, measured to determine how it responds to the influence and variation of external factors. Sembel and Malau (2022) define the dependent variable through market performance indices or equity return. P*t* is the adjusted stock closing price (accounting for dividends and corporate actions) at the end of month *t*, and *Pt-1* is the adjusted closing price at the end of the previous month.

3.4.2 Independent Variable

Independent variables are the systematic risk factors evaluated to examine their association with asset returns. Within the Arbitrage Pricing Theory (APT) framework, they represent the systemic risk factors driving asset prices.

3.4.3 Moderating Variable

A moderating variable is a qualitative or quantitative factor that alters the structural relationship, intensity, or trajectory between an independent variable and a dependent variable. A moderator alters the nature of the baseline relationship based on its presence or intensity. Sembel and Malau (2022) demonstrate that external contextual disruptions or emerging environments can act as powerful moderators, changing how macroeconomic factors map onto stock performance.

To capture these structural shifts without blending distinct economic phases, the COVID-19 disruption is operationalized using two separate binary dummy variables relative to the pre-pandemic baseline:

1. Acute COVID-19 Phase (D_{Acute}): Coded as 1 during the acute crisis period (March 1, 2020 – December 31, 2021) characterized by severe lockdowns and market volatility, and coded as 0 otherwise.
2. Post-Pandemic Recovery Phase ($D_{Recovery}$): Coded as 1 during the economic reopening and recovery phase (January 1, 2022 – June 30, 2023), and coded as 0 otherwise.

The pre-pandemic period serves as the omitted reference baseline (where both D_{Accute} and $D_{Recovery}$ equal 0). This specification ensures that the recovery phase is not hidden inside the baseline or the acute crisis, maintaining precise economic interpretation across different structural regimes. Both the pre-pandemic period (January 2017 – February 2020) and the post-recovery period (July 2023 – December 2025) serve jointly as the omitted reference baseline, where both D_{Acute} and $D_{Recovery}$ equal 0. This assumes that by July 2023, the macroeconomic relationships had stabilized and returned to normal, pre-disruption conditions.

3.4.4 Operational Definition and Measurement of Variables

Table 3.1 below outlines the comprehensive framework of the research variables, detailing their operational definitions, specific measurement proxies, and the empirical literature from which they were adapted.

Table 3.1 Operational Variable Table

Dependent Variable	Description
Stock return $R_{i,t} = \ln\left(\frac{p_t}{p_{t-1}}\right)$	Representing the core dependent variable, it quantifies the relative variance in an asset's spot price over a designated period to evaluate realized investor yield using a continuously compounded logarithmic return metric. To account for corporate actions—such as stock splits, reverse splits, rights issues, and dividend distributions—this study utilizes the monthly adjusted closing price ($P_{i,t}$) rather than the unadjusted closing price. This adjustment ensures that price changes reflect true economic returns to investors without distortions caused by capital restructuring. The observation date for each monthly period is established as the closing price on the final trading day of month t ($P_{i,t}$) relative to the final trading day of month t−1 ($P_{i,t-1}$). $p_{i,t}$ is the adjusted closing price at period t and $p_{i,t-1}$ is the adjusted closing price at period t – 1.
Independent Variable	**Description**
Industrial Production $\Delta IPI_{t-1} = \ln\left(\frac{IPI_{t-1}}{IPI_{t-13}}\right)$	The Industrial Production Index (IPI) tracks shift in factory and manufacturing output over time, which provide clear view on broader business cycles. The calculation uses a year-on-year log-growth and shifts the entire series back by one month to exclude predictable seasonal spikes e.g., holiday production jumps, without throwing away precious data points. The equation representing the continuous Year-on-Year log-growth rate of industrial production from the preceding cycle (t – 1).
Core Inflation $\Delta INF_{t-1} = INF_{t-1} - INF_{t-2}$	To evaluate structural cost pressures, core inflation tracks broader price level increases by excluding volatile food and energy items. This metric utilizes absolute percentage point shifts and is lagged by one period to capture price transmission mechanisms. The equation signifying the absolute movement in the core inflation rate from the immediately preceding cycle, lagged by one period.
Interest Rate $\Delta BI_{t-1} = BI_t - BI_{t-1}$	Serving as an indicator of monetary policy posture, the benchmark interest rate (proxied by the BI-Rate/BI7DRR) employs absolute percentage point modifications lagged by one period to reflect policies shocks. The equation representing the change in the interest rate from the prior period to reflect policy shocks.

Exchange Rate Source: Bloomberg – BI $\Delta EX_{t-1} = \ln\left(\frac{EX_t}{EX_{t-1}}\right)$	Exchange rate is defined as the relative value at which domestic currency is traded against a foreign benchmark (USD/IDR), serving as a crucial proxy for national economic stability and corporate equity valuation, transformed via log-return and lagged by one period. EX_t represent spot exchange rate at period t and $EX_{t-1}$is the spot exchange rate from the previous period, lagged by one period.
Market Return $R_{M,t} = \ln\left(\frac{JCI_t}{JCI_{t-1}}\right)$	Market return functions as a systematic risk factor proxied by the performance of the Jakarta Composite Index (JCI) to capture overall investor sentiment across the Indonesia Stock Exchange at period *t*. JCI_t is the closing price index of the JCI at period *t* and $JCI_{t-1}$is the closing price index from the prior period.

Source: Author, 2026

To ensure economic validity, interest rate and inflation variables are operationalized using absolute changes in percentage points (Δ) rather than percentage growth rates. This approach avoids mathematical distortion and aligns with standard econometric practices when evaluating policy rate adjustments and core price shifts over time. Furthermore, the market return proxy incorporates the composite index movements while acknowledging its inherent structural alignment with the firm's own market capitalization weighting.

3.4.5 Empirical Model Specification

Following the empirical framework of Chen, Roll, and Ross (1986), as adapted for the Indonesian market by Ihsan (2023) and Fakhri et al. (2023), the baseline multi-factor linear regression model incorporating lagged macroeconomic variables is formulated as follows:

$$R_{i,t} = \alpha + \beta_1 R_{m,t} + \beta_2 \Delta\text{IPI}_{t-1} + \beta_3 \Delta\text{BIRate}_{t-1} + \beta_4 \Delta\text{CoreInf}_{t-1} + \beta_5 \Delta\text{EX}_{t-1} + \epsilon_t$$

Equation 3.1 Lagged Multi-Factor Asset Pricing Model
Source: Source: Ross (1976); Chen, Roll, and Ross (1986); Ihsan (2023)

Where:

- $R_{i,t}$ = Logarithmic return of stock i at month t

- $R_{m,t}$ = Market return (JCI) at month t
- ΔIPI_{t-1} = Year-on-year growth rate of Industrial Production Index, lagged by one period (t−1)
- $\Delta BIRate_{t-1}$ = Absolute change in percentage points of the BI Rate, lagged by one period (t−1)
- $\Delta CoreInf_{t-1}$ = Absolute change in percentage points of Core Inflation, lagged by one period (t−1)
- ΔEX_{t-1} = Log-return of USD/IDR exchange rate, lagged by one period (t−1)
- ϵt = Error term at month t

To prevent look-ahead bias and account for the inherent publication lag of macroeconomic statistics, all macroeconomic independent variables are specified using a one-period lag (t−1). Official macroeconomic indicators—including the Industrial Production Index (IPI), changes in the BI Rate (ΔBIRate), and changes in core inflation (ΔCoreInf)—are not available to market participants in real-time during month t. Consequently, investors' decisions and asset prices at period t can only incorporate economic information officially released up to period t−1.

3.5. Research Population

The research population in this study refers to all time series observations of macroeconomic indicators, market return, and the stock price performance of PT Telkom Indonesia (Persero) Tbk within the period under study from 2017 to 2025. This encompasses the pre-pandemic baseline (January 2017 – February 2020), the Acute COVID-19 phase (March 2020 – December 2021), the Recovery phase (January 2022 – June 2023), and the post-recovery baseline (July 2023 – December 2025). In time series research, the population is not defined as a group of individuals or firms, but as the entire set of observable data points over time that represent the behaviour of the variables being examined. Therefore, the population consists of all monthly data related to industrial production, inflation, interest rate, exchange rate, market index, and PT Telkom Indonesia (Persero) Tbk's stock prices that are officially recorded and published by the relevant authorities.

3.6. Statistical Methods

The statistical analysis in this study employs multiple time series regression within the Arbitrage Pricing Theory (APT) framework. The analysis begins with the Augmented Dickey-Fuller (ADF) test to examine the stationarity of all variables and to avoid spurious regression. After stationarity is confirmed, classical assumption tests are conducted. Multiple regression analysis is then performed to estimate the effect of industrial production, inflation, interest rate, exchange rate, and market return on the stock return of PT Telkom Indonesia (Persero) Tbk. The F-test from the regression ANOVA table is used to assess the simultaneous effect of all independent variables, while the partial t-test is used to evaluate the individual effect of each variable. The explanatory power of the regression model is measured using the adjusted R-squared value.

Finally, moderated regression analysis is conducted by incorporating interaction terms between the COVID-19 dummy variable and each independent variable to examine the moderating role of COVID-19 on the relationship between macroeconomic factors, market return, and stock return.

3.7. Augmented Dickey Fuller Test

The Augmented Dickey-Fuller (ADF) test is conducted in this study to examine the stationarity of all-time series variables before performing regression analysis. Stationarity is an important requirement in time series regression because non-stationary data can produce spurious regression results, where statistical relationships appear significant but are meaningless. Therefore, the ADF test is applied to the stock return of PT Telkom Indonesia (Persero) Tbk, industrial production, inflation, interest rate, exchange rate, and market return to ensure that the mean and variance of each variable remain constant over time.

The ADF testing procedure begins by testing each variable at the level form. If the probability value is less than the chosen significance level (typically 5%), the variable is considered stationary at level. However, if the variable is found to be non-stationary, the data are then transformed through first differencing, and the ADF test is repeated. This process continues until the variable becomes stationary. The order of integration is recorded for each variable to determine whether the data

are integrated at level I (0) or at first difference I (1) (Mushtaq, 2011). By ensuring that all variables used in the regression model are stationary, the study avoids the risk of spurious regression and ensures that the estimated relationships between macroeconomic indicators, market return, and stock return are statistically valid. The results of the ADF test also determine whether data transformation is required before proceeding to the classical assumption tests and multiple regression analysis within the APT framework.

3.8. Classical Assumption Test

In this research, classical assumption test would be conducted by multiple series of test, including Normality test, Multicollinearity test, Autocorrelation test, and Heteroskedasticity test.

3.8.1. Normality Test

The normality test is conducted to determine whether the data follow a normal distribution (Santoso, 2010 in Ainiyah et al., 2016). Ideally, research data should be normally distributed because a bell-shaped distribution indicates that the data are evenly spread and representative of the population. Non-normal data can be identified through the degree of skewness. Data that are skewed to the right indicate positive skewness, while data skewed to the left indicate negative skewness. The normality testing can be done by Shapiro Wilk test. Shapiro Wilk method uses a data base that has not been processed in the frequency distribution table.

$$T_3 = \frac{1}{D}\left[\sum_{i=1}^{k} a_i (X_{(n-i+1)} - X_i)^2\right]$$

Where:

- $D = \sum_{i=1}^{k} (X_i - \bar{X})^2$
- a_i is coefficient of Shapiro Wilk Test
- $X_{(n-i+1)}$ is variable of independent at – (n-i+1)
- $\bar{X}$ is average of data

Equation 3.2 Normality Testing Formula
Source: Santoso, 2010

The significance of T3 using the Shapiro–Wilk test is determined by examining the probability value (p). If the p-value is greater than 5%, the data are normally distributed. Conversely, if the p-value is less than 5%, the data are regarded as not normally distributed.

3.8.2. Multicollinearity Test

Multicollinearity Test is conducted to identify whether there is a strong correlation among the independent variables in a multiple regression model. When independent variables are highly correlated with one another, it can distort their relationship with the dependent variable and lead to unreliable coefficient estimates. Therefore, a proper regression model should avoid high intercorrelation among its independent variables (Gani, 2015 in Ainiyah et al., 2016). Multicollinearity testing can be done by looking at value of Variance Inflation Factors (VIF) and Tolerance. VIF is a function of R2 between independent variables that can be written with formula below (Nachrowi, 2006 in Ainiyah et al., 2016):

$$VIF = \frac{1}{(1 - R_n^2)}$$

Where:

- R_n^2 is coefficient of determination variable at n-*th*
- $\boldsymbol{R_n^2 = \frac{b_1 \Sigma Y_1 Y + b_2 \Sigma Y_2 Y + \cdots + b_n \Sigma Y_n Y}{\Sigma Y^2}}$
- n is number of independent variable (1,2,…,n)

Equation 3.3 Variance Inflation Factors (VIF) Formula
Source: Nachrowi, 2006

If VIF <10 and value of Tolerance >0.10, then not multicollinearity. Conversely, if the value of VIF>10 and the value of Tolerance <0.10, then there is a multicollinearity. To prevent high VIF values caused by the inclusion of interaction terms in the Moderated Regression Analysis (MRA), all continuous independent variables are mean-centered before creating the interaction products.

3.8.3. Autocorrelation Test (Durbin-Watson)

The autocorrelation test is used to examine whether there is a linear relationship among the error terms across observations arranged over time in a time series dataset. This test is essential when analysing time series data, as one of the key assumptions of regression is that the residuals are not correlated with each other (Gujarati, 1993 in Gujarati & Porter, 2009). Autocorrelation testing can be done by value of Durbin Watson (DW) statistic, calculated as follows:

$$d_{calc} = \frac{\sum_{i=1}^{n}(e_i - e_{i-1})^2}{\sum_{i=1}^{n} e_i^2}$$

Where:

- e_i = Error at i-th (i=1, 2,…,n)
- n = Number of independent variable (1, 2,…,n)

Equation 3.4 Autocorrelation Testing Formula
Source: Gujarati, 1993

3.8.4. Heteroskedasticity

The heteroskedasticity test verifies that the error terms possess a constant variance, fulfilling the OLS assumption of homoskedasticity (Gujarati and Porter, 2009). If the residuals have non-constant variance, the standard errors become biassed, invalidating the subsequent *t* and *F* statistical inferences. To detect this issue, this study applies the Glejser Test regressing the absolute values of the residuals against the independent variables:

$$|e_t| = \beta_0 + \sum_{i=1}^{k} \beta_i X_{it} + v_t$$

Where:

- $|e_t|$ is Absolute value of the residual at time t
- β_0 is constant term (intercept)
- β_i is parameters of coefficients to be estimated for each independent variable

- X_{it} is independent variables included in the regression model
- v_t is random error terms of auxiliary regression

Equation 3.5 Glejser Test Equation
Source: Gujarati, 1993

If the significance (p-value) of each independent variable exceeds the 0.05 threshold, the null hypothesis of homoskedasticity is accepted, confirming stable variance across the data.

3.9. Model Evaluation

3.9.1. Global F-test and Joint Wald Test

The global F-test in multiple regression is used to examine whether all independent variables in the model (including market return and the COVID-19 dummy) jointly have a significant effect on the dependent variable. In this study, the F-test is employed to determine whether the combination of macroeconomic indicators (industrial production, inflation, interest rate, and exchange rate) together with market return simultaneously influence the stock return of PT Telkom Indonesia (Persero) Tbk. Statistically, the F-test compares the explained variance of the model with the unexplained variance, assessing whether the regression model provides better explanatory power than a model with only a constant term (Gujarati & Porter, 2009). A significant F value indicates that the independent variables, when considered together, contribute meaningfully to explaining variations in stock returns.

$$F = \frac{(\frac{R^2}{k})}{(\frac{1 - R^2}{n - k - 1})}$$

Where:

- R^2 is coefficient of determination
- k is number of independent variables
- n is number of observations

Equation 3.6 F-test ANOVA Formula
Source: Gujarati & Porter, 2009

In addition to the global F-test, a joint Wald test is conducted to specifically evaluate the simultaneous association of the macroeconomic variables ($\Delta IPI_{t-1}, \Delta INF_{t-1}, \Delta BI_{t-1}, \Delta EX_{t-1}$) on stock returns, isolating them from the market return and moderating dummy variables. This joint Wald test directly tests whether the regression coefficients of all macroeconomic factors equal zero simultaneously, providing a rigorous test for hypothesis H1.

3.9.2. Partial t-test

The t-test, also known as the partial test, is used to evaluate the significance of each individual regression coefficient in the model. This test determines whether a particular independent variable has a statistically significant effect on the dependent variable while holding other variables constant. The t-test is essential because, even when the F-test indicates that the model is significant overall, not all independent variables may have a meaningful individual impact (Hair et al., 2010). In this research, the t-test helps identify which macroeconomic indicators and market return variables significantly influence Telkom's stock return.

$$t = \frac{\beta i}{SE\ (\beta i)}$$

Where:

- βi is regression coefficient of variable i
- SE (βi) is standard error of the coefficient βi

Equation 3.7 Partial t-test Formula
Source: Hair et al., 2010

3.9.3. R-squared (R^2)

Adjusted R^2 measures how well the independent variables explain the variation in the dependent variable while adjusting for the number of predictors included in the model. Unlike the regular R^2, which always increases when additional variables are added, Adjusted R^2 accounts for model complexity and provides a more accurate assessment of model fit (Field, 2013). In this study, Adjusted R^2 indicates how strongly macroeconomic indicators and market return explain the variability of Telkom's stock return, ensuring that the explanatory power is not overstated due to the inclusion of multiple variables.

$$Adj\ R^2 = 1 - \left(\frac{(1 - R^2)(n - 1)}{n - k - 1}\right)$$

Where:

- N is number of observations
- K is number of independent variables

Equation 3.8 R-Squared Formula
Source: Field, 2013

3.9.4. Moderated Regression Analysis

Moderated Regression Analysis (MRA) is applied when a researcher seeks to determine whether a moderating variable changes the strength or direction of the relationship between independent and dependent variables. In this research, the COVID-19 pandemic is captured through structural shifts that may alter the relationship between macroeconomic indicators, market return, and PT Telkom Indonesia (Persero) Tbk stock return. According to Baron and Kenny (1986), moderation is tested by introducing interaction terms between the moderator and each independent variable.

To prevent blending distinct economic phases, the moderation is modelled using two separate binary dummy variables relative to the pre-pandemic baseline: the acute crisis phase (D_{Acute}) and the post-pandemic recovery phase ($D_{Recovery}$). The MRA model is specified as follows:

$$Return_t = \beta_0 + \sum_{i=1}^{5} \beta_0 X_{i,t-1} + \delta_1 D_{Acute} + \delta_2 D_{Recovery} + \sum_{i=1}^{5} \gamma_{1,i}(X_{i,t-1}\ x\ D_{Acute)} + \sum_{i=1}^{5} \gamma_{2,i}(X_{i,t-1}\ x\ D_{Recovery)} + \varepsilon_t$$

Where:

- $Return_t$ is stock return of PT Telkom Indonesia (Persero) Tbk.
- β_0 is the constant (intercept).
- $X_{i,t-1}$ is the mean-centered independent variables (Market Return, $\Delta IPI_{t-1}, \Delta INF_{t-1}, \Delta BI_{t-1}, \Delta EX_{t-1}$) Lagged by one period.
- D_{Acute}, $D_{Recovery}$ are the binary dummy variables representing the acute crisis and recovery phases, respectively.
- $\gamma_{1,i}$, $\gamma_{2,i}$ are the interaction coefficients capturing the moderating effect during the acute and recovery phases.
- ε_t is the error term at the time *t*.

Equation 3.9 Moderated Regression Analysis
Source: Baron and Kenny, 1986

The focus of this interaction is whether the pandemic structurally altered the baseline relationships. Should classical assumption testing reveal heteroskedasticity or autocorrelation associated with the COVID-19 dummy variable or its interaction terms, the MRA would be re-estimated using Robust (HAC/Newey-West) standard errors; otherwise, standard OLS standard errors are retained, consistent with the diagnostic procedure outlined earlier in this chapter. Furthermore, the overall moderating effect is evaluated by observing the R^2 change (ΔR^2) and the F-change statistic upon adding the interaction terms.

To summarize the decision rule applied throughout this study: standard OLS standard errors are used by default for both the direct-effect model (Model 1) and the moderated regression model (Model 2/3), since OLS remains the Best Linear Unbiased Estimator (BLUE) under the Gauss-Markov assumptions when these assumptions hold. Robust HAC/Newey-West standard errors are substituted only if the classical assumption tests described earlier in this chapter — specifically White's test for heteroskedasticity and the Breusch-Godfrey test for autocorrelation — indicate a violation in each model's residuals at the 5% significance level. This decision rule is applied uniformly and independently to each estimated model, such that a violation detected in one model does not necessitate the use of robust standard errors in another.

For interaction terms that display statistical significance, a simple-slope test is conducted. This procedure calculates the specific conditional effect (combined slope) of the independent variable during the respective sub-period (either when $D_{Acute} = 1$ or $D_{Recovery} = 1$) and tests its statistical significance using confidence intervals. This ensures that a significant interaction term genuinely translates to a significant relationship during the pandemic phase.

CHAPTER 4
FINDING, ANALYSIS, AND DISCUSSION

4.1. Research Sample Description

This study analyses monthly time-series data covering the period from January 2017 through December 2025. Collected at a monthly frequency, the raw dataset originally contained 108 observations, but the sample size was adjusted to N = 107 for each variable as one observation was omitted to accommodate the lag approach used for return calculations. The sample dataset covers stock return observations for PT Telkom Indonesia (Persero) Tbk, broad market returns (Jakarta Composite Index), macroeconomic indicators (industrial production, core inflation, interest rates, and the USD/IDR exchange rate), and structural crisis indicators inspired by the Arbitrage Pricing Theory (APT) framework.

To capture the shifting market dynamics defined in the research scope, the 107 observations are segmented into three operational sub-phases: (1) Baseline non-crisis phase (67 months), (2) Acute COVID-19 crisis phase (22 months), and (3) Pandemic recovery phase (18 months). Prior to analysis, data were transformed into appropriate metrics as follows:

1. Stock prices of PT Telkom Indonesia (Persero) Tbk and broad market return (Jakarta Composite Index) data were converted into continuous returns, resulting in an adjusted sample size of N = 107 due to the lag approach.
2. Macroeconomic indicators (industrial production, core inflation, interest rates, and the USD/IDR exchange rate) were converted as growth rates or percentage changes to ensure uniform stationarity testing.
3. Dummy variables were incorporated to capture structural breaks: one dummy variable represents the acute COVID-19 crisis period, and a second dummy variable captures the initial pandemic recovery phase.

4.2. Descriptive Statistic Analysis

Descriptive statistical analysis was conducted to establish sample baseline properties and evaluate data distributions prior to dynamic time-series regression modelling (Gujarati and Porter, 2009). Data computation was performed using

Microsoft Excel and Gretl. This section presents the minimum, maximum, mean, and standard deviation values for all continues variables. These baseline metrics provide an initial understanding of the data's volatility and data's average values across both the non-COVID (0) and COVID (1) periods, offering initial indication of how macroeconomic shocks showed in the dataset.

Table 4.1 Descriptive Statistic Across Operational Phases

Variables	N	Minimum	Maximum	Mean	Standard Deviation
Panel A: Full Sample Period (Jan 2017 - Dec 2025)					
Stock Return	107	(0.1066)	0.1117	(0.0050)	0.0436
Market Return	107	(0.1834)	0.0902	0.0046	0.0391
Industrial Production	107	(0.3925)	0.2236	0.0220	0.0752
Exchange Rate	107	(0.0916)	0.1303	0.0020	0.0227
Core Inflation	107	(0.3900)	0.3400	(0.0066)	0.1258
BI Rate	107	(0.2500)	0.5000	0.0000	0.1639
Panel B: Baseline Non-Crisis Periods (Jan 2017 - Feb 2020 and Jul 2023 - Dec 2025)					
Stock Return	67	(0.1066)	0.1117	(0.0131)	0.0416
Market Return	67	(0.1255)	0.0773	0.0043	0.0359
Industrial Production	67	(0.0739)	0.1583	0.0348	0.0312
Exchange Rate	67	(0.0611)	0.0361	0.0018	0.0164
Core Inflation	67	(0.2600)	0.2800	(0.0078)	0.1011
BI Rate	67	(0.2500)	0.5000	(0.0112)	0.1535
Panel C: Acute COVID-19 Crisis Phase (Mar 2020 - Dec 2021)					
Stock Return	22	(0.0738)	0.0786	0.0188	0.0433
Market Return	22	(0.1834)	0.0902	0.0086	0.0564
Industrial Production	22	(0.3925)	0.2236	(0.0242)	0.1449
Exchange Rate	22	(0.0916)	0.1303	0.0022	0.0393
Core Inflation	22	(0.3900)	0.1900	(0.0768)	0.1333
BI Rate	22	(0.2500)	0.0000	(0.0682)	0.1140
Panel D: Recovery Phase (Jan 2022 - Jun 2023)					
Stock Return	18	(0.0990)	0.0635	(0.0031)	0.0414
Market Return	18	(0.0417)	0.0380	0.0007	0.0225
Industrial Production	18	(0.1411)	0.0829	0.0308	0.0493
Exchange Rate	18	(0.0378)	0.0256	0.0025	0.0171
Core Inflation	18	(0.1800)	0.3400	0.0833	0.1515
BI Rate	18	0.0000	0.5000	0.1250	0.1965

Source: Author, 2026 (Microsoft Excel)

Table 4.1 showed the descriptive statistics for the entire observation period and the specified operational sub-phases, illustrating the severe structural disruptions influenced by the COVID-19 pandemic. As observed in the full sample (Panel A), the transformation of raw data into continuous returns and growth rates successfully anchored the mean values near zero, with the stock return mean recorded at -0.0050. Panel B details the baseline non-crisis periods, which are marked by relative stability in the macroeconomic environment and capital markets, wherein the stock return of PT Telkom Indonesia (Persero) Tbk exhibits a standard deviation of 0.0416.

The acute COVID-19 crisis phase is captured in Panel C, providing empirical evidence of the systemic market and economic shocks. This observation confirms the rationale for incorporating COVID-19 as a moderating variable. During this 22-month period, market risk escalated, proved by the standard deviation of PT Telkom Indonesia (Persero) Tbk's stock return increasing to 0.0433 (a surge of approximately 4% compared to the baseline period). At the same time, the real economy experienced acute contractions, with industrial production plummeting to a minimum value of -0.3925 (or -39.25%). In addition, initial lockdown measures caused severe deflationary pressures, driving core inflation to a minimum of -0.3900 (or -39.00%). In response, aggressive monetary easing policies were implemented, which is reflected in the BI Rate recording a negative mean of -0.0682 and a maximum value of 0.0000, indicating a sustained low-interest-rate period.

Panel D outlines the recovery phase, which indicates a normalization in capital market volatility alongside a reversal in macroeconomic policy. A return to market stability is demonstrated by the reduced standard deviations for both the stock return of PT Telkom Indonesia (Persero) Tbk (0.0414) and the market return (0.0225). However, the economic reopening initiated a sharp rebound in core inflation, resulting a positive mean of 0.0833. On the other hand, Bank Indonesia shifted toward monetary tightening to mitigate inflationary pressures, which is reflected by the BI Rate demonstrating a positive mean of 0.1250 and a maximum rate of 0.5000 (50.00%) during this 18-month period.

Finally, the pronounced statistical fluctuations observed between the COVID-19 and non-COVID periods confirm a fundamental divergence in the underlying economic conditions. This distinct structural break validates the specification of the Moderated Regression Analysis (MRA) within the study, ensuring the model accurately captures the altered pricing mechanisms of stock returns during the crisis.

4.3. Stationarity Test (ADF Test) Results

Prior to estimating the regression models, a stationarity test was conducted for all variables using the Augmented Dickey-Fuller (ADF) method to avoid the risk of spurious regression, which is a common issue in time-series analysis when non-stationary variables are directly regressed against one another (Gujarati and Porter, 2009). The ADF test was performed using Gretl software, with the optimal lag length for each variable selected based on the Akaike Information Criterion (AIC), following a "testing down" procedure from a maximum lag order of one. All tests were specified with a constant term, consistent with the nature of the data, which had already been transformed into returns and growth rates rather than raw level series.

Table 4.2 ADF Test Results at Level

Variable	Lag Order	ADF t-Statistic	p-value	Conclusion
Stock Return (TLKM)	0	(9.7693)	0.0000	Stationary I(0)
Market Return	0	(9.2382)	0.0000	Stationary I(0)
Industrial Production	1	(3.8171)	0.0027	Stationary I(0)
Exchange Rate	1	(8.7968)	0.0000	Stationary I(0)
Core Inflation	0	(5.2896)	0.0000	Stationary I(0)
BI Rate	0	(5.3748)	0.0000	Stationary I(0)

Source: Author, 2026 (Gretl)

As presented in Table 4.2, the null hypothesis of a unit root (non-stationarity) is rejected for all six variables, as each p-value falls well below the 0.05 significance threshold. The stock return of PT Telkom Indonesia (Persero) Tbk recorded the strongest rejection of the unit root hypothesis ($\tau_c = -9.7693$; $p = 0.0000$), followed closely by market return and BI Rate. Industrial production exhibited the comparatively weakest, though still statistically significant, test

statistic ($\tau_c = -3.8171$; $p = 0.0027$), requiring the inclusion of one lagged difference term to account for residual autocorrelation. Similarly, the exchange rate variable required one lag to achieve a well-specified test equation.

These results indicate that all variables are integrated of order zero, or I(0), meaning that the data-generating process underlying each series does not exhibit a stochastic trend at the level. This finding is consistent with the theoretical expectation outlined in Chapter 3, given that the raw price and index series were transformed into returns and percentage changes prior to testing, a transformation that inherently removes unit root behaviour in most macroeconomic and financial series (Brooks, 2019). Consequently, no differencing procedure was required, and all variables were retained in their original transformed form — namely, returns for stock return and market return, and growth rates for industrial production, core inflation, BI Rate, and exchange rate — for use in the subsequent regression models.

The confirmation of stationarity across all variables provides the statistical foundation necessary to proceed with the classical assumption tests and the estimation of the direct-effect and moderated regression models, as no risk of spurious regression arising from non-stationary series is present in the dataset.

4.4. Classical Assumption Test

Following the confirmation of stationarity for all variables, classical assumption tests were conducted on the direct-effect regression model (Model 1) to ensure that the Ordinary Least Squares (OLS) estimation satisfies the Best Linear Unbiased Estimator (BLUE) properties (Gujarati and Porter, 2009). These tests encompass normality of residuals, multicollinearity, heteroskedasticity, and autocorrelation. All tests were performed using Gretl software based on the estimated OLS regression of stock return (TLKM) on industrial production, core inflation, BI Rate, exchange rate, and market return.

Table 4.3 Classical Assumption Test Results (Model 1)

Test	Statistic	p-value	Conclusion
Normality (Jarque-Bera/Chi-square)	0.807	0.6681	Residuals are normally distributed
Multicollinearity (VIF)	Max VIF = 1.177	—	No multicollinearity detected
Heteroskedasticity (White's Test)	$TR^2 = 17.167$	0.6421	Homoskedastic
Autocorrelation (Breusch-Godfrey)	LMF = 0.283	0.5960	No first-order autocorrelation
Durbin-Watson	DW = 1.8707	—	Confirms absence of autocorrelation

Source: Author, 2026 (Gretl)

The normality test yielded a Chi-square statistic of 0.807 with a p-value of 0.6681, which exceeds the 0.05 significance threshold. Consequently, the null hypothesis of normally distributed residuals cannot be rejected, indicating that the residuals of Model 1 satisfy the normality assumption required for valid statistical inference.

The multicollinearity diagnostic, assessed through Variance Inflation Factor (VIF) values, showed that all independent variables recorded VIF values well below the conventional threshold of 10, with the highest value observed for core inflation (VIF = 1.177). This result confirms the absence of problematic linear dependence among the independent variables, which is further supported by the Belsley-Kuh-Welsch collinearity diagnostics, where the highest condition index (1.686) remained substantially below the threshold of 10 indicating weak near-linear dependence.

Heteroskedasticity was examined using White's test, which regresses the squared residuals on the independent variables, their squares, and cross-products. The test statistic ($TR^2 = 17.167$) produced a p-value of 0.6421, failing to reject the

null hypothesis of homoskedasticity. This indicates that the variance of the residuals remains constant across observations, satisfying the homoskedasticity assumption.

Autocorrelation was assessed using both the Durbin-Watson statistic and the Breusch-Godfrey Lagrange Multiplier (LM) test for first-order autocorrelation. The Durbin-Watson statistic of 1.8707 lies close to the ideal value of 2, suggesting the absence of autocorrelation. This finding is corroborated by the Breusch-Godfrey test, which produced an LMF statistic of 0.283 with a p-value of 0.596, failing to reject the null hypothesis of no first-order autocorrelation.

Given that Model 1 satisfies all four classical assumptions without violation, the OLS estimates are considered efficient, unbiased, and consistent, and the use of Heteroskedasticity and Autocorrelation Consistent (HAC) or Newey-West robust standard errors, as anticipated in Chapter 3, is not required for this model. The regression results presented in Section 4.5 are therefore based on standard OLS standard errors.

4.5. Direct Effect Model (Model 1) Results

Aligned with the rule in chapter 3 (section 3.9.4), standard errors are reported using OLS unless classical assumption testing indicates otherwise. The first regression model was estimated to examine the direct influence of industrial production, core inflation, BI Rate, exchange rate, and market return on the stock return of PT Telkom Indonesia (Persero) Tbk, addressing the first research question.

Table 4.4 Model 1 Regression Results

Variable	Coefficient	Std. Error	t-ratio	p-value
Constant	(0.00587)	0.00452	(1.298)	0.1971
Industrial Production	0.0118	0.0607	0.1943	0.8464
Core Inflation	(0.0268)	0.0365	(0.7354)	0.4638
BI Rate	(0.0376)	0.0274	(1.372)	0.1730
Exchange Rate	0.0038	0.1868	0.0201	0.9840

Market Return	0.1158	0.1090	1.063	0.2905

Source: Author, 2026 (Gretl)

Note: F(5.101) = 0.842; p-value(F) = 0.5229; R^2 = 0.0400; Adjusted R^2 = (0.0075); Durbin-Watson = 1.8707

Table 4.5 Joint Wald test for Macroeconomic Indicators (H1)

Test	Statistic	p-value	Conclusion
Joint Wald test (IPI, INF, BIRate, EXRate)	F(4. 101) = 0.815	0.5184	H1 not supported — macroeconomic indicators are not jointly significant

Source: Author, 2026 (Gretl)

As shown in Table 4.4, the overall model was not statistically significant, as indicated by the F-statistic of 0.842 (p-value = 0.5229), which exceeds the conventional 0.05 threshold. None of the five macroeconomic and market variables exhibited a statistically significant association with the stock return of PT Telkom Indonesia (Persero) Tbk, as all p-values exceeded 0.05. The adjusted R^2 of (0.0075) further indicates that the direct-effect model, considered in isolation, explains virtually none of the variation in stock returns, and performs no better than a model containing only the intercept.

Prior to interpreting these results, classical assumption tests showed in table 4.3 confirmed that Model 1 satisfies all requirements for valid OLS inference, residuals are normally distributed, no multicollinearity is present, and the model exhibits neither heteroskedasticity nor autocorrelation. Consequently, the non-significant findings of Model 1 cannot be attributed to violations of classical assumptions, but instead reflect a genuine absence of a statistically significant linear association between the observed macroeconomic indicators and stock return over the full sample period. It should be noted that this non-significance does not by itself indicate that PT Telkom Indonesia (Persero) Tbk's stock return is resilient or insensitive to inflation, exchange rate, or BI Rate movements; rather, it indicates that a significant linear association was not detected within the scope and sample period of this study. It should also be noted that, because each of the five hypotheses

H2–H6 corresponds to a single coefficient within Model 1, each hypothesis is evaluated directly through its individual t-test reported in Table 4.4, without requiring a separate joint test; this differs from the joint testing approach subsequently applied to the moderation hypotheses in Section 4.6, where each hypothesis is represented by two interaction coefficients (Acute Crisis and Recovery phases) rather than one. To directly test H1, a joint Wald test was conducted on the four macroeconomic indicators (industrial production, core inflation, BI Rate, and exchange rate), isolating them from market return. The test statistic ($F(4.101) = 0.815$; $p = 0.5184$) failed to reject the null hypothesis that these coefficients are jointly zero, indicating that H1 is not supported: macroeconomic indicators, considered jointly, were not significantly associated with the stock return of PT Telkom Indonesia (Persero) Tbk under normal market conditions. This finding motivates the subsequent investigation of the moderating role of the COVID-19 pandemic in Section 4.6.

It is also important to note that market return, used as one of the regressors in this study, is calculated from the Jakarta Composite Index, of which PT Telkom Indonesia (Persero) Tbk is a constituent. As such, part of the observed association between market return and stock return in this study may reflect this mechanical, index-construction relationship rather than a purely economic one, and this should be considered when interpreting the role of market return within the model.

4.6. Moderated Regression Model (Model 2) Results

To examine the moderating role of COVID-19, a moderated regression model was estimated by incorporating two dummy variables — representing the Acute Crisis phase and the Post-Pandemic Recovery phase — along with interaction terms between each mean-centered independent variable and the two dummy variables. The full moderated model, comprising seventeen regressors (five direct-effect variables, two dummy variables, and ten interaction terms), was first estimated in its complete specification.

Table 4.6 Full Moderated Regression Model Results

Variable	Coefficient	p-value	Sig.
Constant	(0.0146)	0.0106	**
Industrial Production (centered)	0.0592	0.7301	
Core Inflation (centered)	(0.0010)	0.9845	
BI Rate (centered)	(0.0736)	0.0356	**
Exchange Rate (centered)	0.3351	0.2918	
Market Return (centered)	0.0635	0.6493	
Dummy Acute Crisis	0.0226	0.0726	*
Dummy Recovery	0.0119	0.4074	
IPI × Acute Crisis	0.0920	0.6273	
Inflation × Acute Crisis	(0.0833)	0.3953	
BI Rate × Acute Crisis	(0.0925)	0.3874	
Exchange Rate × Acute Crisis	(0.8821)	0.0360	**
Market Return × Acute Crisis	0.1588	0.4757	
IPI × Recovery	0.0269	0.9299	
Inflation × Recovery	(0.0506)	0.5797	
BI Rate × Recovery	0.0921	0.1946	
Exchange Rate × Recovery	0.7359	0.2942	
Market Return × Recovery	(0.0270)	0.9569	

Source: Author, 2026 (Gretl)

Note: F(17.89) = 1.559; p-value(F) = 0.0931; R^2 = 0.2294; Adjusted R^2 = 0.0822; Durbin-Watson = 2,0167

The full moderated model in Table 4.6 achieved a higher R^2 (0.2294) than the direct-effect model, but the overall F-test remained only marginally significant at the 10% level (p = 0.0931), while the majority of individual coefficients, particularly the interaction terms, were not statistically significant. Given the limited sample size available for the Acute Crisis (22 observations) and Recovery (18 observations) sub-periods, the inclusion of ten interaction terms raised concerns regarding the parsimony and robustness of the fully specified model, consistent with concerns raised during the supervisory review process. Prior to testing whether the fully specified model could be simplified, each moderation hypothesis (H7–H12) was evaluated directly against the full moderated model reported in Table 4.6.

Table 4.7 Joint Wald Test for H7
(COVID-19 Moderation of All Macroeconomic Indicators)

Test	Statistic	p-value	Conclusion
Joint Wald test (all 10 interaction terms)	F(10.89) = 1.240	0.2770	H7 not supported

Source: Author, 2026 (Gretl)

Table 4.8 Sub-Hypothesis Tests for COVID-19 Moderation by Variable (H8-H12)

Hypothesis	Variables Tested Jointly	F-Statistic	p-value	Conclusion
H8 (Industrial Production)	IPI × Acute Crisis, IPI × Recovery	F(2.89) = 0.136	0.8732	Not supported
H9 (Core Inflation)	Inflation × Acute Crisis, Inflation × Recovery	F(2.89) = 0.412	0.6635	Not supported
H10 (Interest Rate)	BI Rate × Acute Crisis, BI Rate × Recovery	F(2.89) = 1.448	0.2406	Not supported
H11 (Exchange Rate)	Exchange Rate × Acute Crisis, Exchange Rate × Recovery	F(2.89) = 4.085	0.0201	Supported

H12 (Market Return)	Market Return × Acute Crisis, Market Return × Recovery	F(2.89) = 0.273	0.7616	Not supported

Source: Author, 2026 (Gretl)

The joint Wald test on all ten interaction terms (Table 4.7) failed to reject the null hypothesis that COVID-19 jointly moderates the relationship between all macroeconomic indicators and stock return (F(10.89) = 1.240; p = 0.2770), indicating that H7 is not supported. Disaggregating this test by individual macroeconomic variable (Table 4.8), each hypothesis was evaluated using a joint F-test on its two associated interaction terms (Acute Crisis and Recovery), since the moderating role of COVID-19 for each variable is represented across both structural phases rather than a single coefficient. The moderating role of COVID-19 was found to be statistically significant only for exchange rate (H11: F(2.89) = 4.085; p = 0.0201), while no significant moderating association was found for industrial production (H8), core inflation (H9), BI Rate (H10), or market return (H12).

These disaggregated results directly motivate the model simplification presented below, in which the nine interaction terms exhibiting the weakest individual significance — comprising both terms each from H8, H9, H10, and H12, plus the Recovery-phase component of exchange rate (EXRate × Recovery) — were jointly tested for exclusion, while the Acute Crisis-phase component of exchange rate (EXRate × Acute Crisis) was retained given its individual significance in Table 4.6. A joint significance (F-test) was therefore conducted on these nine terms to determine whether they could be excluded without a significant loss of explanatory power.

Table 4.9 Joint Significance (Omit Variables) Test

Test	Statistic	p-value	Conclusion
F-test for joint exclusion of 9 interaction terms	F(9. 89) = 0.749	0.6632	Variables jointly excludable

Source: Author, 2026 (Gretl)

The test statistic (F = 0.749; p = 0.6632) failed to reject the null hypothesis that the coefficients of the nine omitted interaction terms are jointly equal to zero, providing statistical justification for their exclusion. This restriction improved all three information criteria (AIC, BIC, and Hannan-Quinn), confirming that the more parsimonious specification is preferable on statistical grounds rather than through ad hoc variable selection.

Table 4.10 Parsimonious Moderated Regression Model (Model 3) Results

Variable	Coefficient	Std. Error	t-ratio	p-value
Constant	(0.0147)	0.00512	(2.873)	0.0050
Industrial Production (centered)	0.0846	0.0603	1.405	0.1633
Core Inflation (centered)	(0.0261)	0.0361	(0.7222)	0.4720
BI Rate (centered)	(0.0554)	0.0276	(2.005)	0.0477
Exchange Rate (centered)	0.4826	0.2721	1.774	0.0791
Market Return (centered)	0.0989	0.1034	0.9568	0.3411
Dummy Acute Crisis	0.0317	0.0108	2.931	0.0042
Dummy Recovery	0.0198	0.0120	1.657	0.1006
Exchange Rate × Acute Crisis	(0.8797)	0.3654	(2.407)	0.0179

Source: Author, 2026 (Gretl)
Note: F(8. 98) = 2.528; p-value(F) = 0.0152; R^2 = 0.1710; Adjusted R^2 = 0.1034; Durbin-Watson = 2.0018

Table 4.11 Classical Assumption Test Results (Model 3)

Test	Statistic	p-value	Conclusion
Normality (Chi-square)	2.782	0.2489	Residuals normally distributed
Multicollinearity (Max VIF)	2.540	—	No multicollinearity
Heteroskedasticity (White's)	$TR^2 = 40.483$	0.3192	Homoskedastic
Autocorrelation (Breusch-Godfrey)	LMF = 0.0174	0.8950	No first-order autocorrelation

Source: Author, 2026 (Gretl)

Unlike the direct-effect model, the parsimonious moderated model in Table 4.10 is statistically significant overall ($F(8.98) = 2.528$; $p = 0.0152$), with an adjusted R^2 of 0.1034, indicating a meaningfully improved explanatory power once the moderating role of the COVID-19 pandemic is properly accounted for. As confirmed in Table 4.11, this model satisfies all classical assumptions, ensuring the validity of the following interpretations.

Three findings stand out. First, BI Rate exhibits a statistically marginally significant, negative association with stock return (B = (0.0554); p = 0.0477), suggesting that increases in the benchmark interest rate are associated with lower stock returns for PT Telkom Indonesia (Persero) Tbk, a pattern consistent with the discount rate mechanism posited by asset pricing theory. Second, the dummy variable for the Acute Crisis phase is positive and highly significant (B = 0.0317; p = 0.0042), indicating a structural shift in average stock return during the acute period of the pandemic, independent of the macroeconomic variables considered. Third, and most notably, the interaction term between exchange rate and the Acute Crisis dummy is negative and significant (B = (0.8797); p = 0.0179), indicating that the estimated sensitivity of stock return to exchange rate fluctuations differed significantly during the acute phase of the COVID-19 pandemic compared to non-

crisis periods. This finding is consistent with the moderating role of COVID-19 hypothesized in Chapter 3: while exchange rate movements alone were not significantly associated with stock return under normal conditions, their estimated association became considerably more pronounced during the period of acute systemic crisis, addressing the second research question of this study.

To further examine the total magnitude of this relationship, a linear restriction test was conducted on the combined coefficients of the baseline exchange rate and its crisis interaction. The test yielded a test statistic of $F(1.98) = 2.8057$ with a p-value of 0.0971, indicating that while the structural shift (interaction) itself is statistically significant, the net combined slope during the acute phase (totaling approximately −0.397) does not achieve strict statistical significance at the conventional 5% level, though it exhibits marginal significance at the 10% level. This suggests that the exchange rate's estimated explanatory power over PT Telkom Indonesia (Persero) Tbk's stock return during the peak disruption period was substantially diminished and statistically inconclusive at conventional significance levels.

No evidence was found of a significant moderating effect for industrial production, core inflation, BI Rate, or market return, nor for any variable during the Recovery phase, suggesting that the moderating association of COVID-19 on the pricing mechanism of PT Telkom Indonesia (Persero) Tbk's stock return was concentrated specifically in the exchange rate channel during the period of acute crisis, rather than operating uniformly across all macroeconomic factors or persisting into the recovery period.

4.7. Hypothesis Testing Summary

Tabel 4.12 below summarizes the results of hypothesis testing conducted throughout this chapter.

Table 4.12 Summary of Hypothesis Testing Results

Hypothesis	Statement	Result	Conclusion
H1	Macroeconomic indicators jointly associate with stock returns	F(4.101)=0.815; p=0.5184	Not supported

H2	Industrial production positively associated with stock returns	p=0.8464	Not supported
H3	Inflation rate negatively associated with stock returns	p=0.4638	Not supported
H4	Interest rate negatively associated with stock returns	p=0.1730	Not supported
H5	Exchange rate negatively associated with stock returns	p=0.9840	Not supported
H6	Market return positively associated with stock returns	p=0.2905	Not supported
H7	COVID-19 jointly moderates all macroeconomic indicators	F(10.89)=1.240; p=0.2770	Not supported
H8	COVID-19 moderates industrial production	F(2.89)=0.136; p=0.8732	Not supported
H9	COVID-19 moderates inflation rate	F(2.89)=0.412; p=0.6635	Not supported
H10	COVID-19 moderates interest rate	F(2.89)=1.448; p=0.2406	Not supported
H11	COVID-19 moderates exchange rate	F(2.89)=4.085; p=0.0201	Supported
H12	COVID-19 moderates market return	F(2.89)=0.273; p=0.7616	Not supported

Source: Author, 2026 (Gretl)

Of the twelve hypotheses tested, only H11 was supported, indicating that the moderating role of COVID-19 in this study is concentrated specifically in the relationship between exchange rate and stock return during the acute crisis phase, rather than operating across macroeconomic indicators broadly. Notably, while H4 (the direct effect of interest rate) was not supported within Model 1, interest rate emerged as a statistically significant predictor once the moderated model structure was introduced in Model 3 (Table 4.10); this distinction is discussed further in Chapter 5.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1. Conclusion

This study examined the association between macroeconomic factors (industrial production, core inflation, BI Rate, exchange rate, and market return) and the stock return of PT Telkom Indonesia (Persero) Tbk within an APT-inspired multifactor time-series framework, and investigated the moderating role of the COVID-19 pandemic on this relationship.

With respect to the first research question, to directly test H1, a joint Wald test conducted on the four macroeconomic indicators (industrial production, core inflation, BI Rate, and exchange rate), isolating them from market return, resulted an F-statistic of 0,815 (p=0,5184), failing to reject the null hypothesis that these coefficients are jointly zero. In addition, none of the individual variables was significantly associated with stock return when considered independently of the pandemic period, and the overall direct-effect model (Model 1) was not statistically significant (F(5,101)=0,842, p=0,5229). These findings indicate that H1 is not supported, suggesting that within the scope and sample period of this study, macroeconomic indicators, considered jointly or independently, were not significantly associated with the stock return of PT Telkom Indonesia (Persero) Tbk under normal market conditions. However, this does not imply that PT Telkom Indonesia (Persero) Tbk's stock return is inherently resilient to these macroeconomic factors.

Of the six moderation-related hypotheses (H7–H12) tested to examine the moderating role of COVID-19, only H11 — concerning the moderating effect of COVID-19 on the relationship between exchange rate and stock return — was supported; H7, H8, H9, H10, and H12 were not supported.

With respect to the second research question, the moderated regression model provided evidence that the COVID-19 pandemic was associated with a change in the relationship between macroeconomic factors and stock return. Following a joint significance test that justified the exclusion of statistically weak interaction terms, the resulting parsimonious model (Model 3) was found to be

statistically significant overall (F(8,98) = 2,528, p = 0,0152). The first finding of the research is BI Rate exhibited a marginally significant association with stock return. Second, the Acute Crisis phase dummy variable was positive and highly significant, indicating a structural shift in average returns during the acute period of the pandemic. Third, the interaction between exchange rate and the Acute Crisis dummy was negative and significant, indicating that the estimated sensitivity of stock return to exchange rate fluctuations differed significantly during the acute phase of the pandemic compared to non-crisis periods (though a linear restriction test indicates that the net combined slope during this phase achieves only marginal statistical significance at the 10% level, p=0,0971, pointing to a substantial diminishment in its explanatory power at conventional significance levels). No significant moderating associations were found for industrial production, core inflation, market return, or for any variable during the Recovery phase.

Together, these findings are consistent with BI Rate functioning as a candidate systematic risk factor for PT Telkom Indonesia (Persero) Tbk's stock return under normal conditions, while exchange rate risk appears to become more relevant specifically during periods of acute systemic crisis. Notably, interest rate presents an interesting case: it was not significantly associated with stock return in the direct-effect model (H4), yet became a statistically significant predictor once the moderated model structure was introduced in Model 3. This suggests that the association between interest rate and stock return may only become detectable once the structural shift introduced by the COVID-19 pandemic is accounted for, rather than reflecting a stable relationship across the full sample period. Given that this study examines a single firm using an APT-inspired multifactor time-series specification rather than a formal test of the Arbitrage Pricing Theory, these findings should be interpreted as exploratory evidence rather than a validation of APT itself. It should also be acknowledged that market return, as constructed from the Jakarta Composite Index, mechanically incorporates the stock return of PT Telkom Indonesia (Persero) Tbk as one of its constituents, which may partly account for the observed association between the two variables.

5.2. Theoretical Implications

The findings of this study contribute to the body of literature applying an APT-inspired multifactor approach within emerging capital markets, particularly in the context of an extreme exogenous shock such as the COVID-19 pandemic. As this study is based on a single-firm time-series regression rather than a cross-sectional or panel test of priced risk factors, it does not constitute a formal validation of the Arbitrage Pricing Theory; rather, it offers exploratory evidence that the estimated association between exchange rate and stock return appears to differ across crisis and non-crisis periods.

This observation is consistent with, though not conclusive proof of, the broader literature on structural breaks in asset pricing relationships during periods of systemic financial distress, and suggests that incorporating moderating or interaction effects may be a useful direction when applying multifactor asset pricing frameworks to firms operating in markets subject to significant macroeconomic volatility.

5.3. Practical Implications

The results of this study offer several exploratory insights, which should be interpreted with appropriate caution given the observational, single-firm nature of the analysis. For investors and portfolio managers, the finding that exchange rate sensitivity appears to increase during periods of acute crisis suggests that currency risk exposure may warrant closer attention when evaluating positions in PT Telkom Indonesia (Persero) Tbk's stock during periods of heightened systemic uncertainty, even though such exposure was not found to be statistically significant during normal market conditions. Additionally, the negative association observed between BI Rate and stock return suggests that monetary policy stance may be a relevant factor to monitor when evaluating the company's equity performance, although this study does not establish a causal mechanism for this relationship. For academics and future researchers, this study provides an exploratory empirical basis for further investigation into regime-dependent risk factor associations in the Indonesian capital market, particularly within the telecommunications sector.

5.4. Limitations of the Study

Several limitations should be acknowledged when interpreting the findings of this study. First, the sub-period sample sizes for the Acute Crisis (22 observations) and Recovery (18 observations) phases are relatively small, which may limit the statistical power and robustness of the interaction effects estimated within those periods. Second, the adjusted R^2 of the final moderated model (0,1034), while a meaningful improvement over the direct-effect model, indicates that a substantial proportion of the variation in stock return remains unexplained by the variables considered, suggesting the presence of additional risk factors not captured in this study. Third, this study focuses exclusively on a single firm, PT Telkom Indonesia (Persero) Tbk, which may limit the generalizability of the findings to other firms or sectors within the Indonesian capital market. Fourth, the APT-inspired framework applied in this study incorporates a limited set of five macroeconomic variables, and the possibility remains that other systematic risk factors, not included in the model, may also be associated with stock return. Fifth, this study relies exclusively on external, market-wide and macroeconomic variables; firm-specific or internal factors — such as corporate earnings, capital expenditure decisions, dividend policy, or management actions — are not incorporated into the model, even though these factors may also be associated with PT Telkom Indonesia (Persero) Tbk's stock return. Sixth, while PT Telkom Indonesia (Persero) Tbk was deliberately selected as the largest market-capitalization constituent within Indonesia's communication services sector, this same characteristic — including its majority state ownership and dominant market position — may limit the extent to which findings generalize to smaller, privately owned, or less dominant firms within the same sector. Seventh, market return in this study is derived from the Jakarta Composite Index, of which PT Telkom Indonesia (Persero) Tbk is a constituent stock. Consequently, the estimated association between market return and stock return may be partly mechanical in nature, arising from the firm's inclusion in the index itself, rather than reflecting a purely independent economic relationship. Future studies with access to a market index excluding the firm under study would be better positioned to isolate this effect.

5.5. Recommendations for Future Research

Based on the findings and limitations above, several directions for future research are recommended. First, future studies could extend the analysis to a broader sample of firms within the telecommunications sector or across multiple sectors of the Indonesian capital market, to examine whether the moderating association of COVID-19 observed in this study generalizes beyond a single firm. Second, future research may consider incorporating additional macroeconomic or market-based variables, such as commodity prices, bond yields, or investor sentiment indices, to develop a more comprehensive multifactor asset pricing model. Third, future research could construct or obtain a market return series that excludes the constituent stock under study, in order to isolate the mechanical component of the market return–stock return association from its economic component. Fourth, given the evidence of a regime-dependent risk association found in this study, future research could examine other periods of systemic crisis or structural break in the Indonesian market, to assess whether the patterns observed during the COVID-19 pandemic are consistent across different types of exogenous shocks.

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