MAPPING FRAGILITY AND FINANCIAL INSTABILITY HYPOTHESIS IN INDONESIA: EVALUATING NINOMIYA'S MODEL AND STABILIZING ROLE OF ISLAMIC FINANCE

A Thesis

Submitted to the Master's Study Program of Economics at the Faculty of Economics and Business in partial fulfillment of the requirements for the degree of

Master of Arts (M.A.)

by:

Ucca Bhanuwati Astutiningtyas Palupi

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UNIVERSITAS ISLAM INTERNASIONAL INDONESIA

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ABSTRACT

Ucca Bhanuwati Astutiningtyas Palupi
03212310008
ucca.palupi@uiii.ac.id
Economics
Universitas Islam Internasional Indonesia

Minsky's Financial Instability Hypothesis suggests that behind the stable market system, there are culminating processes of fragility that are waiting to burst. This hypothesis unveils the meaning behind capitalistic growth, which is followed by characteristics of inequality, distribution problems, and labour market problems. Many research have been conducted to study the meaning behind conceptual thinking of Minsky's in describing Financial Instability Hypothesis through conceptual interpretation and also empirical study to capture the Minsky's moment through historical data This study is inspired on how Islamic Economics Scholars describe the position of Islamic Economics and Finance in describing the crises, where in essence crises are the end product of modern capitalism as a form of paradigm shift towards economics system, further suggest Islamic Economics and Finance provide a comprehensive framework to build a moral economics. Therefore, this study took place to examine the evolving structure of financial fragility in Indonesia through the lens of Minsky's Financial Instability Hypothesis, through an empirical framework that could describe the feedback loop between the capitalist system and behavioural aspects. This study utilizes the GARCH and VAR models to quantitatively analyse the relationship between the behavioural proxy, namely instability of confidence (σ^2) to describe FIH and its relation to macro-financial data. The findings suggest that the volatility cluster exists even under stable economic growth and causal relation between instability and income suggests broader aspects besides debt level and investment that influence the magnitude of causal interference. However, we found that the contractions experienced by Indonesia differ from one another, aligned with Minsky descriptions of altered landscape. Ultimately, the author simulates the mandatory zakat within the existing GARCH model, and the results suggest that the effectiveness of zakat as a buffer lies in its structure, not in its magnitude. This finding may provide recommendations to the Indonesian government on how the economic buffer should be structured.

Keywords: *Financial Instability Hypothesis, Confidence, Expectations, Endogenous Fragility, VAR, GARCH, Islamic Finance, Zakat, Comparative Analysis*

ACKNOWLEDGEMENTS

In the Name of Allah—the Most Compassionate, Most Merciful.
All praise is due to Allah, Lords of the worlds – [Al Fatihah, (1):1-2]

This thesis and my master study journey would not be able to reach completion and be directed to this path without Allah's blessings and guidance who has brought me to a very supportive study environment at Universitas Islam Internasional Indonesia, a perfect place for contemplation and understand real value behind numbers, meaning behind assumptions, and compassions that remind us that knowledge, at its core, could and should serve humanity (*falah*). I am deeply grateful to all people around me who have been willing and sincere in accompanying me throughout the process; their presence has truly been the source of strength, idealism, encouragement, and warmth at the same time.

I would like to express my deepest gratitude and appreciation to my supervisors, Dr. Ugi Suharto, Ph.D, whose insights, idealism, patience, and thoughtful feedback have helped me sharpen the quality of my work. Your guidance has truly made a profound difference not only in my thesis and academic journey but also in shaping my worldview, for which I am sincerely thankful.

I wish to extend my heartfelt gratitude to my family, whose unwavering love and prayers have become my foundation. To my beloved husband, thank you for your patience and countless supports that have strengthened me throughout this journey. To my mothers, thank you for your endless understanding and prayers. To my dear sons, your presence has been my joy, my motivation, and my inspiration. Watching you grow teaches me what pure compassion truly is, and I hope that one day, you will discover your own tune to see the harmony that lies in the pursuit of knowledge.

In addition, I would like to extend my gratitude to my university, faculty members, and library for providing such a supportive environment to study. Every kind word, discussion, and joy-filled contemplation is supported by numerous wonderful books that have facilitated me personally to learn from so many wonderful minds across the world. No moment, no matter how small, has gone unnoticed.

This work is dedicated to all those who walked this path with me, in spirit or in presence.
Wallahu a'lam bishawab.
Allahumma barik.
Thank you.

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ABBREVATIONS DIRECTORY

FIH	: Financial Instability Hypothesis
HSP	: Hedge, Speculative, and Ponzi (Minsky's phase)
LR	: Lender's Risks Type (Taylor and O'Connels)
GARCH	: Generalized Autoregressive Conditional Heteroskedasticity
ARCH	: Autoregressive Conditional Heteroskedasticity
AR/MA	: Autoregressive / Moving Average
VAR	: Vector Autoregression
VECM	: Vector Error Correction Model
FP	: Financial Position (Diffusion Index)
RR	: Interest Rate on Loans (Diffusion Index) or Rate on Return (Conceptually)
σ^2	: Instability of Confidence (Conditional Variance)
y	: Income
D_y	: Differenced Income (Stationary form of income)
i	: Investment
r	: Interest Rate
b	: Debt
D_b	: Differenced debt (Stationary form of debt)
Z	: Simulated Zakat data from optimum zakat rate
θ	: Optimum zakat rate (derived from previous research on structural observations)
RR-FP Model	: Model using RR and FP
RR-only Model	: Model using RR only
Debt-led	: VAR system includes y, σ^2, r, D_b
Investment-led	: VAR system includes y, σ^2, r, i

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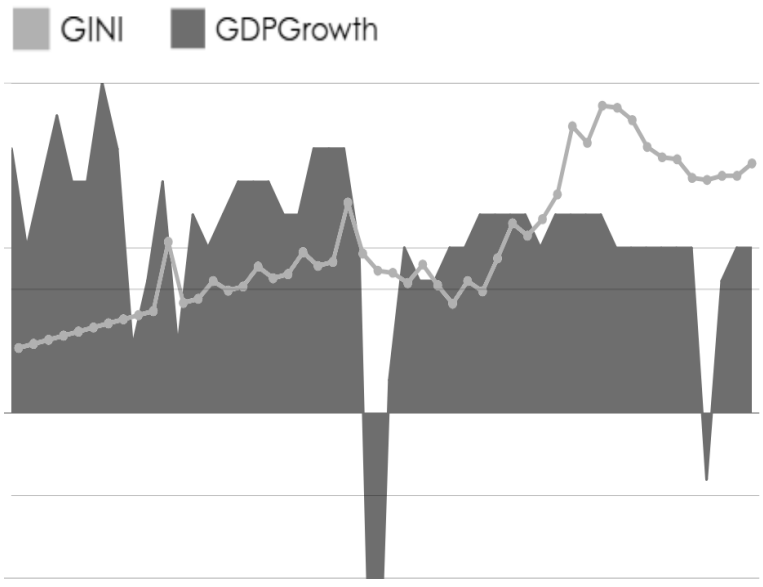
CHAPTER I
INTRODUCTION

1.1. Background

The Financial Crisis presents us with the fact that the occurrence of these crises was not a result of a contaminating effect, instead it has to be structural corrosion within the economic system. This has led to instability in the economic landscape in recent decades, coexisting with financial innovation, which paradoxically affects economic growth. The paradoxical condition refers to the phenomenon of growth in economics, but a decline in social cohesion. Studies have shown that Economic growth can exacerbate social polarization due to "jobless recovery" (Keen, 1995). The social polarization indicates the existence of inequality in various forms within the country.

This phenomenon is a global concern, which also happened in Indonesia. To have a better picture of the issues, let's see Figure 1, where the Left Y Axis represents the GINI Index, while the Right Y Axis represents the GDP Growth, and the X Axis represents the period. The GINI index was aggregated using a degree-wise approach to capture the 10-year mean value, and GDP was plotted as a line graph to represent the 10-year mean value. From figure 1.1 We observe that economic growth positively correlates with inequality, meaning that a one-unit rise in GDP growth is linked to an increase in the GINI index, which measures inequality.

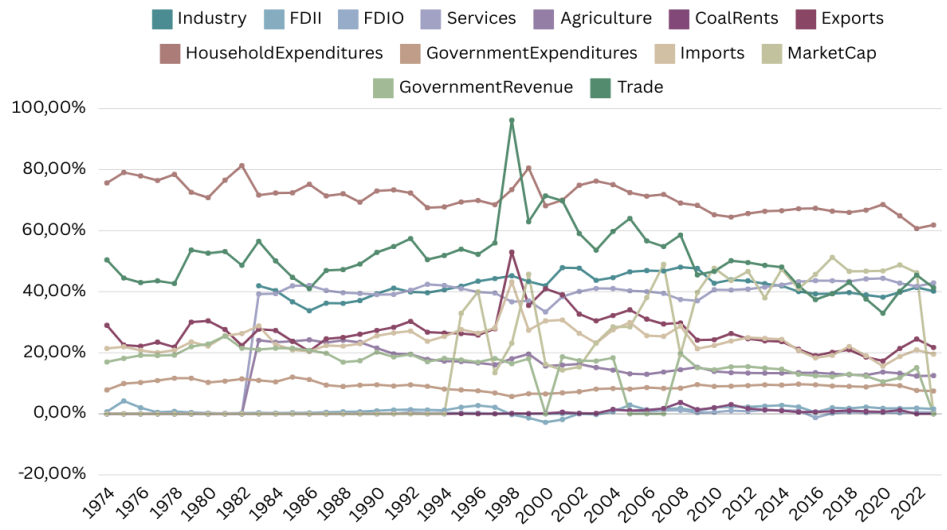
Figure 1. 1. GDP and GNI Trends Comparison



Source: World Bank – World Development Indicator Dataset

This crisis did not result solely from housing market dynamics, but was fundamentally rooted in wider economic inequalities. The so-called "democratization of homeownership" led to high delinquencies and foreclosures, triggering economic instability through a credit crunch. However, this relationship appears to be more likely a two-way interaction. While instability seems to be a root structural cause, the exploitative nature of financialization exacerbates inequality over time due to money-making opportunities that seemingly disregard macroeconomic and social consequences (Kaboub, Todorova, and Fernandez, 2010). This phenomenon could then be expanded to understand the cycle that the financialization of the economy creates to produce such output. It was when Minsky foresaw the global trends of financial liberalizations taking effect, emphasizing how systemic risks amplify in economic systems with his theory called the Financial Instability Hypothesis (FIH). Minsky's framework suggests that prolonged periods of stability lead to speculative financial behaviours that ultimately culminate in crises. This point of view of his was grounded on the Keynesian Macro Dynamic Model and the Economic Financial Structure (Keen, 1995). Minsky describes that financial markets evolve in a cyclical character: stability and economic growth lead to speculative excess, which finally culminates in crises (H. P. Minsky, 1986). According to him, this is exacerbated by bounded rationality, an economic concept coined by Herbert Simon that describes the limited cognitive capacity individuals have in processing complex financial information when they have to make decisions under uncertainty (H. P. Minsky, 1982).

Figure 1. 2. Sectoral Economic Share of GDP



Source: World Bank – World Development Indicators

Herbert Simon and Hyman Minsky were two well-known economists of the 20th century who studied the dynamics of socio-political economics alongside many other notable scholars who opposed the positivist economics paradigm. Both demonstrate critiques of positivist-rationalist assumptions about perfect markets and the economic man concept, where Simon, with his behavioral decision theory and Rational Decision Making theory, describes the bounded rationality of economic agents (Michalos and Simon, 1970; Simon, 1955, 1997). Minsky, with his historically grounded analysis, criticizes the obsession with equilibrium through his Financial Instability Hypothesis.

Interestingly, both Minsky's and Simon's conceptual thinking align with the essence of prohibition and encouragement in the Islamic Economics system, which describes the embracement of limitation and a more social-cohesion approach to address the instability in economic systems (Suharto, 2017).

In Indonesia, financialization has introduced similar dynamics, as highlighted by Figure 1.2. The figure illustrates the changing contributions of various economic sectors to GDP from 1990 to 2023. It shows a noticeable rise in the services sector, which may indicate early signs of financialization, as the variable encompasses all industries within the services sector, including the financial industry. Simultaneously, the stagnation or decline in agriculture and industry sectors could also indicate a shift away from real production towards financial mechanisms.

The increasing influence of FDI inflows and outflows, although not as noticeable as the volatility trend in the services sector, further underscores the growing integration of Indonesia's economy into global financial markets. The issue that arises when the economy diverges from the real economy, due to financialization, is the tendency of economic actors and businesses to prioritize short-term returns over long-term stability. According to Minsky, the emphasis on financialization for profit maximization in the short term is a source of conflict that fosters unsound financial behavior (H. Minsky, 1980a). This, in turn, creates conducive conditions for excessive debt accumulation and amplifies financial fragility by way of self-propelling destructive financial cycles. This becomes crucial as Indonesia's Constitution explicitly mandates that Indonesia's Economy needs to be based on the principles of *Ekonomi Kerakyatan* refers to article 33 of the Undang-Undang Dasar 1945 (Baswir, 2010)[1].

[1] Article 33 of the 1945 Constitution describes that "the *Ekonomi Kerakyatan* (people's economy) is an economic system aimed at realizing people's sovereignty in the economic sector." Dr. Baswir, senior economist and researcher at *Pusat Studi Ekonomi Kerakyatan* suggest, there are three basic principles of a people's economy which includes; (1) The economy is structured as a joint effort based on the principle of

However there are some episodes where Indonesia's Economics seems tend to demonstrate oligopoly characteristics (Johansson, 2018; Machmud, 2016; Setiawan and Effendi, 2016). This invites scholars to observe the roots of the problem, some approach it through current policy response study, some use a problem-based approach, for example, by revisiting the Asian Financial Crisis of 1998, which became the heaviest hit for Indonesia's economic stability in respect of financial stress, including observations through the lens of Minsky's conceptual theory about Financial Instability Hypothesis which anchor in systemic-structural risks.

The video Big Finance, Demystified[2] shows that these practices exhibit risks which are very often hidden in derivative markets, where large financial institutions seek both to hedge and speculate at the same time by using complex instruments that interlink risks in a manner that is not easily evaluable. The complex nature of the current financial system often makes tail risks overlooked. Empirically proven by the 2008 subprime mortgage crisis, which showed that large, complex financial institutions (LCFIs) took on excessive leverage, manufacturing tail risks that were systemic and inadequately capitalized (Acharya, et al., 2009; Moldogaziev, 2013). This was a fundamental cause of the 2007-2009 financial crisis. Distortions induced by regulation and government guarantees allowed LCFIs to take on excessive systemic risk (Acharya et al., 2009), contributing to the financial crisis. This study underlines that regulation is one of the most important factors that could reduce the systemic fragility risk. It also denotes that the lack of effective regulation has allowed a financial institution to easily put profits over stability, as well as increase the risks associated with speculative behavior.

However, considering the discussion of financialization and its resulting instability, we will see that financialization plays a significant role not only in the level of debt but also in the value of assets themselves. Financialization increases when either debt or asset prices are commodified through extractive means. This condition did not happen suddenly; it was a culminating process of the maturity of capitalism. As businesses mature, they often finance themselves through retained earnings. Banks adjust their profit strategies by focusing on two main avenues: transactional finance and profits from households.

kinship; (2) Branches of production that are important to the state and that affect the livelihoods of many people are controlled by the state; and (3) The land, water, and all the wealth contained therein are controlled by the state and used for the greatest prosperity of the people (Baswir, 2010).

[2] See Institute of New Economic Thinking Oxford (2015) entitled Big Finance, Demystified, give dynamic discussion between Sir **John** Anderson **Kay**, CBE, FRSE, FBA, FAcSS, Dean of the Saïd Oxford Business School with Rob Johnson, President of the Institute for New Economic Thinking.

Furthermore, households have experienced a shift in their relationship with the financial system. Individuals and households are now more actively involved in financial matters, leading to increased borrowing and the acquisition of financial assets to compensate for their low wages. (Costas, 2014). From here, we could see how financialization affects the economy in various ways. The fragility of society due to low real economic activity will exacerbate, given even slight shocks. The fragility, therefore, will also drive society to behave in a more risk-taking manner due to the suffocating conditions they might have experienced.

The Islamic economic perspective on financialization of the economy then adds a discourse about an ethical dimension, where the economy is supposed not solely to rely on growth but also on humanism. In Islam there is a concept of excessive uncertainty which called *gharar* that aligns with Minsky's critique of speculative excess. Under conditions of bounded rationality, financial agents encounter increasingly complex products, leading to overconfidence and suboptimal investment decisions.

This is reflected in the over-leveraging of assets, which, as Minsky suggests, transitions economies from conservative to speculative and, eventually, Ponzi finance phases. The dynamics between Economic conditions and Financial sectors could be the *'illah* of the prohibition of *gharar*, which is due to the bounded rationality of human beings. Therefore, a study on human perceptions of the rationality concept is significant in understanding the structure of modern financial markets, where financial agents often encounter sophisticated financial products and pressures to make quick decisions due to the intense conditions. As it was, financialization, in the explanation given by Storm (2018) adds another layer to this dynamic where financial markets have grown into and decisively influence fields other than traditional banking, such as social services and natural resources, reinforcing speculative behavior while strengthening market volatility. This "financialization of everything" embeds finance logic in non-financial sectors where market forces did not exist. It has produced a shift in the "rules of the game" and allowed for rent-seeking practices by a global financial elite (Storm, 2018). Moralist economists often refer to these conditions as disembedded finance, a condition where financialization prioritizes returns in the short term over real production, often inflating asset prices regardless of their economic fundamentals, thereby increasing market skewness and volatility.

The connection between Islamic economics and finance principles, economic dynamics of financialization, and bounded rationality serves as an important key to the explanation of financial instability. This becomes a central logic for the author to understand the cause of Indonesia's economic challenges and history. In addition, the limited literature on how financial instability discussions in Indonesia encourages the author to empirically study the phenomenon of Minsky's Financial Instability Hypothesis.

1.2. Problem Statement

The economic growth of Indonesia in the last decades has been reflected in the constant rise of its GDP. However, this economic growth is happening side by side with persistently high income inequality, reflected by a high Gini index. This disparity between the two elements reflects a basic problem: at a superficial level, the economy is performing well, but deeper structural problems have yet to be resolved.

Many scholars in the 20th century, such as Hyman Minsky, Benjamin Bernanke, Fisher, Taylor, and O'Connell, were drawn to the increasing monetization of economic activity that undermined the value of the activity itself, resulting from the detachment of monetary activities. Some argue in a more radical manner, where innovative logic in modern capitalistic/ neo-liberal economic thought deliberately regulates economic affairs at a pace that the government will not be able to catch up with (Fox, 2009).

These also chime with the older theoretical thought of Minsky, named the Financial Instability Hypothesis, that the modern capitalistic economy is inherently and perpetually oscillating between stability and instability. As financial mechanisms are increasingly relied upon during economic booms, falling risk aversion eventually culminates in excessive speculation and fragility, leading to economic downturns. Keen (1995) on his paper elaborate Minsky's hypothesis on how financial crisis aftermath usually addressed by policy which focus on the "jobless recovery". Rather than dealing with structural inefficiencies, such as low productivity or a lack of job opportunities, recoveries from financial crises are often based on monetary interventions, such as the injection of liquidity into financial markets. This, while providing short-term relief, often fails to restore the broader economy to its pre-crisis growth trajectory, exacerbating systemic risks and inequality.

This trend also aligned with the current economic problems faced by Indonesia. Although the country has experienced periods of stable growth, the system continues to face criticism for its failure to meet the actual poverty level. This is supported by recent arguments about the disparity between the local and worldwide standards on the poverty line (Infobanknews, 2025) and furthermore, connecting the problem to Minsky's hypothesis leads the author to set a ground research question:

> "How relevant is Minsky's Financial Instability Hypothesis for understanding Indonesia's economic dynamic and its manifestations of discrepancy, through a certain empirical framework?"

1.3. Research Questions

Thus, connecting Indonesia's economic situation and history to recent studies of Minsky's Financial Instability Hypothesis to address the proposed problem statement, has encouraged the author to propose the following set of questions:

1) Does Indonesia's financial structure appear to be fragile according to Minsky's Financial Instability Hypothesis?
2) How did major financial crises and associated policy shifts shape Indonesia's post-crisis macro-financial structure?
3) How can Islamic finance principles and redistribution mechanisms offer stabilizing alternatives to financial structures that are prone to fragility?

1.4. Objective of the Study

The study will now examine Indonesia's dependence on financial mechanisms during three phases: pre-crisis, crisis, and post-crisis. Such a division would help in understanding how past shocks influenced policy decisions and the efficiency of measures taken to avoid repeated crises. This study attempts to capture the role of finance in Indonesia's economy and determine if policy has tended to focus on "money pumping"-injecting liquidity into the system, rather than deeper structural issues such as productivity and employment. The Financial Instability Hypothesis of Minsky postulates that excessive financialization and dependence on monetary interventions would heighten the likelihood of systemic risks and inequality, rather than sustainable economic stability.

The study, therefore, aims to examine Indonesia's economic system within the theoretical framework provided by Minsky, as a means of ascertaining whether it demonstrates signs of financial fragility, thereby deriving broader insights into the implications of financial mechanisms on economic resilience and equity. Therefore, to create an alignment with the previous problem statement and question, the proposed study objectives are as follows:

1) Assessing Indonesia's macro-financial data to observe the possibility of fragility through Ninomiya's Framework.
2) Examining how financial crises and associated policy responses have shaped its post-crisis macro-financial structure and fragility dynamics in Indonesia.
3) Evaluating the potential of Islamic finance mechanisms, particularly zakat as structural buffers to mitigate financial volatility and systemic fragility in Indonesia.

1.5. Significant of the Study

The study's significance lies in its potential to bridge the gap of limited studies available that extend Minsky's Financial Instability Hypothesis in Indonesia settings (Hendartono, 2017; Suharto, 2017) especially those that demonstrate an empirical framework to observe Minsky's instability phenomenon. Therefore, this study was made to explore the possibilities of an empirical framework to be utilized. In addition, this empirical framework also brought several assumptions that underlie it both economically (mathematical equation relation) and econometrically (why the econometrics method is chosen).

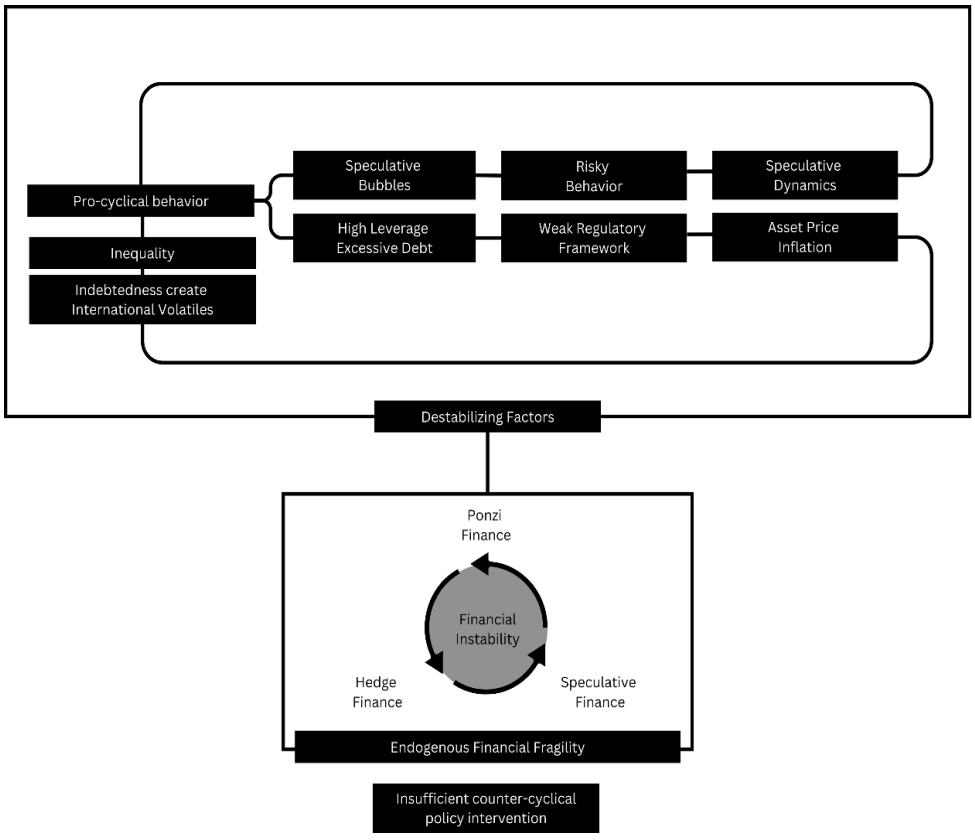
CHAPTER II
LITERATURE REVIEW

2.1 Minsky's Financial Instability Hypothesis

Financial Instability Hypothesis by Minsky (1964) starts with a thesis that criticizes the mainstream economic thought where there is no causal relation between debt and income. Carl Marx mainly influenced his works on the fundamental instability of capitalism, Joseph Schumpeter on the ability of banks to create money and demand out of nothing, Fisher on debt-deflation, and Keynes on the behaviour of investors under uncertainty (Keen, 2014).

Minsky's works strengthen the antithesis of the capitalist economic system, where the system posits a significant proportion of financial sectors, making the system vulnerable to instability. Minsky describes that instability that is inherent within the capitalist economic system occurs due to several destabilizing factors, as described in Figure 2.1.

Figure 2. 1. Minsky FIH conceptual frameworks (1964-1966)



Source: Author's Elaboration of Minsky works (1964-1966)

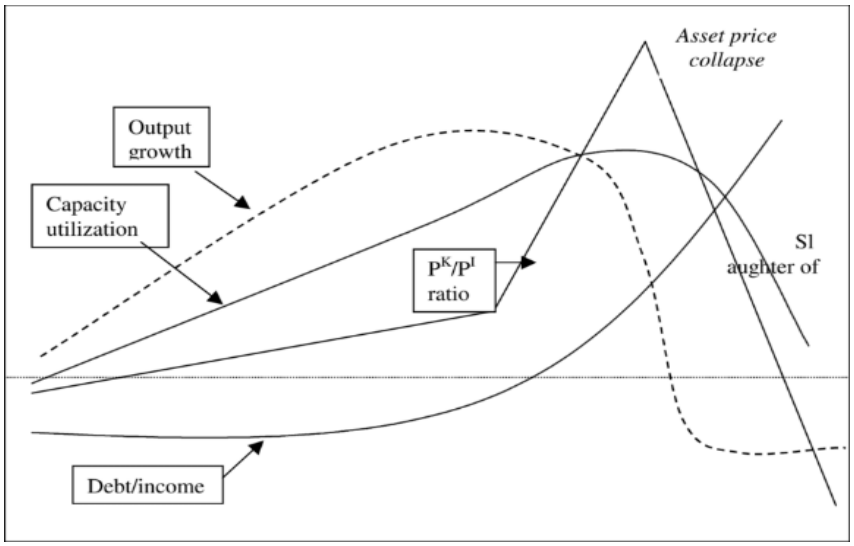
He emphasizes how the destabilizing factors influence the instability of the economic system by producing an unstable cycle, which is categorized as three major events in the financial system, which are hedge, speculative, and Ponzi finance. This condition led to overheated economic expansions, resulting in an increase in the debt ratio, which ultimately led to economic stress. His work consistently explores the inhibitor of financialization economy as firstly occur in 1920 Great Depression (Keen, 2013).

Therefore, to get to know with his wonderful works, let's get to know to his exploration journey. Hyman Minsky's development of the Financial Instability Hypothesis reflects a road of theoretical innovation from 1964 to 1996. The fundamental concepts of his theory, first outlined in "Longer Waves in Financial Relations" in 1964, assumed that financial instability is not random but rather endogenous-that economic expansions create conditions promoting financial panics during downturns (H. P. Minsky, 1964). In "The Financial Instability Hypothesis" of 1977, Minsky formalized the FIH. He postulated that financial systems evolve from stable to fragile through hedge, speculative, and Ponzi finance cycles in a continuous manner. He criticized mainstream theories for neglecting the way financial structures influence macroeconomic stability (H. P. Minsky, 1977). By the 1980s, in works such as "Capitalist Financial Processes and the Instability of Capitalism" (1980) and "Financial Markets and Economic Instability" (1981), Minsky had incorporated a reflection of Keynesian views underpinning how financial novelties contributed to rising systemic fragility. He opined that fiscal and monetary policies structured in order to counterbalance post-war crises created an insecure financial structure unintentionally (H. Minsky, 1980b; H. P. Minsky, 1981).

Then he imply on how this cycle will keep on happening by criticizing how Federal Reserve's need to spend on resource development rather than consumptions to induce a tranquil recovery (H. P. Minsky, 1982). In his "Debt and Business Cycles" article, he showed that speculative and Ponzi finance become increasingly pervasive in contemporary capitalist systems-that modern economies are more vulnerable to crisis (H. Minsky and Vaughan, 1990). Finally, his 1996 essay entitled "Uncertainty and the Institutional Structure of Capitalist Economies" stressed that institutional reform is needed in order to deal with uncertainties and risks which may fall upon financial systems (H. P. Minsky, 1996).

Figure 2.2 describe the visualization of debt cycle, where the growth curve of output and capacity utilization traces out the expansionary phase of the economy. As economic stability becomes more continuous, firms and households become more optimistic which led to increasing financial capacity utilization which at the end will led to economic output rise. However the rising output curve significantly influence by the proportion of of the debt which could be measure by debt to income ratio, which summarizes the process of increasing leverage.At this level, firms and households borrow in order to invest and expand output. However in the near future as optimism increases, borrowing is eventually used more and more to finance speculation rather than productive investment. Minsky says in this phase, a transition from "hedge finance" to "speculative finance" where the cash flows can cover only the interest, not the principal, and finally to "Ponzi finance," where debt is required to pay existing obligations, takes place. In short the graph also illustrated how stability in financial markets breeds risk-taking behaviors (Dymski, 1999).

Figure 2. 2. Minsky's Financial Instability Hypothesis Cycle



Source: Dymski (1999) visualizations

Steve Keen (1995) in this case also contribute to Minsky works as the next generation of Minskyan. In his paper he also summarized Minsky research journey, as mention before in 1980's Minsky elaborate his works to Keynes thought about it. Keen append that Minsky contribution to General Theory of Keynes was he able to codify the development of expectations over time, with an explicit monetary framework.

Keen in his work elaborate Minsky work and the foundation of Goodwin's limit cycle model, he mention the four basic insights which are euphoric expectations, the importance of long-term debt, the destabilizing impact of income inequality, and the stabilizing effect of government (Keen, 1995). Steve Keen contribution to financial instability hypothesis, often referred as the Keen model by researchers, was create a research software based on Minsky's Financial Instability Hypothesis elaboration to describe the system dynamic interactions between wages, employment, and debt in an economy (H. Minsky and Keen, n.d.). This model has been extended and analyzed in various ways to understand the conditions under which economies can reach different equilibria, including those characterized by financial stability or instability.

2.2 Kenshiro Ninomiya's Theoretical Interpretation of Financial Instability Hypothesis

The Financial Instability Hypothesis is a pivotal conceptual framework that deepens our understanding of the discrepancy in economic dynamics. However, as its were introduced by Hyman Minsky in conceptual interpretation, people are unaware of the materialization process of this concept. This invites many scholars to synthesize this conceptual thought, either theoretically or empirically. Upon conducting this study, the author curated studies on the empirical measurement of the Financial Instability Hypothesis, without limiting geographical considerations, and learned from several studies conducted by Prof. Kenshiro Ninomiya.

His research primarily focuses on economics and finance, and he has conducted extensive studies on the system dynamics of economics since 2001, which covers both theoretical formalization and empirical examination of the Financial Instability topic[3]. Ninomiya emphasises two core drivers in his macro dynamic system modelling interpretations of the financial stability, which are (i) cumulative interest-bearing debt burdens (Kenshiro Ninomiya, 2001a, 2001b, 2005a, 2005b) and his novelty concept (ii) instability of confidence (Kenshiro Ninomiya and Tokuda, 2012, 2017, 2021)

[3] Author gather Kenshiro Ninomiya information through the Rikkyo University information page. https://univdb.rikkyo.ac.jp/view?l=en&u=100001967&k=1&sm=name&sl=ja&sp=40

Ninomiya's early publications (2001a, 2001b, 2002) analyse the financial instability phenomenon through multiple approaches, namely the Financial Instability Hypothesis by Hyman Minsky, Kaldorian Dynamics by Nicholas Kaldor[4], and Keynes-Goodwin[5] model. Ninomiya extends his observations of theoretical dynamics into fiscal and monetary policy (2005a, 2005b) to empirically study the instability phenomenon by pivoting the discussion on the role of interest-bearing debt as a driver of financial instability by describing the economic cycle through Hopf Bifurcation[6] theorem.

The observations were (i) from the monetary policy side, a zero-interest rate policy is helpful to address the cumulative interest-bearing debt risks when it produces a prolonged recession (2005a) while (ii) from the fiscal policy side, even when the fiscal policy took a counter-cyclical approach to stabilize the economy, the system remains unstable under the influence of interest-bearing debt risks, this situation is then called the "debt burden trap".

Ninomiya then advanced his research by incorporating capital mobility, market structure, and the economic system into his system dynamic modeling with a consistent objective: to measure the stability of the system. In 2007, Ninomiya observed that the globalization of capital markets makes lender risk evaluation crucial for both open and closed economy systems. Specifically, in an open economy, the stability of the system depends on the level of risk posed by international lenders. This implies a possibility that economic stability may conceal the fragility of the domestic economy. (Ninomiya 2007, p. 349)[7]. Ninomiya and Sanyal in 2009 then provide more detailed emphasis on how unseen instability can occur by calling this phenomenon "a bubble without inflation" (Kenshiro Ninomiya and Sanyal, 2009).

[4] Kaldorian Dynamics refer to a business cycle model developed by Nicholas Kaldor, which defines the oscillations phenomenon between expansion and contraction in the economy that arise endogenously from the interaction between savings, investment, and capital stock through Hopf Bifurcation (Krawiec and Szydlowski, 1999).

[5] Keynes-Goodwin model is a theoretical model that combines the business cycle model by Keynes and business cycle model by Goodwin. If Keynes's business cycle model focuses on investment-driven fluctuations that majorly interpreted due to external shocks, Goodwin's business cycle model focus on the interplay of employment rate and wage share in generating the fluctuations which made it endogenously driven (Franke and Asada, 1994).

[6] Hopf Bifurcation theorem is a theory that describe the system transitions from stable equilibrium to a limit cycle (oscillatory behaviour) as a result of varied parameter (Heijden, 2011).

[7] Ninomiya's formalization of the dynamic of the system align with Minsky's concept of Financial Instability Hypothesis where "stability is unstable"

They describe the dynamic transmission path that derived from their mathematical formalization of the economic equation and visualize that the pro-cyclical path happens when Y↑ ⇒ B↑ ⇒ MD↑ ⇒ Inf↓ ⇒ MS↑ ⇒ R↓ ⇒ I↑ ⇒ Y↑ (p. 76) where Y is income, B is debt, MD is Money Demand, MS is Money supply, Inf is inflation, R is interest rate, and I is investment. This pro-cyclical present debt-led growth path triggers an increase in money demand; however, instead of provoking inflation, it creates disinflation as the new money supply offsets demand through low-cost investment (bubbles without inflation).

In addition, they suggest that this condition represents an economic condition where an increased demand for money tends to be related to incentivizing their economic risks, which requires maintaining their balance in their portfolio. Therefore, Ninomiya and Sanyal argue, counter-cyclical policy will become effective only when the central bank recognizes the characteristics of money demand that might reflect more on interest rate control response rather than inflation control response, furthermore, the counter-cyclical policy would be efficient when it follows the path Y↑ ⇒ B↑ ⇒ MD↑ ⇒ (Central Bank Tightens) R↑ ⇒ I↓ ⇒ Y↓ (p. 77 author interpretations added).

At this point, we could see that Ninomiya and Sanyal (2009) have enabled more understanding of Minsky's conceptual dynamics through the dynamic equation of the debt burden of firms into non-linear economic dynamic models, which are used to indicate financial conditions (Kenshiro Ninomiya, 2009). The advancement of his pursuit in modelling Minsky's hypothesis continued in the same year by incorporating the concept of the financial accelerator hypothesis by Bernanke and Gertler in 1989, and the extended statistical analysis of Taylor and O'Connell's idea by Uchida in 1987 and Ueda in 2006 (which observed instability in an oligopolistic or short-run economy). The outcome was a Hopf bifurcation system dynamic modelling, which merged debt burden and financial assets to measure financial instability (ibid.). In 2011, Ninomiya and Tokuda began to extend Ninomiya's model by incorporating Semmler's (1987) financial cycle based on the idea of "S-shaped" saving function as an axis, and introduced a new concept of "instability of confidence" as a measurable indicator of Minsky's Financial Instability Hypothesis (Kenshiro Ninomiya and Tokuda, 2011).

The significance of the instability of confidence concept keeps being analyzed through several empirical models that aim to see another possibility of leading factors of instability, namely the debt-led instability model (2017) and investment-led instability model (2012, 2021) through both mathematical and empirical observations.

To provide their descriptions of their observations of the dynamics, the author summarizes the key points as follows:

1. Debt-led instability path (2017). When the economic system has characteristics where investment is sensitive to changes in interest rate, relatively small (2017, p.45) the system might become stable at; $Y\uparrow \Rightarrow I\uparrow \Rightarrow B\uparrow \Rightarrow i\downarrow \Rightarrow I\uparrow \Rightarrow Y\uparrow$ (Y is income; I is investment; B is debt; i is interest) and by considering the case where instability of confidence depends on income and debt burden, the instability might transmitted through interest rate thus the path would be; $Y\uparrow \Rightarrow \sigma^2\downarrow \Rightarrow \mu\uparrow \Rightarrow i\downarrow \Rightarrow I\uparrow \Rightarrow Y\uparrow$.
2. Investment-led instability path. Ninomiya and Tokuda utilize an investment-led model in their two empirical study, first using Korean data in 2012 and the second one using American data in 2021; therefore, the author will elaborate on their 2021 findings. They suggest several characteristics of the "euphoria state" which include:
    a. I_{σ^2} is large, implies investment sensitivity to change in instability of confidence is large (p.3).
    b. $L_{\sigma^2} > 0$, implies lender risk sensitivity to change in instability of confidence more than 0 (p.4).
    c. $\mu_{\sigma^2} < 0$, implies money multiplier sensitivity to change in instability of confidence less than 0 (p.4).
    d. Dynamic equation for net income is $Y = \alpha (C + I - Y)$, $\alpha > 0$.

    The characteristics mentioned above might transmit the instability to the system through two scenarios, which describe the role of the money multiplier (μ) and the lender risk's (L):

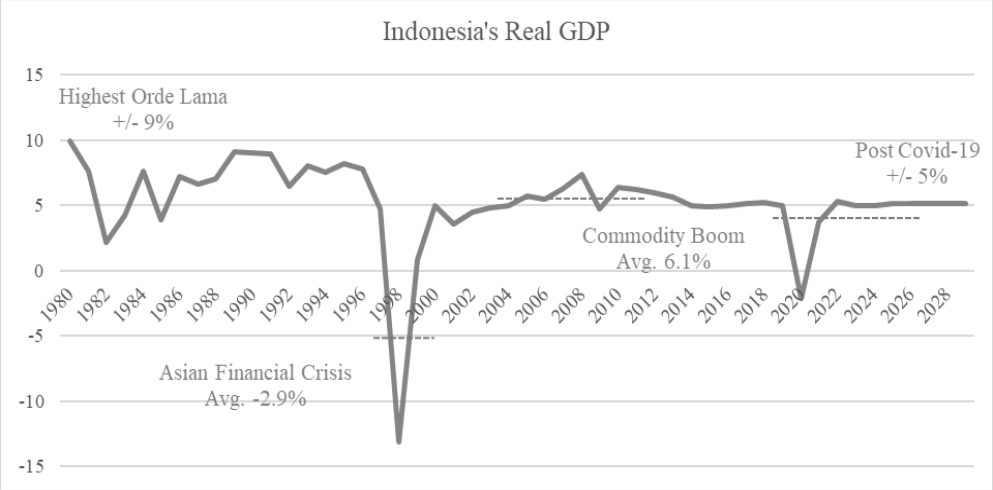
    a. Unstable type 1: $Y\uparrow \Rightarrow \sigma^2\downarrow \Rightarrow \mu\uparrow, L\downarrow \Rightarrow I\downarrow \Rightarrow I\uparrow \Rightarrow Y\uparrow$
    b. Unstable type 2: $Y\uparrow \Rightarrow \sigma^2\downarrow \Rightarrow I\uparrow \Rightarrow Y\uparrow$

    Therefore, Ninomiya's modelling framework insight, particularly regarding the instability of confidence σ^2 and confidence-driven cycles (2012, 2017, 2021) sets a ground for an empirical framework that is further discussed in Chapter 3.

2.3 Indonesia Financial Crisis

Indonesia has experienced several significant financial crises, most notably the 1997/98 Asian financial crisis and the 2008/09 global economic crisis. Figure 2.3 describes all the financial crises experienced by Indonesia from 1980 to 2024. The graph suggests there were three significant events categorized as financial crises: the Asian Financial Crisis in 1998, the Commodity Boom and Sub-Prime Crisis in 2008, and the latest was the COVID-19 Pandemic in 2020. Now, let's break down the event one by one. Indonesia's financial crisis in 1997-1998 was a result of internal and external shocks at that time.

Figure 2. 3. Indonesia Real GDP Growth



Source: International Monetary Fund (2024)

The first financial crisis recorded in the literature was the Asian Financial Crisis in 1998. This event is captured as a sequence of global repercussions as a result of the rise in the supremacy of the US dollar (Greene, 1981; Imansyah, Siregar, Muttaqin, and Korea, 2014; Sadli, 2015; Tambunan, 2010). This event was widely discussed as a representation of market liberalization and structural reforms in the financial structure of the Economy (Greene, 1981). The biggest background underlying the occurrence was speculative attacks on regional currencies, which precipitated an acute rupiah devaluation, capital flights, and a contraction in economic growth by as much as -13% (Sadli, 2015; Tambunan, 2010).

The next event capture was the commodity boom and the subprime crisis. The commodity boom is described as a significant shift in commoditization as a result of massive industrialization.

During the early 2000s, Asian economies experienced substantial capital inflows (Roy and Kemme, 2020), in this period of time, most countries were in an industrialization process. This additional capital created more opportunities for countries to boost their growth as they found an urgent need to correct their economy after experiencing the 1998 crisis. These conditions were exacerbated by financial market liberalization and a heavy reliance on foreign capital, particularly from the U.S., as highlighted in various research pieces that underscore the role of global economic integration in increasing vulnerability, which would later escalate in 2008, known as the subprime crisis. That crisis had been characterized by the collapse of a housing bubble, driven a great deal by low-interest rates, excessive risk-taking by financial institutions, and the growth of new complex financial instruments such as mortgage-backed securities (Imansyah et al., 2014). The crisis also revealed intrinsic problems with Indonesia's financial system. Over-leveraged corporations and slack banking supervision are major problems. (Sadli, 2015; Tambunan, 2010).

Discussing the financial crisis, as Minsky suggests, the deregulation of the financial market also exacerbated the shift between phases of the economic cycle (stability-speculative-ponzi). The 1999 financial crisis in Indonesia set the first example of deregulation of the financial market. It started in the late 1980s until early 1990s, when Indonesia had a large number of private banks, until they were reduced to 230 banks in 1997 (Bennett, 1999). Moving back to the early 1980s, when financial market expansion could be seen in the deregulation packages of 1983 (PAKJUN 1983) and 1988 (PAKTO 88), which were often hailed as transformative financial regulation that opened up Indonesia’s banking sector to private competition and liberalized capital flows (Nuryasman and Wiweko, 2001; Winarti and Rinardi, 2020).

Table 2.1 describes how the early deregulation of banks in Indonesia took place. PAKJUN 1983, as the first deregulation of the banks, initially aimed to boost the economy that was experiencing weakening due to declining exports in 1982, falling foreign exchange reserves at the central bank, and a deficit of around USD 7,073 million. (Winarti and Rinardi, 2020). PAKJUN 1983 marked the banking liberalization in Indonesia, which was followed by PAKTO 1988. PAKJUN 1983 deregulation has come with consequences of competitiveness in the banking sector, and it also led to an ideal circumstance which pushed each bank to neglect the risks. The PAKTO 1988 was implemented to address the excessive liberalization in the banking industry during that period by establishing credit limits.

However, alongside these stricter credit limits, the policy continued to promote liberalization by allowing foreign banks to operate in Indonesia. It could be said that private banks have become more competitive, while on the other hand, state banks struggled with inefficiencies (Kenward, 1997; McLeod, 1999).

State bank inefficiencies stem not only from market competitiveness but also from deregulation that adversely affects state banks. For example, state banks are closely linked to political power and historically used as social tools that hinder them from competing on the same level as private banks (Nuryasman and Wiweko, 2001). The rigid bureaucratic structures also hampered the adaptability and led to higher operational costs compared to a private bank (Winarti and Rinardi, 2020).

Table 2. 1. Summary of Deregulation 1983 and 1988

PAKJUN 1983	PAKTO 1988
Eliminate the credit page system.	Providing licensing facilities for the establishment of new banks, including private banks, cooperatives, and joint ventures.
Give banks the freedom to determine interest rates on deposits and loans.	Allowing foreign banks to open branches in several major cities in Indonesia.
Reduce Bank Indonesia's intervention, especially in the distribution of Bank Indonesia Liquidity Credit (KLBI), except for certain credits such as cooperatives and exports.	Encouraging banks to become foreign exchange to support non-oil and gas exports.
	Setting the maximum credit limit (BMPK).
	Providing taxation facilities for deposit interest and other capital market products

Source: Author’s Summary

Alongside with finance liberalization, this period was also marked by the growth of industrialization. However, this situation remains unfavorable due to the natural conditions of Indonesia, which make transportation and maintenance costs significantly high. Additionally, rapid credit expansion, fueled by an influx of foreign capital, led to asset bubbles.

The vulnerabilities crystallized in the mid-1990s and re-regulation (McLeod, 1999) was taken to address the crisis, which was caused by the inadequacy of banking regulations and the central bank's inability to manage systemic risks effectively, which was also a sequential event created by the deregulation in 1980, which led the financial sector to the Gilded Age. Neither 1998 nor 2008 showed the positive side of the financialization of the economy, instead reinforcing the hypothesis of the fragility of the system, and again exacerbated by deregulation.

The crisis highlighted how interconnected Indonesia's economy had become with global financial markets. Increased global financial liberalization in the early 2000s attracted foreign portfolio investments, particularly in government bonds and equities. However, this reliance on foreign capital again exposed Indonesia to external shocks when global investors withdrew funds amidst the crisis (Bennett, 1999; Kenward, 1997).

Studies have shown that the 2008 financial crisis in Indonesia led to a slowdown in economic growth, due to financial market stress (Boediono, 2016; Sadli, 2015; Tambunan, 2010). However, understanding the circumstances pre-crisis in 2008 will lead us to the understanding of why Indonesia could experience a financial crisis, and why there are confident voices in Indonesia that suggest Indonesia is fundamentally strong enough.

Table 2. 2. Fuel Subsidies, National Budget Deficit, and Current Transactions

Year	BBM Subsidies		National Budget Deficit (Trillion IDR)	Current Transactions
	Trillion IDR	% of National Budget		
2004	69,0	16,2	-23,8	-0,5
2005	95,6	18,8	-14,4	-3,0
2006	64,2	9,6	-29,1	10,9
2007	83,8	11,1	-49,8	10,5
2008	139,1	14,1	-4,1	0,1

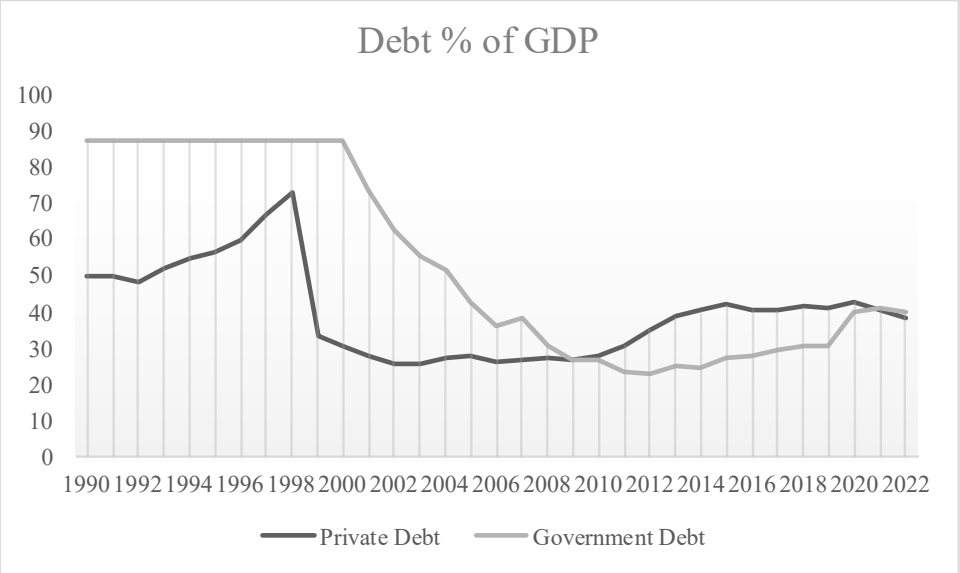
Source: Ekonomi Indonesia Dalam Lintasan Sejarah – Prof. Dr. Boediono

Indonesia confidence in early 2008 before experiencing crisis not a groundless hypothesis. Based on Prof. Dr. Boediono Book Ekonomi Indonesia Dalam Lintasan Sejarah (2016) he summarize Indonesia pre-crisis condition as display in table 2.2, he suggest Indonesia confidence before crisis were coming from the soundness of economic condition at that time.

However, Indonesia as an open economics country, strength economic condition only would not enough to bear the global fragility. In summary there are several key things that made Indonesia contaminated with US Sub-Prime Crisis which are liquidity problem in capital market, transfer of depositor funds who like to seek saver financial institutions (in this case Indonesia's people prefer to move their fund to Singapore bank which has strengthen fundamentals), and systematic deleveraging risks (Boediono, 2016).

From the literature and our discussion about Indonesia financial crisis history, we could see that the key driver of Indonesia Financial Crisis have high correlation with Minsky's hypothesis. According to Minsky's hypothesis, extended periods of stability and growth are followed by overconfidence on the part of investors and financial institutions, which leads to excessive borrowing and speculative investments. These phase reflect the Indonesia timeline from 1980's – 2008. The process thus nurtures financial fragility and makes economies susceptible to shocks. When the capital inflows became reverse which in other words could also be said as deregulation, the bubbles start to booms, the fragility of the over-leveraged firms and banks materialized themselves in conformity with Minsky's theory (Roy and Kemme, 2020).

Figure 2. 4. Debt-to-GDP Ratio Comparison Private and Government



Source: International Monetary Fund (2024)

Figure 2.3 compares private and government debt as a percentage of GDP in Indonesia, from 1990 to 2022. From this graph, it is evident that significant changes have occurred over the period. Since the early 1990s, government debt has prevailed over the total amount, reflecting heavy government involvement in economic finance during this period. However, from the early 2000s onwards, sharp reductions in government debt took place. Followed by a stable period of private debt, then hikes in 2008. The sharp peak level of private debt in the year 2008 coincided with the financial crisis in that year, and consequently, this peak reflects increased sensitivity of the private sector due to financial instability; consistent with Minsky's Financial Instability Hypothesis, which emphasizes the transition from stable to speculative and Ponzi financing phases (Keen, 1995; H. P. Minsky, 1977, 1981, 1996; H. Minsky and Vaughan, 1990). Post-2008, the private debt ratio stabilized in relatively higher territory, whereas government debt was modest. This indicates a structural shift, reflecting that private sector activities are a primary driver of indebtedness and highlighting the Indonesian economy's dependence on private capital. The divergence between Public Sector Debt and General Government Debt indicates more extensive participation by private non-government agents in the accumulation of debt. This can be interpreted, through the lens of Minsky's Financial Instability Hypothesis, as indicative of systemic risk build-up because indebtedness rises with expansion. This phenomenon could be extended to the statement of Prof. Costas (2014) in his seminar at Boston University, he said there is no doubt at all that financialization has witnessed a historic reversal of trends of inequality (Costas, 2014). Therefore, Indonesia's history sets an example for Minsky's diagnosis and critique of the capitalist economy.

2.4 System Dynamic Model

2.4.1 General Introduction to System Dynamic Model

A System Dynamics Model (SDM) in economics is a methodology used to understand and simulate the behavior of complex economic systems over time. It integrates traditional economic models with dynamic simulation techniques to analyze how policy variables evolve towards equilibrium and to assess the impact of different interventions. Make it capable of addressing the need for immediate cessation within a variable dynamic relationship (Mass, 1983).

The key component of the system dynamic model in general lies in three key elements: 1. Stock and Flows, 2. Feedback Loops, and 3. Non-linear Dynamics (Sterman, 2002). Now, let's break down the definition of each element. The first element is 1. Stock and Flows is a concept of programming where Stocks represent accumulations of resources or information, while Flows are the rates at which these stocks change (Radzicki, 2011; Sterman, 2002). To illustrate this concept, consider the analogy of population growth. The trend of population is influenced by birth rate and mortality rate, where population serves as the stock, and birth rate and mortality rate represent the flows (one inflow and one outflow).

The second element is 2. Feedback Loops are mechanisms through which the system self-regulates (ibid.). Positive feedback loops amplify changes, which might be growth or decline depending on the initial relationship. In contrast, negative feedback loops emphasize the capability of the system to stabilize itself through counterbalancing deviations from a given state. (ibid.). Recognizing how feedback loops can define the deviation from a destabilizing state of the system aligns with Minsky's hypothesis, which suggests the destabilizing nature of capitalism.

The third element is 3. Non-linear Dynamics, which refers to the behaviour of the system itself, where it tends to be random even though it is deterministic (Birkhoff, 1929; Goldberger, 1996). In summary we could said that System Dynamic Model refer to a model which apply an assumptions that the system behavior arises from internal structures, interactions between variables are deterministic, though often non-linear, giving rise to complex dynamics as a nature of the system, in addition it also imply that dynamic of the system influence greatly by endogenous variable rather than exogenous variable.

This summary aligns with the statement of the founding father of the Dynamic System Model in Economics, Professor Jay Forrester of the Massachusetts Institute of Technology. He suggests in one of his articles that dynamic behavior in systems arises from the internal structure rather than external inputs, such as policies and feedback mechanisms, which are embedded in the system that will determine the trajectory (Forrester, 1968). The utilization of the system dynamic model has started to be widely used in the field of economics, highlighting the dualism among economists who believe in both the system dynamic model and the dynamic stochastic general equilibrium model. Essentially, the main difference between the two models is how variance is acknowledged within the system.

As previously discussed, the System Dynamic Model argues that endogenous influences play a key role in the system's distortion, as it emphasizes the internal structure of the system, which includes feedback loops and delays as primary causes of the observed dynamic behavior rather than external forces. (Forrester, 1968; Sterman, 2002). On the other hand Dynamic Stochastic General Equilibrium Model (DGSE) suggests exogenous stochastic shocks, such as technology or policy shifts, influence the system's equilibrium path, which creates economic fluctuations and distortions (Gali, 2008; Kydland and Prescott, 1982). Although the approach might suggest contrast differences, they share the same values, which helps to understand the dynamic within the system on how variables could evolve due to certain conditions (Sterman, 2002). In other words, we could also summarize the difference between the models by saying that System Dynamics excels in its ability to model systems with inherent feedback and non-linear relationships (Sterman, 2002), whereas DSGE focuses on equilibrium dynamics and relies heavily on exogenous shocks to simulate deviations (An and Schorfheide, 2007). At this point, we could see the explanation of system dynamics highlights more on its role as a foundation for Minsky's Financial Instability Hypothesis, where Minsky emphasized the importance of conducting a thorough analysis from a short-term perspective (Keen, 1995) to address long-term financial fragility. However, some studies emphasizing the empirical evidence of the Minsky moment utilize the DGSE model (Kenshiro Ninomiya and Tokuda, 2017; Stockhammer and Gouzoulis, 2023) to analyse the dynamic relationship between variables.

Corresponding to Ninomiya and Tokuda's (2011; 2012; 2017; 2021) studies, they consistently demonstrate the utilization of the Hopf bifurcation theorem to construct and elaborate the dynamic system, which includes certain assumptions and considerations (e.g., lender's risk, multiplier conditions, s-shaped savings functions) for the model, then utilize univariate[8] model, namely the GARCH family model (including the T-ARCH model in 2012), and the multivariate model, namely the VAR model, for practical empirical analysis (2011; 2012; 2017; 2021).

[8] Univariate model refers to a model which observes a single endogenous variable = y_t, while a multivariate model observes two or more interdependent variables simultaneously = $\begin{cases} y_t \\ x_t \end{cases}$.

GARCH family model is considered a dynamic linear model as it accounts for the volatility changes over time, which enable an observation of the underlying pattern under an endogenous driven force (Ali, et.al., 2022; Hajizadeh, et.al., 2012; Laux and Ng, 1993). Similarly, the VAR model is also considered as a dynamic linear model as the method; (i) incorporates lagged values of the VAR-list variables into the certain variable equation, implies the current state of a variable depends on its past and the past of other variables as well, (ii) the model also facilitates endogenous dynamic analysis (Akkaya, 2021; An and Schorfheide, 2007; Goeltom, 2008; Hudiyanto, et.al., 2022; Nishi, 2012; Rehal, 2025)

2.4.2 System Dynamic in Indonesia

Discussing the implementation of dynamic systems in Indonesia within the economic scope, we will find most literature talking about policy implications and forecasting, especially in the scope of monetary and fiscal. The table summarizes the curated studies related to economic dynamic model analysis in Indonesia, including papers that study monetary, macroeconomic, and regional growth. Each one of the studies uses methodologies, either System Dynamics or Dynamic Stochastic General Equilibrium (DSGE) models, to analyse economic conditions in Indonesia. The detailed synthesis of entries is summarized in table 2.3, with a description as follows:

1. Dynamic Model (Goeltom, 2008; Iljas, 2017) of Monetary Policy Transmission Mechanisms:

   Two papers study monetary policy transmission mechanisms in Indonesia. Iljas 2017 examines the dynamic adjustment of monetary policy throughout the reform period and emphasizes inflation targeting as one of the key tools for policy operations, he utilize VAR/VEC model. Goeltom 2008, in turn, gives profound insights into how Indonesia moved on to embrace inflation targeting in the post-1997–2000 crisis environment underlain by structural adjustments through a Structural Vector Autoregression Model (SVAR). Both-of-these studies utilize System Dynamics Models in simulating the macroeconomic effects of policy interventions on inflation, exchange rates, and output by underlining Indonesia's macroeconomic vulnerabilities and reform measures.

2. Dynamic Modelling of Monetary Policy (Hudiyanto et al., 2022):

   This paper, examines the monetary policy transmission mechanisms in Indonesia between 2010 and 2018 using VAR/VEC Model. In the context of the inflation targeting framework, it discusses how monetary instruments interact with interest rates and inflationary outcomes. The research identifies how dynamic modeling captures the complexities in monetary policy under an evolving economic landscape.

3. Dynamic Modelling of Macroeconomic Growth Analysis (Gunawan et al., 2023):

   This paper utilize panel data model techniques. The study applies FD-GMM (First-Difference Generalized Method of Moments) and Sys-GMM (System Generalized Method of Moments) in the assessment of determinants of economic growth, such as HDI, poverty levels, and the agglomeration effect within the period between 2016 and 2021. This research work mainly emphasizes the dynamic interdependence between the variables of growth.

4. Dynamic Modelling of Cross-Regional Economic Growth Dynamics (Badriah and Arintoko, 2024):

   Badriah and Arintoko (2024) discuss the regional disparity in Indonesia's economy using a dynamic panel data approach to find the determinants of growth across different provinces between 2015 and 2022. The variables under study are technological progress, population, investment, human capital, economic openness, and structural change. This research captures heterogeneity among regions and points out the role of inequality in influencing growth outcomes, bringing forth critical implications for policy at the level of equitable development.

Table 2. 3. Dynamic Model in Indonesia's Economic Study

Author(s)	Year	Title	Economic Focus	System Dynamic/ DSGE Application	Descriptions	DOI or Link to Access
Achjar Iljas	2017	The Transmission Mechanism of Monetary Policy in Indonesia	Monetary Policy	Dynamic Model	Discusses the Indonesian experience with monetary policy adjustments and their transmission mechanisms during economic reforms.	https://www.bis.org/publ/plcy03e.pdf
Miranda S. Goeltom	2008	The Transmission Mechanisms of Monetary Policy in Indonesia	Monetary Policy	Dynamic Model	Explores monetary policy transmission mechanisms post-crisis, focusing on inflation targeting and structural reforms.	https://bis.org/publ/bispap35.htm
Hadir Hudiyanto et al.	2022	Monetary Policy Transmission Mechanism in Indonesia	Monetary Policy	Dynamic Model	Analyzes inflation targeting and the transmission mechanisms of monetary policy using dynamic models for 2010-2018.	https://ijecm.co.uk/
Ashari Gunawan et al.	2023	Econometric Model of Economic Growth in Indonesia Using Dynamic Panel Data	Macro Ecnomic Growth	Dynamic Panel Data	Uses dynamic panel data methods (FD-GMM and Sys-GMM) to study economic growth determinants in Indonesia (2016-2021).	https://doi.org/10.56457/jimk.v11i1.344
Lilis Siti Badriah et al.	2024	The Dynamics Model of Cross-Regional to Enhance Economic Growth: New Empirical Evidence from Indonesia	Regional Economic Growth	Dynamic Panel Data	Examines determinants of economic growth across regions in Indonesia using a dynamic model with multiple variables.	https://doi.org/10.2478/eoik-2024-0046

2.5 Islamic Finance

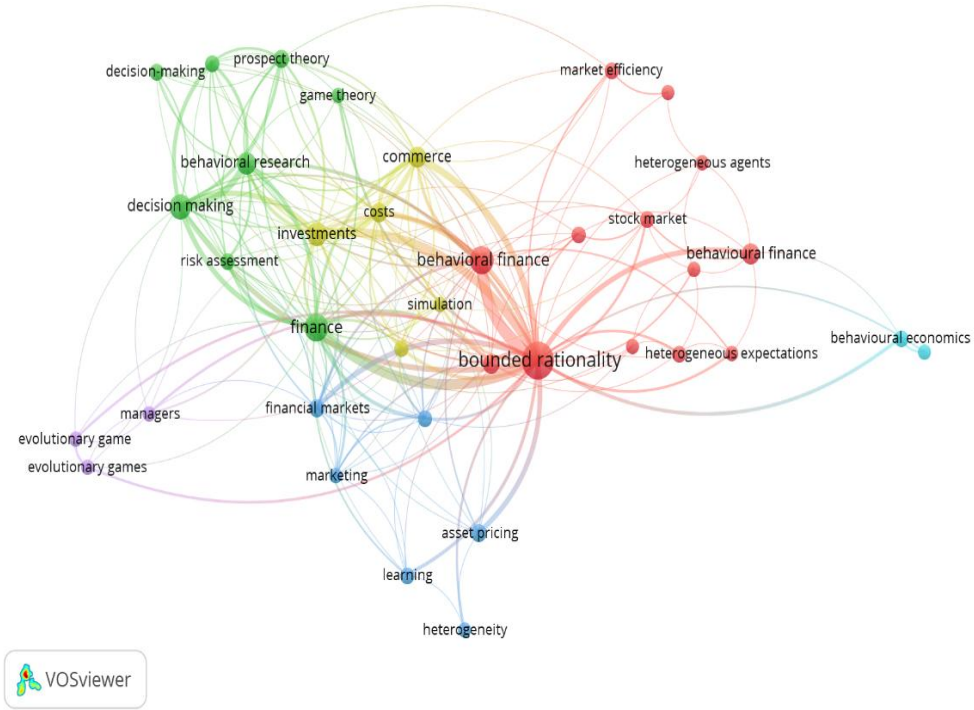
Gharar, commonly understood as excessive uncertainty or risk, can significantly impact market cycles by exacerbating volatility and amplifying the potential for financial instability. In financial markets, gharar manifests in various forms, such as speculative investments, ambiguous contracts, and complex financial products whose risks are difficult for investors to assess. These elements of uncertainty and speculative risk influence market cycles in several key ways; Speculative Bubble Catalyst, Market Volatility Exuberance, and Social Distortion (D'Alvia, 2020). Moreover cited from D'Alvia (2020) according to Knight, money-creation processes are centred on uncertainty, where, from a Western context, empirical studies suggest risk and uncertainty are inherent and necessary for profit generation. Knight identified the "confusion" between "the problem of intuitive estimation" and "the logic of probability," whether a priori or statistical. D'Alvia (2020) then complements Knight's discussion into the ontological perspective of risks, he implied:

> "The story of risk was initiated by formalising its ontological meaning (a theory of being) based on an objective dimension under the laws of probability. Therefore, risk management is a revolutionary idea whereby the future, far from being the antagonist, mysterious fate or voluntas dei, becomes an opportunity to acquire wealth and establish favourable economic conditions."

From his explanation, we could see how the financial system embodies the element of gharar and how gharar has been made as the axis in the financial system. Connecting this discussion to Minsky's Financial Instability Hypothesis, we could also see that the discussion about gharar and the problem of gharar itself have been significant issues not only among Muslims but also the rest of the world. However, they note the gharar problem as excessive risks. On the other hand, when we refer again to D'Alvia's explanation on how ontologically speaking the understanding of risks has been constructed, we could directly spot the problem within the society regarding risk perceptions. It's like a double-edged sword. Many studies have been made in the scope of the gap between risk perceptions and capacity, mainly concerning the limit of human rationality to respond to risks. These gaps are often referred to as the "Perception Gap" (Slovic, Finucane, Peters, and MacGregor, 2013; Slovic and Peters, 2006).

Slovic especially mentions that these issues arise as the double existence of risks, risks as feelings, and risks as rationality. This refers to the cognitive ability of humans, where, to simplify decision-making, humans will ignore some information (ibid.). He also mentions that being rational does not necessarily lead to a positive outcome; sometimes, fewer judgments create a positive outcome than more complex methods. This is the 'illah of Gharar prohibition in Islam. The prohibition of gharar in Islamic finance, therefore, touches fundamentally on the ethical and practical problems emanating from excessive uncertainty in conventional financial systems. Based on Minsky's FIH, the presence of gharar amplifies systemic risks through speculative bubbles and financial instability cycles. In view of Minsky's theory, the periods of economic stability are associated with an enhanced appetite for risk; hence, speculative and even Ponzi financing become common. This cycle is reminiscent of the impact of gharar, since it creates environments in which speculation, fed by ambiguous contracts and opaque mechanisms of finance, acts as a catalyst for market volatility (Suharto, 2017).

Figure 2. 5. Words Map Bounded Rationality and Finance



Source: Author's VOS Viewer result from Scopus Database[9]

[9] Word map generated with statistical software name VOS Viewer after cleaned with OpenRefine (C. for S. and Society, 2023; van Eck and Waltman, 2011)

Another category from Polanyi that helps in critically grasping the prohibition of gharar in Islamic finance is embeddedness. According to Polanyi, the disembedding of financial systems—whereby financial activities are decoupled from real economic activities—results in social and economic dislocations. Similar concerns about the convergence of Islamic financial instruments into conventional debt-based mechanisms have also been raised by Asutay and Yilmaz (2024). They further show that the "rapidly growing preference for debt instruments, such as murabahah and sukuk, over equity-based models like mudarabah, erodes the foundational principles of risk-sharing and partnership, hence embedding gharar into financial systems in the name of market integration (Asutay and Yilmaz, 2024).

The concept of bounded rationality emerges as a central theme in this study, intricately linking discussions of maysir, gharar, and riba due to the systemic financial instability. The word map drawn here underlines the themes of behavioral finance, choice under endogeneity, and bounded rationality. The generated words map illustrates the limitations of human cognition in the face of complex financial system risks. The words map supports Slovic's view of the dual nature of risk perception, represented both as feelings and as analytical constructs. Visualization underlines the relevance of market efficiency and heterogeneous agents for financial behavior and shows that systemic risks are deeply embedded in the dynamics of speculation and opaque finance practices. The prominence of concepts such as "behavioral finance" and "bounded rationality" itself further bridges the ontological critiques of Knight and D'Alvia through the idea that financial markets tend towards amplifying instability due to a disembedded logic, segregating the system from ethical and social imperatives (D’Alvia, 2020). The narrative further intersects with Slovic’s duality of risk perception, which describes risk as feeling versus risk as analysis. Slovic and Peters (2006) elaborates that the "rapidly growing preference for debt instruments over equity-based models erodes the foundational principles of risk-sharing and partnership and hence embeds gharar into financial systems in the name of market integration. Similarly, Suharto (2017) and Asutay and Yilmaz (2024) suggest that an unstable system due to speculation erodes morality in the economy. The ‘illah (underlying reason) for this prohibition is thus deeply rooted in the alignment of financial practices with ethical and socially responsible behavior (Asutay and Yilmaz, 2024; Polanyi, n.d.; Suharto, 2017).

2.6 Theoretical Framework

The Financial Instability Hypothesis (FIH) has been extended through multiple scholarly directions. Among the most influential contributors to this study are Prof. Steve Keen and Prof. Kenshiro Ninomiya. Prof. Steve Keen's study focuses on the dynamic interaction at the macroeconomic level, which in his simple causal model of FIH includes: 1. Capital stocks determine output, 2. Output determines employment, 3. Employment determines the Rate of change of wages (through the Phillips Curve), 4. Output minus wages is profit, 5. Profit determines interest, 6. Investment is the rate of change of capital, 7. Private Debt investment function, which is influenced by the level of retained earnings and assumptions of profit, is now the net of interest payments as well as wages (Keen, 2014). Prof. Kenshiro Ninomiya extended Minsky's hypothesis with a particular focus on the system dynamic modelling of monetary behavior dynamics, which includes fiscal and monetary policy observations, e.g., profit-sharing mechanism and zero interest rate policy in Japan, affecting the cyclicality of the policy on the economy based on Minsky's theoretical logic. He argues that the causal relation between interest rate and debt level could develop to a cumulative interest-bearing debt burden and be interpreted as an aspect of financial instability (Kenshiro Ninomiya, 2006). His focus on interest-bearing debt burden represents the exponential nature of interest, which is supported by Marx, Schumpeter, Keynes, Knell (Knell, 2015), Steve Keen (Keen, 2013), and Hiroshi Nishi (Nishi, 2012). Ninomiya's contribution to the Financial Instability Hypothesis study was to introduce the instability of confidence as a variable to measure the instability proxy by dispersion of confidence (Kenshiro Ninomiya and Tokuda, 2011, 2012, 2017, 2021).

In comparison, the mathematical logic explanation to describe the relation between variables (e.g., interest-bearing debt and disinflation bias) aligns with Islamic economics critiques of the modern-capitalistic economic system. The alignment could easily see form; (i) the relevancy of prohibition of *riba* from interest bearing debt conditions (under high level of debt and open economy structure, economic stability conceal domestic fragility (Ninomiya, 2007), (ii) *gharar* or excessive risks or uncertainty (disinflation bias, market's innovations-monetary dilemma (Ninomiya and Sanyal, 2009)), and (iii) *maysir* or gambling which in this case refers to economics agent intentions on the extra demand of money either to debt or investment which determine the nature of finances (extractive or supportive) (ibid.). Thus, essentially driven by unstable expectations (instability of confidence).

Therefore, Ninomiya's theoretical extensions and empirical studies serve as a ground theory for executing the empirical research as well as the interpretations. Ninomiya and Tokuda suggest instability could be measured through the discrepancy between confidence and expectations that leads to market distortions. Ninomiya and colleagues elaborate this condition into an extension of an economic mathematical equation, however, in this study, the author tries to synthesize Ninomiya's study into simpler equation terms:

$$Y = f(I, C, G) \quad \text{eq. (1)}$$

Based on the Keynesian Macro Dynamic framework, Economic Output (Y) expressed by the relationship of Investment (I) Consumptions (C) and Government Spending (G). As discussed before, Keynes questioned the gap of endogenous notions of money supply, then Minsky suggested an answer to that question by emphasizing the centrality of Investment in money supply that contributes to the economic cycles through financial dynamics. Keynes noted that investment decisions are heavily influenced by expectations about future returns, liquidity, and market sentiment, which are inherently unstable under conditions of uncertainty. Minsky then breaks down the uncertainty through the lens of the evolution of financial structure. Ninomiya's study set an example of how this relation could be defined, he suggests Investment as a function of interest rate (i), debt (B), and confidence (σ^2), therefore, we could make an expression of Investment as follows:

$$I = I(Y, B, i, \sigma^2) \quad \text{eq. (2)}$$

Where we could draw the correlation, where $I_Y > 0$ means higher income increases investment, $I_B < 0$ means a higher debt burden reduces investment. $I_i < 0$ means higher interest rates discourage investment, $I_{\sigma^2} < 0$ means instability of confidence reduces investment (Kenshiro Ninomiya and Tokuda, 2017). To acknowledge the indebtedness risks in the system, Ninomiya defines the evolution of debt over time through the following equation:

$$B^{\cdot} = I - \theta Y + iB \quad \text{eq. (3)}$$

The dynamic of the debt level is noted as $B^{\cdot}$or we could also say the rate of change in debt. I represent the demand for funds to finance the economic activities through the investment channel. Equation 3 describes conditions where Debt accumulation ($B^{\cdot}$) increases with investment (I) and interest costs (iB), but decreases with retained earnings approximated by θY. To deprive the financialization, we would need the counterpart variable that represents the availability of income for funding internal activities (retained earnings), which in this study is noted as θY. Then iB represent the interest burden on existing debt, which represents the cost of accumulated liabilities (Kenshiro Ninomiya and Tokuda, 2017). The previous descriptions might imply a condition where, even though no new borrowing takes place, the servicing cost of past debt adds to the total debt burden over time. By considering this condition, therefore, Ninomiya describes this relation through the multiplier-accelerator, which could be expressed as follows:

$iB_t = \sum_{k=1}^{t} iB_{t-k}$ ..... eq. (3.1)

The equation 3.1 describes how the accumulation of debt will keep increasing, this condition occurs because iB continue to be influenced by the existence of iB as a recurring cost of interest payment, which will influence the B_t as an accumulation of debt. At this point, we could see the correlation between specific dynamics and wider dynamics represented in equations 3.1 to 1. In addition, the construction of the dynamic of debt level as proposed by Ninomiya also aligned with the statement of Prof. Lapavitsas Costas (2014), where he mentions in his public lecture that the interplay between interest rate and level of financialization of institutions will determine the direction of finance (Costas, 2014). To be specific, he implies that the growth of debt is influenced by the capability of the firm to generate income θY for internal financing (ibid.). Therefore, it explains the negative direction of θY within the model (see equation 3). This feedback loop of accumulated interest payments aligns with Minsky's hypothesis, where rising debt service costs contribute to financial fragility, especially when income and investment growth lag behind debt accumulation. Demonstrate by the illustrations, how leverages are increasing during economic booms $Y \uparrow\ I \uparrow$, along with inadequate income to set off debt growth $W < B^{\cdot}$ (Kenshiro Ninomiya and Tokuda, 2017).

It visualizes the feedback loop relation within the system, which underlies the analysis of financial instability as a result of excessive debt accumulation, the interplay of interest, and deregulation (Keen, 1995; H. Minsky and Vaughan, 1990; Rammelt, 2019). Furthermore, this study also considers an additional scenario described by Kenshiro Ninomiya and Tokuda (2021), which recognized a proposition of a direct relation from the instability of confidence (σ^2) as dispersion of confidence to income (Y), therefore it assumes instability of confidence depends on income and instability of confidence is sensitive to changes in Y (as previously described on page 14, investment-led unstable path. This relation could be expressed as follows:

$$\sigma^2 = \sigma^2(Y) = \sigma_0^2 - \beta Y, \quad where \ \ \beta > 0, \ \sigma_0^2 > 0 \quad \text{eq. (4)}$$

Now we see that instability of confidence could be transmitted through debt and income; therefore, we need to define instability of confidence prior to macro analysis. Given σ^2 is not level but dispersion of confidence, Ninomiya and Tokuda (2012, 2017, 2021) construct a variable through GARCH modelling, which could be described as follows:

$$\sigma 2 = GARCH(\mu_{t-1}^2, \sigma_{t-1}^2) \quad \text{eq. (5)}$$

The equation 5 suggests that $\sigma 2$ is derived from the squared prediction shock from the previous period, notated by μ_{t-1}^2 and the conditional variance from the previous period, notated by σ_{t-1}^2. This ability could answer why the GARCH model was chosen instead of a similar indexing approach like PCA (Principal Component Analysis). The equation illustrates that the instability of confidence is dynamically determined by past shocks and also its past volatility. This emphasizes the GARCH model's fitness to measure the dispersion in confidence-expectations. In addition, the GARCH model is a common method used to model time-varying volatility in financial markets (Ali et al., 2022; Laux and Ng, 1993). Following Ninomiya and Tokuda (2012, 2017, 2021), to observe the impact of the dispersion of confidence on the economic system, corresponding to equations 1 and 2, this study utilized a VAR model. The objective of the VAR model is to capture the relation between variables that are assumed to be endogenous. As Ninomiya's model proposes a revolutionary approach to describe the economic variables' relation through mathematical equations, therefore the VAR model is suitable to observe the relevance of his proposed model.

CHAPTER III
METHODOLOGY

3.1 Type and Strategy of Research

The research relied on quantitative methodology and its extended practical interpretations derived from the literature study. To examine the relationship between proxied instability and macro-financial data, the author primarily utilizes secondary data for quantitative econometric modelling and conducts a literature study to synthesize the findings into practical interpretations. The ground literature of the quantitative econometric modelling mainly employs the framework studied and demonstrated by Ninomiya and Tokuda (2017;2021) in conducting empirical analysis to detect the existence of volatility of the fragile macro-financial structure in the economic[10].

In this study, quantitative analysis was conducted through two methodologies, namely the GARCH model and the VAR model. In terms of the stage of empirical analysis, it will be divided into two stages: the first is quantitative analysis to identify the fragility pattern, and the second is quantitative analysis to simulate zakat as a stabilizer tool for volatility. Conceptually, the GARCH model is used to capture the fragility pattern, while the VAR model is employed to examine the relationship between the proxied fragility derived from GARCH analysis and macro-financial data.

After conducting the quantitative analysis through regression, the author will elaborate on the results to bridge the findings into the contextual concept of Islamic Finance in its position to prohibit excessive interest called *riba* and the concept of redistribution of wealth instrument called *zakat*. Thus, zakat is analyzed through simulation, the way it is calculated or constructed to be tied with will be further discussed through literature study, while the concept of *riba* will be derived from the interpretation of the findings, on how the proxied fragility response to financial data, such as the interest rate. Furthermore, the details of the variable and the flow of analysis will be described in the following sub-chapter.

[10] In chapter two, the author discussed how Ninomiya's framework is suitable for empirical analysis of Minsky's Financial Instability Hypothesis. Ninomiya attributed Taylor and O'Connell's (1985) concept of lender risk type to the Minskian structure and a merged dynamic between the Kaleckian model and Minsky's HSP to develop the framework to analyse the fragility.

3.2 Research Orientations, Framework, Hypothesis, and Rationale

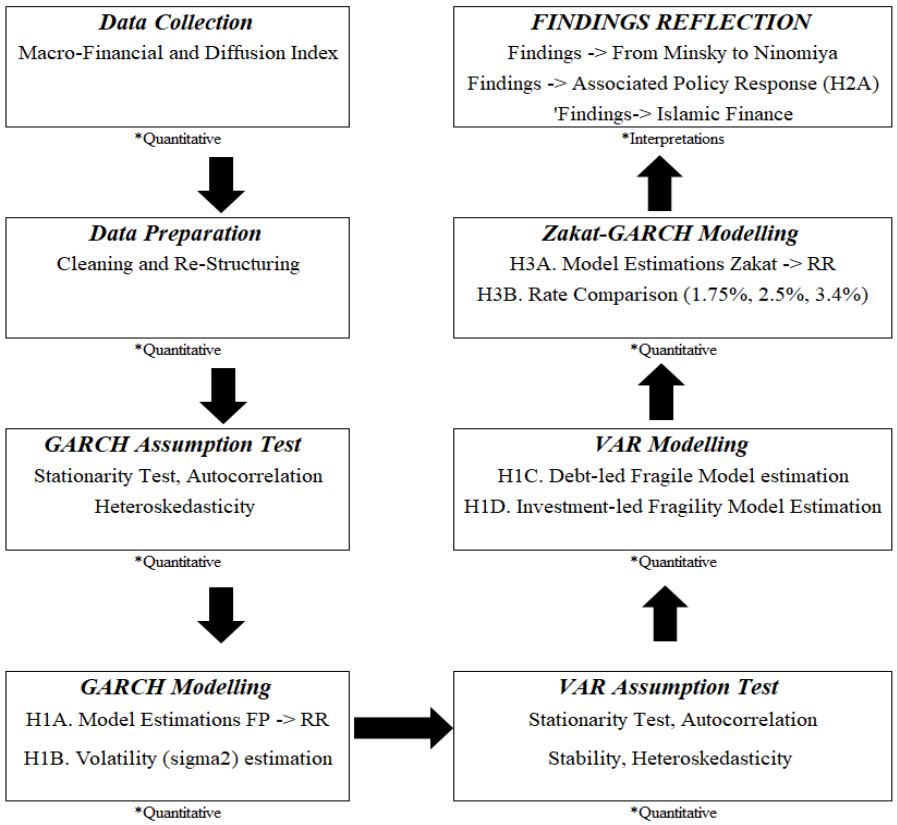
3.2.1 Research Orientations

The empirical study operationalises under the assumptions of endogenous instability purposed by Minsky implies the fragility force not only drives the outcome of macro-financial economic variables, but is also driven by them. Therefore, the study focuses on (i) Volatility of Confidence and (ii) The dynamic relation between confidence with macro-financial data. This framework, align with the previous study that have been conducted by Ninomiya and Tokuda (2017) which described the empirical framework to analyse the causal relation between confidence and macro-financial data, and Suharto (2017) which contextually described the role of zakat as natural stabilizing buffer.

3.2.2 Research Framework

The framework is divided into three main analytical process and each main analytical process aimed to test specific hypothesis as described on figure 3.1.

Figure 3. 1. Research Framework



Source: Author's reasoning

3.2.3 Research Hypothesis and Rationale

As described on figure 3.1, the main analytical process divided into three and each process has their own objection which could branch into sub-objection. This approach taken to provide empirical study to address the objective of this study, which could be summarize as follows:

1. Assessing Indonesia's macro-financial data to observe the possibility of fragility through Ninomiya's Framework. This objective planned to be address through:
   a) GARCH Modelling with purposed hypothesis and methods:
      i. H1A. Business volatility in profit expectation (RR) driven by internal confidence (FP)

         Rationale:

         Ninomiya and Tokuda (2017) demonstrate that the diffusion index of financial position (FP) significantly influences perceived borrowing costs, or in other words, the expected rate of return or perceived profitability, which is proxied by the diffusion index of interest rate on loans (RR). This approach taken by Ninomiya and Tokuda by integrates the lender's risk type by Taylor and O'Connell's (1985) as a component of a behavioural representations that shaped by internal perceived financial confidence.

      ii. H1B. The conditional volatility of RR, forms instability of confidence (σ^2), exhibits a similar pattern to recorded financial contractions.

         Rationale:

         Ninomiya and Tokuda (2017; 2021) suggest that the instability of confidence could define the interplay of business confidence with the volatility in the macro-financial indicator. These findings validate σ^2 reliability as a systemic fragility indicator that describes the transmission of fragility from businesses to macroeconomic conditions and the possibility of volatility clustering, which describes the booms and busts phases outlined by Keynes and later detailed through endogenous financial instability by Minsky as the Hedge, Speculative, and Ponzi finance phases (HSP).

b) VAR Modelling with proposed hypothesis and methods:

i. H1C. Debt burden significantly influences the instability of confidence which transmitted to macro-financial indicator

Rationale:

Minsky, in his Financial Instability Hypothesis, suggests that the cyclical nature of fragility force in finance is due to the nature of debt accumulation combined with a lax environment that exacerbates the instability into crisis. In essence, debt level has a structural correlation with fragility, which later on might alter firm behavior and risk perceptions. Ninomiya add this logic through his empirical analysis and he demonstrate the structural relation between debt burden and fragility in the form of volatility in business expectations (σ^2).

ii. H1D. Investment decision significantly influences the instability of confidence which transmitted to macro-financial indicator.

Rationale:

Minsky argues that in a modern capitalist economy, which relies on market-driven output, investment decisions are made under fundamental uncertainty rather than based on actual calculable risk. This is due to the way expected returns are calculated, which essentially depends on certain assumptions. Therefore, Ninomiya, through his framework, adds confidence and highlights how both confidence and volatility shape investment, and how investment can be fragile. This fragility might spill over into other macro-financial variables such as interest rates and income.

2. Examining how financial crises and associated policy responses have shaped its post-crisis macro-financial structure and fragility dynamics in Indonesia.

a) H2A. Indonesia's post-crisis policy response significantly alter the structural behaviour of macro-financial fragility

Rationale:

The objective is to interpret the macro-financial dynamics across recorded crisis episodes, that captured on the statistical findings. This approach aims to synthesize contextual meaning from the empirical findings by describe policy evolution narratives in Indonesia's.

3. Evaluating the potential of Islamic finance mechanisms, particularly zakat as structural buffers to mitigate financial volatility and systemic fragility in Indonesia.
   a) H3A Zakat dampens the volatility in confidence, implying a shift in market behaviour.

      Rationale:

      Zakat, is a core instrument in Islamic social finance instrument, designed to redistribute the wealth, from the surplus holders to the economically disadvantaged through ethical principles. This aligns with Minsky's suggestion about stabilizing buffer which emphasizing to system and behavioural control of capitalistic economic system, which has rich quasi-confidence and expectations. Initially GARCH model conducted to capture the possibility of market volatility influenced by endogenous financial instability, the zakat simulation data then will be test to initial GARCH model to see weather zakat-linked-gdp reduce the volatility (σ^2).

   b) H3B. The structural impact of Zakat is more significant in reducing volatility regardless of its size.

      Rationale:

      Ahmed, Asutay, and Wilson, (2013) emphasize that Islamic Moral Economy tied to ethical commitment to promote justice, solidarity, and mutual responsibility. Ugi Suharto (2017) add Islamic Finance, provide both ethical commercial finance framework and social finance framework, that in essence need to be operates in harmony. The harmonious between both frameworks were to create a moral cues or signals that could alter the economic expectations. This align with the prospect theory where individuals are highly responsive to changes in the perceived fairness or distributive signals (Kahneman and Tversky, 1979)

3.3 Data and Data Source

To analyze the dynamic relation between perceived confidence and financial-economic conditions to describe the endogenous notion of how fragility developed, the variable need to be proxy to reflect the objective. Following Ninomiya and Tokuda (2017; 2021) this study employed two model which are debt-led fragility and investment-led fragility. The data observed in this study are in the form of quarterly basis with the period span from 2002 Q1 until 2023 Q4 therefore, this study utilize 85 observations to be analyze.

Table 3. 1. Variables and Data Source

Variables	*Descriptions*	*Source*
r : interest rate	Real interest rate by Central Bank of Indonesia SEKI BI I.25 SUKU BUNGA, DISKONTO, IMBALAN	Central Bank of Indonesia, SEKI (Statistik Ekonomi Keuangan Indonesia)
y : income	Real GDP	FRED
b : debt burden	External Outstanding Debt	Central Bank of Indonesia, SEKI VI.1
i : investment	Gross Domestic Investment (Capital Formation)	Badan Pusat Statistik (BPS)
$\sigma 2$: instability of confidence	Variance Volatility of RR	
RR : rate on return	Diffusion index of change in interest rate on loan BIBS Table 3. Access to Credit	Central Bank of Indonesia, BIBS (Bank Indonesia Business Survey)
FP : financial position	Diffusion index of financial position BIBS Table 3. Financial Condition	

Interest rate (r) gathered from Central Bank of Indonesia data base named *Statistik Ekonomi Keuangan Indonesia* (SEKI), the variable name is BI Policy Rate, Discount, Rate of Return (*Suku Bunga, Diskonto, Imbalan*) number I.25[11] in the form of percentage. Income (y) gathered from Federal Reserve Economic Data (FRED) by St. Louis Fed, the variable name is Real Gross Domestic Product for Indonesia in the form of billions domestic currency or IDR (seasonally adjusted quarterly). Debt burden (*b*) gathered from Central Bank of Indonesia data base named SEKI, the variable name is External Outstanding Debt (*Posisi Pinjaman Luar Negeri*) number VI.1 the form of millions of USD which have been represents both public (government and monetary institutions) and private sector (bank, non-bank, and non-financial institutions).

[11] The numbering of the data follows the information provided on the table of content. The data downloaded in bulky zipped data includes the doc of table of content and all the data set. The data could be access through the link https://www.bi.go.id/id/statistik/ekonomi-keuangan/seki/Default.aspx (Central Bank of Indonesia, 2023).

Investment (*i*) gathered from Central Bureau of Statistics or *Badan Pusat Statistik* (BPS), the variable is a processed data from the summation process of variable name Gross Fixed Capital Formation (GFCF) and Inventory derived from the dataset name Quarterly DB at Constant Prices by Expenditure (Billion Rupiah)[12]. Instability of confidence (σ^2) is another processed data besides investment (*i*) data. Instability of confidence (σ^2) constructed through the GARCH modelling by predicting the variance dataset (quarterly basis) right after estimating the conditional variance of RR[13]. Rate on Return (RR) is proxy through the variable name Diffusion Index on Interest Rate while Financial Position is proxy through the variable name Diffusion Index on Financial Position, both were gathered from the BIBS (Central Bank of Indonesia Business Survey, 2024) data set, Central Bank of Indonesia database. As it names diffusion index, both RR and FP were in the form of ordinal number (scale confident to not confident), this approach follows Ninomiya and Tokuda (2017) which demonstrate a predictions of instability of confidence through Diffusion Index of Interest Rate and Financial Positions in Japan named TANKAN Business Survey by Central Bank of Japan[14].

3.4 Object and Subject Of Research

The paper uses Minsky's Financial Instability Hypothesis in putting Indonesia's financial system into perspective. It focus on the observations of systemic fragility and instability within Indonesia's financial structure, therefore the research objects of this study are dynamics of financialization and economic and financial structure. In line with the objective and methodology purpose in this study, thus the subject of the study defined as the macroeconomic indicators and financial systems of Indonesia, which are represented by variables on interest rates, GDP, leverage ratios, and the constructed indices for financial position and interest rate of loans dynamics, are the subjects of the research. These variables come from statistical data obtained through the Central Bank of Indonesia, OJK (Financial Services Authority), and public statistical data sources.

[12] The approach taken under two considerations; (i) data availability in similar basis (quarterly), (ii) follows one of World Bank's variable descriptions which describe "Investment = Gross capital formation = Gross fixed capital formation + change in inventories." The data set could be access through the link https://www.bps.go.id/id/statistics-table/pdb-triwulanan-menurut-pengeluaran--milyar-rupiah-.html (Badan Pusat Statistik, 2023)

[13] Why variance of RR only? Because the conditional variance volatility of RR more intuitive compare to RR-FP model, author assume as the relation between FP to RR have been defined, therefore we could isolate intrinsic volatility of RR as dependent variable.

[14] The Tankan (Short-Term Economic Survey of Enterprises in Japan) is a statistical survey conducted by the Bank of Japan in accordance with the Statistics Law (Law No. 53 of 2007) (Japan, 2002).

3.5 Model Descriptions

To empirically analyse Indonesia's macro-financial fragility in the context of Minsky's Financial Instability Hypothesis, two econometric model utilized to complement each other findings, namely: (i) Generalized Autoregressive Conditional Heteroskedasticity (GARCH) and (ii) Vector Autoregression (VAR).

a. GARCH MODEL SPECIFICATIONS

As the main objective is to capture the fragility relation to macro-financial indicators, a specific variable is needed to proxy instability. Conceptually, this study utilized Ninomiya and Tokuda's framework to define a measurable proxy of instability that align theoretically and empirically, they argues expectations and confidence is not a static relation nor unpredictable relation, it created through a feedback loop (Kenshiro Ninomiya and Tokuda, 2011, 2012, 2017, 2021) between what the business and the lender perceive as confidence and expectations (related to finance) from each other's perspective. In addition, technically, GARCH's conditional variance is commonly utilized as a proxy of fragility in financial assets, which is derived from its volatility pattern (Ali et al., 2022; Ardia, Bluteau, Boudt, and Catania, 2018; Da, Engelberg, and Gao, 2015; Laux and Ng, 1993; Li and Zhang, 2008; Matei, 2009). Following Ninomiya and Tokuda (2017; 2021) to reflect the lender's risk-type behavioural structure in the Kaleckian context of the Business Cycle, the linear equation between Financial Position (FP) and Rate on Return (RR) could be expressed in equation 1 (eq.6):

$$RR_t = \alpha_0 + \alpha_1 \cdot FP_t + \mu_t \quad \text{(eq. 6)}$$

Equation 6 describes the mean equation of the GARCH model, which essentially describes the expected relation between a business's expectations for the financial environment and the perceptions of the economic climate (Kenshiro Ninomiya and Tokuda, 2012, 2017, 2021). By assuming the deviation from the linear relation mean equation between RR and FP is reflected in unobservable factors (μ_t) are influenced by time-varying uncertainty and disturbance (ibid.), therefore, the unobservable factors (μ_t) expressed as follows (eq. 7):

$$\mu_t = \sigma_t \cdot \varepsilon_t \quad , \quad \varepsilon_t \sim i.i.d.(0,1) \quad \text{(eq. 7)}$$

Equation 7 described that unobservable factors (μ_t) were a component of residuals (σ_t) and error term (ε_t). Furthermore, Ninomiya and Tokuda (2017; 2021) describe the residuals as time-varying conditional variance, which reflects the heteroskedastic process, and standard GARCH theory assumes the error term ε_t to be statistically independent and identically distributed ($\varepsilon_t \sim i.i.d.$) and random (variance 1) without bias (mean 0). Therefore, the GARCH model was developed by putting time-varying conditional variance σ_t as a proxy of financial confidence fragility, named as instability of confidence (ibid.). The variance equation and the assumptions expressed in equation 8 (eq. 8).

$$\sigma_t^2 = \gamma_0 + \gamma_1 \cdot \mu_{t-1}^2 + \gamma_2 \cdot \sigma_{t-1}^2 \qquad \mu_t \mid \text{Info}_{t-1} \sim N(0, \sigma_t) \quad \text{(eq. 8)}$$

σ_t^2 is the variance equation, while the $\mu_t \mid \text{Info}_{t-1}$ shows the assumptions taken in the model, which is given all past information up to time t-1, the structural innovation term (μ_t) is normally distributed (ibid.).

b. VAR MODEL SPECIFICATION

The literature suggests the VAR model enables dynamic observations of relations between endogenous variables (Goeltom, 2008; Hudiyanto et al., 2022). Essentially, there are several ways to express the VAR model, in expanded linear mathematical expression, summation expression, and/or matrix expression. Thus, the general VAR(p) equation could be expressed as follows:

$$Y_t = \alpha_0 + \sum_{k=1}^{p} A_k Y_{t-k} + \varepsilon_t \quad \text{(eq. 9)}$$

$$Y_t = \alpha_0 + A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_p Y_{t-p} + \varepsilon_t$$

This study employed 5 endogenous variables, therefore, Y_t represent 5 x 1 vector of endogenous variables, α_0 represent *K x 1* vector of constants, therefore A_p is a *5 x 5* matrix of parameters associated with lag t of Y_p (Rehal, 2025). In full VAR matrix expression of summation equation 9 and by attributing the proposed 5 endogenous variables to be observed, the VAR is formally expressed as eq. 10:

$$\begin{bmatrix} D\_y_t \\ r_t \\ i_t \\ D\_b_t \\ \sigma_t^2 \end{bmatrix} = A_1 \begin{bmatrix} D\_y_{t-1} \\ r_{t-1} \\ i_{t-1} \\ D\_b_{t-1} \\ \sigma_{t-1}^2 \end{bmatrix} + A_2 \begin{bmatrix} D\_y_{t-2} \\ r_{t-2} \\ i_{t-2} \\ D\_b_{t-2} \\ \sigma_{t-2}^2 \end{bmatrix} + \ldots + A_p \begin{bmatrix} D\_y_{t-p} \\ r_{t-p} \\ i_{t-p} \\ D\_b_{t-p} \\ \sigma_{t-p}^2 \end{bmatrix} + \varepsilon_t \quad \text{.....(eq. 10)}$$

Assuming the VAR system chosen optimum lag is 1 the VAR system equation described on matrix form eq.10[15] could be expressed through linear equations (details for each VAR-list in the VAR system) as follows:

Equation for Income (*D_y*):

$D\_y_t = \alpha_{21} r_{t-1} + \alpha_{22} D\_y_{t-1} + \alpha_{23} D\_b_{t-1} + \alpha_{24} \sigma_{t-1}^2 + \varepsilon_{1t}$ (Debt Model)

$D\_y_t = \alpha_{11} D\_y_{t-1} + \alpha_{12} \sigma_{t-1}^2 + \alpha_{13} r_{t-1} + \alpha_{14} i_{t-1} + \varepsilon_{1t}$ (Inv. Model)

Equation for Interest rate (*r*):

$r_t = \alpha_{11} r_{t-1} + \alpha_{12} D\_y_{t-1} + \alpha_{13} D\_b_{t-1} + \alpha_{14} \sigma_{t-1}^2 + \varepsilon_{1t}$ (Debt Model)

$r_t = \alpha_{31} D\_y_{t-1} + \alpha_{32} \sigma_{t-1}^2 + \alpha_{33} r_{t-1} + \alpha_{34} i_{t-1} + \varepsilon_{1t}$ (Inv. Model)

Equation for Investment (*i*):

$i_t = \alpha_{41} D\_y_{t-1} + \alpha_{42} \sigma_{t-1}^2 + \alpha_{43} r_{t-1} + \alpha_{44} i_{t-1} + \varepsilon_{1t}$ (Inv. Model)

Equation for Debt (*D_b*):

$D\_b_t = \alpha_{31} r_{t-1} + \alpha_{32} D\_y_{t-1} + \alpha_{33} D\_b_{t-1} + \alpha_{34} \sigma_{t-1}^2 + \varepsilon_{1t}$ (Debt Model)

Equation for Instability of Confidence (*i*):

$\sigma_t^2 = \alpha_{41} r_{t-1} + \alpha_{42} D\_y_{t-1} + \alpha_{43} D\_b_{t-1} + \alpha_{44} \sigma_{t-1}^2 + \varepsilon_{1t}$ (Debt Model)

$\sigma_t^2 = \alpha_{21} D\_y_{t-1} + \alpha_{22} \sigma_{t-1}^2 + \alpha_{23} r_{t-1} + \alpha_{24} i_{t-1} + \varepsilon_{1t}$ (Inv. Model)

The VAR regression follows the equation expressed above, therefore, the notations or expressions of the ordering of the variables represent the recursive order, while the ordering of the coefficients (e.g. in the debt model the numbering of the coefficients start by α_{11} while in inv. (investment) model start by α_{31}) basically representing the possibility of the causal structure of the recursive order.

[15] In discussion chapter the equation 10.2.n refers to Debt Model equation and equation 10.3.n refers to Investment Model

CHAPTER IV
FINDINGS AND ANALYSIS

4.1 Financial Instability Hypothesis Empirical Analysis

This study adopts two types of econometrics approaches, namely Generalized Autoregressive Conditional Heteroskedasticity (GARCH) and Vector Autoregression/Vector Error Correction Model (VAR/VECM), as described in the methodology section. To make empirical investigations of the Financial Instability Hypothesis by Minsky, at least two theoretical assumptions had to be met. Two theoretical assumptions are time-varying financial volatility and endogenous evolution of instability of the system.

The GARCH model employed in the study is primarily used to capture the time-varying volatility that characterizes financial instability. Minsky suggests the financial system undergoes phases of stable to unstable over time as the dynamics in the stable period induce speculative booms (H. P. Minsky, 1977). His statement implied the possibility of volatility clustering (recurrent stable – unstable period). GARCH models are designed to handle the non-constant variance (heteroscedasticity) observed in financial time series data (Hajizadeh et al., 2012; Matei, 2009; Viljoen, Conradie, and Britz, 2022) strengthen its fitness to be used as a risk management tool (Ardia et al., 2018). These attributes of GARCH enable the model to measure and forecast the volatility of instability of confidence, notated as σ^2 (Kenshiro Ninomiya and Tokuda, 2017) which is derived from the conditional variance of variables that represent the shifts between expectation and confidence (ibid.).

As the Financial Instability Hypothesis was mainly constructed by Minsky in theoretical logic (at least until his last papers in 1996), the empirical framework to analyze it is still limited. Later on, many post-Minsky economists contributed to developing an empirical framework to analyze the phenomenon described by Minsky. Given this condition, a specific model that enables interdependencies analysis of variables that are in a considerably new relation (could be based on a conceptual basis or even a proxy basis). Therefore, the VAR/VEC model is employed as it enables the analysis of dynamic interrelationships. From the literature review, the author found several recent empirical studies that seek to operationalize Minsky's concepts also utilize VAR/VEC (Dejuan Bitriá, 2017; Greenwood-nimmo, Greenwood-nimmo, and Tarassow, 2013; Kenshiro Ninomiya and Tokuda, 2017, 2021).

4.1.1 Volatility Modelling

4.1.1.1. GARCH Estimations

Instability of confidence become one of variables that newly introduced as a form of interpretation of fragility (Kenshiro Ninomiya and Tokuda, 2017) that exist within the unstable system. Based on literature, the purpose of the GARCH estimation was to extract the conditional variance series from the diffusion index rate of return (RR) which described the perceptions of the business on the availability of liquidity in which modelled to be influenced by Diffusion index of Financial Position (FP) as well.

In simple terms the relationship between RR and FP reflects how uncertain lenders and borrowers feel about the economy and each other. These become central as confidence or perceptions or preferences towards finance could contributed to the asymmetry in the market. Thus, in business cycle theory, the behavioural aspect i.e expectation and confidence, lead to fluctuations in aggregate demand, investment, and debt dynamics (Gali, 2008; Knell, 2015; Kenshiro Ninomiya, 2017; Kenshiro Ninomiya and Tokuda, 2021).

In the process author decide to proceed the GARCH analysis with two approach, first approach GARCH analysis with diffusion index of financial position data (*fp*) and one without. The first with *fp* aiming to capture the dynamics relation of diffusion index of financial position (*fp*) with diffusion index of rate on return (*rr*), as describe on eq. 6 *rr* and *fp* has a direct influence, where $\boldsymbol{\alpha_1}$ represents *rr* sensitivity to *fp*. In contrast, author consider to also analyse the GARCH model without *fp*, aiming to isolate the volatility clustering which financial crisis-related dynamics. This approach was took place after several GARCH model estimation analysis, which led to two distinct interpretations on model estimation interpretation and their intuitive figure descriptions. Besides, Ninomiya and Tokuda (2021) suggest the construction instability of confidence variable (σ^2) depends heavily on the availability and suitability of the data (Ninomiya and Tokuda 2021). Furthermore, the key concept of the constructions of instability of confidence is lays on the conditional heteroscedasticity characteristics of data that extracted from sentiment indexes (Kenshiro Ninomiya and Tokuda, 2017, 2021).

In the process, the GARCH model was estimated several times using several models, starting from the simplest to the more complex model, by adding more ARCH terms or ARMA terms to the tested model. The assumptions needed for the GARCH model are first that the model can converge and pass the diagnostic test, then the author compared the AIC/BIC value of each model that passed the assumptions, so that the model is fit to be analyzed further. In additions the model estimation had to be test gradually by increasing the complexity once the simpler model is failed, mainly to avoid over complex model maintaining the fitness of the model. Table one summarizes all the model estimation that have been tested.

First the model estimated to reach converged, once the model reached convergence author execute *estat ic* command to extract the AIC/BIC value which needed to find the most fit model, and if the model estimated unable to converged, it automatically eliminated from the list. The literature suggests lesser AIC/BIC value indicate more model fitness. Thus, in this study author aiming to analyse 2 GARCH in order to see the relation between *rr* → *fp* and see the volatility clustering in the model.

Table 4. 1. Stationarity Test for GARCH mod

Variables		*Augmented Dickey Fuller (ADF)*				*Phillips–Perron (PP)*			
		Constant		*Constant and Trend*		*Constant*		*Constant and Trend*	
		t-statistic	p-value	t-statictic	p-value	t-statistic	p-value	t-statictic	p-value
rr	Level	-3.509	0.0078**	-4.415	0.0021**	-3.289	0.0154*	-4.376	0.0024**
fp		-2.976	0.0372*	-3.033	0.1231	-2.868	0.0492*	-2.926	0.1540

Prior to GARCH model estimations Dickey–Fuller test for unit root executed to check the stationarity of the variable described on table 4.1. The computed result of ADF suggests that *fp* (0.0372) and *rr* (0.0078) stationary at level. Eight model being tested for each objective and author choose one converged model with lowest AIC value, passed the diagnostic test include stationarity test, autocorrelation test, and heteroskedasticity test, and also the intuitive descriptions of the forecasted volatility which derived from the model's conditional variance.

Table 4. 2. Summary of GARCH Model Estimations

Model	*Findings*
arch rr, arch(1)	Able to converged (10 iterations), AIC -233.06
arch rr, arch(1) garch(1)	Able to converged (10 iterations), AIC -234.18
arch rr, arch(1) garch(2)	Able to converged (10 iterations), AIC -233.23
arch rr, arch(1) garch(1) ar(1)	Unable to converged (300 iterations)
arch rr, arch(1) garch(2) ar(1)	Able to converged (15 iterations), AIC -297.16
arch rr, arch(1) garch(1) ar(1) ma(1)	Able to converged (88 iterations), AIC -311.24
arch rr, arch(1) garch(2) ar(1) ma(1)	Able to converged (42 iterations), AIC -316.38 Autocorrelation p-value 0.4417 > 0.05 fail to reject H0 of no autocorrelation Heteroskedasticity p-value 0.9994 > 0.05 fail to reject H0 of no heteroskedasticity
arch rr, arch(1) garch(2) ar(1) ma(2)*	Able to converged (24 iterations), AIC -297.58 Autocorrelation p-value 0.0844 > 0.05 fail to reject H0 of no autocorrelation Heteroskedasticity p-value 0.9970 > 0.05 fail to reject H0 of no heteroskedasticity
arch rr fp, arch(1)	Able to converged (12 iterations), AIC -265.59 Autocorrelation p-value 0.0000 reject H0 of no autocorrelation
arch rr fp, arch(1) garch(1)	Able to converged (18 iterations), AIC -274.89 Autocorrelation p-value 0.0000 reject H0 of no autocorrelation
arch rr fp, arch(1) garch(2)	Able to converged (17 iterations), AIC -276.25 Autocorrelation p-value 0.0000 reject H0 of no autocorrelation
arch rr fp, arch(1) garch(1) ar(1)*	Able to converged (32 iterations), AIC -223.71 Autocorrelation p-value 0.042 < 0.05 borderline significant autocorrelation Heteroskedasticity p-value 0.757 fail to reject H0 of no heteroskedasticity
arch rr fp, arch(1) garch(2) ar(1)	Able to converged (28 iterations), AIC -324.72, Autocorrelation p-value 0.005 reject H0 of no autocorrelation
arch rr fp, arch(1) garch(1) ar(1) ma(1)	Unable to converged (300 iterations)
arch rr fp, arch(1) garch(2) ar(1) ma(1)	Unable to converged (300 iterations)
arch rr fp, arch(1) garch(2) ar(1) ma(2)	Able to converged (44 iterations), AIC -322.86, Autocorrelation p-value 0.005 reject H0 of no autocorrelation

arch rr, arch(1) garch(2) ar(1) ma(2) chosen model for volatility clustering*

arch rr fp, arch(1) garch(1) ar(1) chosen model for rr > fp analysis*

Furthermore, before going to the model interpretations, the author conducts another diagnostic test through visual representations using GARCH Auto-Correlation and Partial Auto-Correlation graph as described in figures 4.2 and 4.3. The test took place to strengthen the model's fitness and give more justification for the chosen GARCH model diagnostic test needed. Figure 4.2 justifies the chosen GARCH model with ARMA terms, which satisfies the no-autocorrelation condition as most lags fall within the 95% confidence bands. Partial Auto-Correlation (PAC) Graph taken place to strengthen the AC justification. It concludes that all lags reside within the confidence interval. Thus, findings support the model fitness.

Figure 4. 2. GARCH's Auto-Correlation (AC) Graph

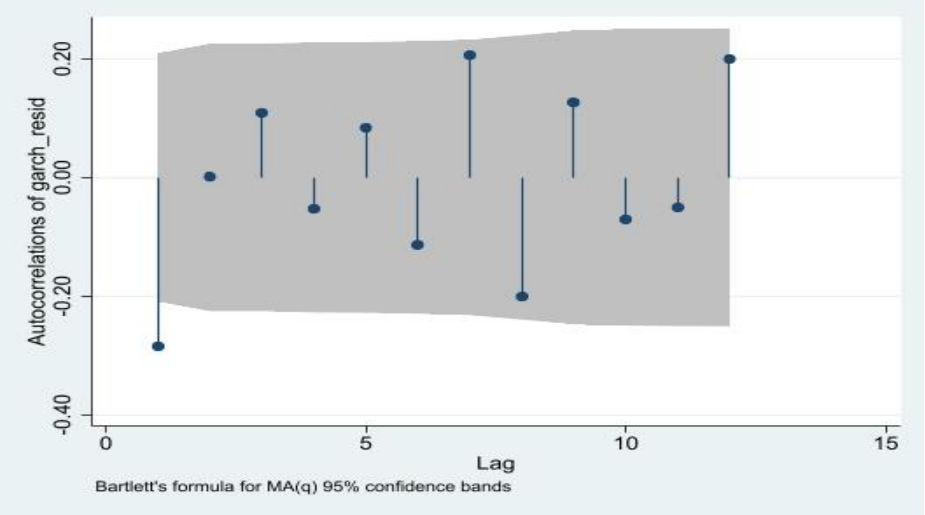
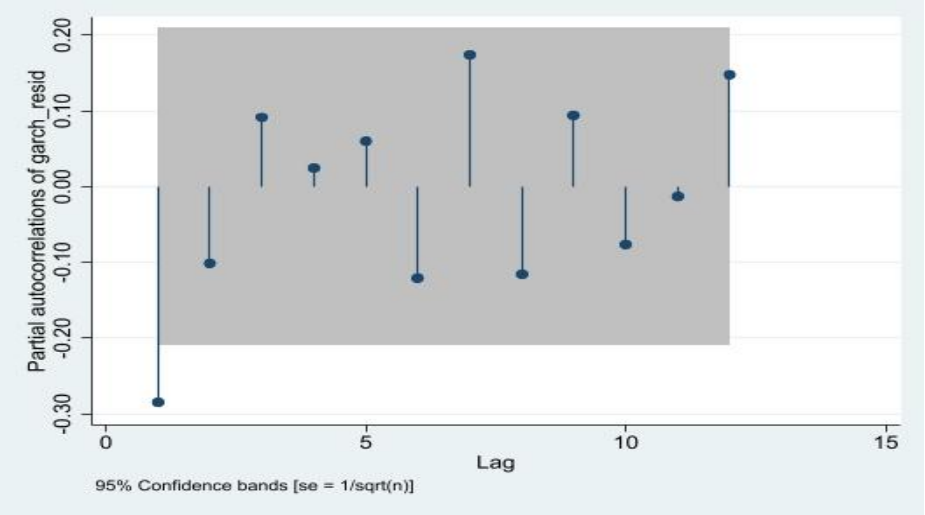


Figure 4. 2. GARCH's Partial Auto-Correlation (PAC) Graph



Source: Author's Stata

4.1.1.2. Endogenous Instability the Relation Between Confidence (Financial Fundamentals) and Expectations (Rate on Return)

In this study, one core dimension of financial fragility is explored through the empirical link between financial fundamentals—specifically, the relationship between the rate of return (RR) and financial position (FP). The estimated model adopts a GARCH (1,1) specification with an AR (1) disturbance structure, or in stata command could be expressed as; *arch rr fp, arch(1) garch(1) ar(1)*. The computed result able to captures not only the direct effect of financial position on return but also the dynamic volatility behaviour over time (shows by how RR react to FP through baseline coefficient).

Corresponding to the base behavioural linear equation described on equation 1 and the findings of GARCH model estimations for RR and FP, the model specification is extended to account the model fitness by using GARCH (1,1) with AR(1) in the mean equation. Therefore, the extended model of equation 1 could be now expressed as follows (eq. 1.1):

$$RR_t = -0.0562 + 0.2679 \cdot FP_t + 0.7947 \cdot RR_{t-1} + \varepsilon_t \quad \text{(eq.6.1)}$$

As previously described on eq. 1 that $\alpha_0 \; and \; \alpha_1$ shows the coefficient of that represent by the mean equation relation between variables. Therefore, we substitute $\alpha_0 \; and \; \alpha_1$ with the coefficient suggests by the GARCH result[16] coefficient shows a statistically significant at the 1% level. Furthermore, as the selected model using ARMA terms AR(1), therefore, the model need to add the ARMA mean equation 0.7947 which represent how RR influenced by the past values of itself.

In this model FP assume as exogenous and RR is endogenous variable. The positive and significant coefficient of FP suggests that stronger financial positions (proxied, for example, by the resilience of institutions or households) tend to be associated with higher returns, implying a reinforcing feedback mechanism between perceived stability and profit expectations. In addition by the positive value of ARMA terms +0.7947, it's indicate the past value of rr are strong predictors of current rr.

[16] See Appendix No. 1 arch rr fp, arch(1) garch(1) ar(1) result

This dynamic is consistent with the financial accelerator theory and supports Minsky's proposition that agents' balance sheet strength influences investment and profit realization during economic upswings. On the other hand, the GARCH model also enabled the volatility observations through the conditional variance (volatility) equation, where the computed result defines the explanatory volatility, which is defined by the coefficient present on the GARCH and ARMA terms (if any). From the same GARCH RR-FP model that have been derived, we could get the volatility equation as follows:

$$\sigma_t^2 = -0.0000384 + 0.00406 \cdot \varepsilon_{t-1}^2 + 1.0145 \cdot \sigma_{t-1}^2 \quad \text{(eq.8.1)}$$

Where the coefficient -0.0000384 coming from the constant term ARCH _cons, the coefficient 0.00406 coming from ARCH L1 which represent the lagged residuals (ε_{t-1}^2), and 1.0145 coming from the GARCH L1 which represent the lagged variance (σ_{t-1}^2). Interestingly, while the GARCH L1 term is highly significant (0.000 < p 0.05), suggesting strong persistence of volatility, the ARCH term is statistically insignificant (0.866 > p 0.05), and the baseline also suggest weak significancy level (0.263 > p0.05). This indicates that the current volatility of RR is more influenced by past expectations of volatility (σ_{t-1}^2) $rather\ than$ immediate past shocks and/or deviations from the mean (ε_{t-1}^2). Implies that the volatility in this model exhibits long-term persistence (expectations) rather than short-term responsiveness (baseline or deviations).

The model passed the heteroskedasticity test (Portmanteau p-value = 0.7570), confirming the adequacy of the GARCH structure in modeling conditional variance. However, the autocorrelation test yielded a p-value of 0.0420, suggesting mild residual correlation, which should be interpreted with caution.[17] This fragility arising from the financial fundamentals channel—where perceived financial strength feeds into return expectations—demonstrates how endogenous instabilities can arise even under stable external conditions. It reflects the Minskyan insight that financial structures are not neutral but can become inherently fragile when balance sheet optimism and pro-cyclical leverage reinforce each other.

[17] See appendix No. 2 Multicollinearity, Autocorrelation, Heteroskedasticity Test of GARCH model.

This model not only supports that logic but also provides empirical grounding for the notion that expectations tied to fundamental positions are crucial drivers of dynamic instability within capitalist economies.

4.1.1.3. Volatility Cluster Estimations

To capture the volatility clustering, a series of GARCH models were estimated using the rate of return (RR) variable only. This approach taken due to two considerations, first the arch rr fp model produce a volatility graph that harder to interpret it might be due to the dampen effects of fp (material confidence) to rr (expectations), second from the first model estimations it conclude that fp has strong explanatory power over rr, therefore in terms of analysing past- historical data, author assumes that rr only suffice to capture the volatility in the market without disregarding the role of fp in building the confidence.

The process start by estimating several GARCH model. Initially, the model specified as ARCH(1) GARCH(2) AR(1) MA(1) was identified as the statistically optimal specification, this was due to the model exhibit lowest AIC/BIC values and also passed diagnostic tests for autocorrelation and heteroskedasticity. However, upon generating the conditional variance forecast, the resulting pattern appeared unable to capture the Hedge-Speculative-Ponzi (HSP) period where in Minsky's hypothesis known as a cyclical pattern before crisis.[18] As interpretability is crucial for linking statistical results to real-world macroeconomic events, the author tested alternative specifications.

Thus, the ARCH(1) GARCH(2) AR(1) MA(2) model was selected as the preferred model for analysing volatility clustering. Even though the model has slightly less model fitness in terms of AIC/BIC, it produced a more intuitive and meaningful volatility forecast. The resulting graph clearly reflects the cyclical nature of financial instability and aligns with key economic episodes, including the 1998–2002 Asian Financial Crisis, the 2008 Global Financial Crisis, the 2012 Taper Tantrum, and the 2019 COVID-19 pandemic.

[18] Appendix No. 3 Tunnel Graph

Table 4. 3. RR GARCH Model Summary

Indicator	Findings
Optimization Method	BHHH and BFGS (alternating)
Convergence Iterations	24 iterations
Log-Likelihood	154.29
Wald Chi-square	101.29
Chi-square Significance	$p < 0.01$ (0.000)
AR(1) Coefficient	0.7916
AR(1) Significance (p-value)	< 0.01 (statistically significant)
MA(2) Coefficient	0.1252
MA(2) Significance (p-value)	0.189 (not statistically significant)
Interpretation of AR(1)	Strong positive autocorrelation in RR; past values influence current expectations
Interpretation of MA(2)	Although statistically insignificant, inclusion improves model fit and passes diagnostics

The chosen model converged successfully after 24 iterations, alternating between BHHH and BFGS optimization algorithms. The final log-likelihood value is 154.29, indicating a good fit relative to earlier model candidates. The Wald Chi-square statistic is 101.29, significant at the 1% level (p-value = 0.000), implying that the model as a whole is statistically significant. AR(1) coefficient shown 0.7916, $p < 0.01$ indicate strong positive autocorrelation in RR, means past values significantly influence current expectations. While MA(2) coefficient seems to be statistically unsignificant as shown by the p-value, however given the analysis that have been done before testing several GARCH model, MA terms still need to be incorporated as it creates better model fitness that also addressed the diagnostic tests. Now let's break down the GARCH with ARMA term model findings as describe on table 4.3 one-by one:

1) GARCH (1,2) Mean Equation with ARMA (1,2) term:

$$RR_t = -0.0134 + 0.7916 \cdot RR_{t-1} + 0.1252 \cdot \varepsilon_{t-2} + \varepsilon_t \quad \text{.....(eq. 6.2)}$$

As it names describes ARMA is a statistical model that combine two component, ARMA capable in captures temporal dependencies in the time series. Equation 1.1 describe how expectation proxy by RR developed overtime. The AR(1) gives p-value 0.000 means past values of expectation influence current value of expectation significantly. On the other hands even the MA(2) terms seem statistically not significant with p-value 0.1252

means the confidence level around $\pm$ 78% we still could incorporate the coefficient in the dynamics equation as both terms AR(1) and MA(2) has made the model fitted based on AIC/BIC value as well as diagnostic test that have been done. This condition justified by several study that have been done that imply a better model fit supported by diagnostic support, can justify the inclusion of a non-significant term (Di Gangi, Lapucci, Schoen, and Sortino, 2022; Foroni, Marcellino, and Stevanovic, 2019).Therefor the interpretation of the dynamics is at current level of RR is driven by a baseline force of -0.0134, past experience (t-1) influence current level with force +0.7916 means it gives positive relation to the current expectation, the dynamics of current level of RR also attributed by 0.1252 marginal force. This might represent as an additional component (secondary influences or delayed) besides primary component that influence the current level of expectations.

2) The Volatility Equation of RR:

$$\sigma_t^2 = 0.00171 + 0.4675 \cdot \varepsilon_{t-1}^2 - 0.2007 \cdot \sigma_{t-2}^2 \quad \text{.....(eq. 8.2)}$$

Equation 2.1 derived from the matrix of conditional variance of GARCH model[19]. The equation describes the statistical representation of fragility led by expectation as time-varying volatility. The value of 0.00171 represent the baseline force, the value of +0.04675 represent the ARCH term which describe that recent shocks to expectations (relation between RR and FP) influence the perceived stability of system. This finding aligns with the theoretical descriptions of Financial Instability Hypothesis by Minsky that suggest in financial markets, even in stable periods, exhibit latent vulnerabilities due to shift expectations and behaviours. Interestingly, the GARCH(2) term shows negative relation to expectation with the value of -0.2007 at the variance two periods prior represent by the number (2). Implies the impact of past volatility may possibly give a counterbalance force to the current instability. This is an interesting finding because it might possible could also empirically describe Minsky's

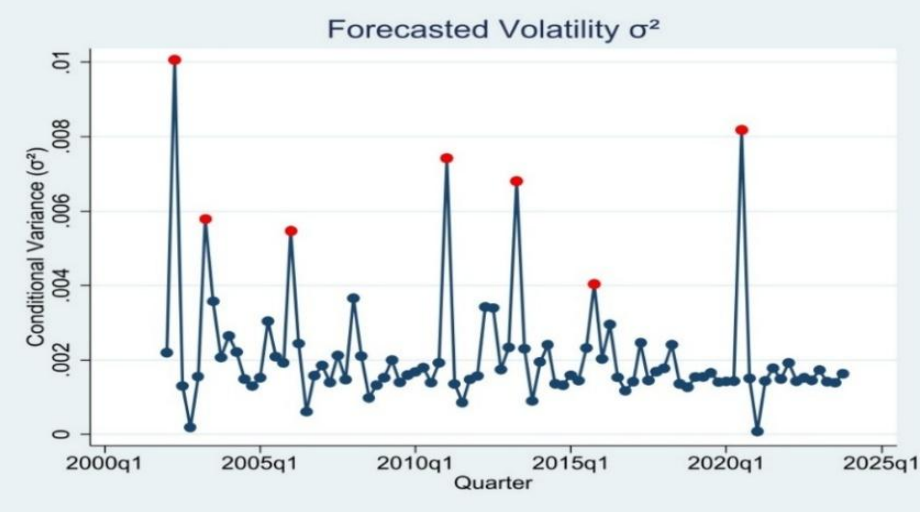
[19] See appendix 2.

statement that stability is unstable. In additions this finding could also justify the endogenous force of financial instability which means instability not merely driven by external factors but also internal feedback between expectations, confidence, and perceived risks over time. This finding also strengthened Ninomiya and Tokuda's (2017) statement that confidence as a measurable and volatile component of financial fragility in instability.

4.1.1.4. Forecasted Volatility Graph

Volatility forecasting is the subsequent analysis step, once the model is fit. Volatility spikes were defined based on local conditional variance maxima in the GARCH(2,1) where values crossed over the series' 90th percentile or more than twice their surrounding quartiles average which could be seen from the forecasted table.[20] Figure 4.3 describe periods that author's categorize as spike namely 2002q2, 2003q2, and 2015q4. The example of three period mentioned before categorize as spikes since they are statistical outliers in conditional behaviour. On another hand, though 2008 and 2012 coincided with familiar economic events, during those times conditional variance produced relatively flatter trends or increasing inclines in Indonesia, thus were not classified as sharp spikes in the index of volatility. Thus, further literature study is necessary to explain events that occurred in that quarter.

Figure 4. 3. Forecasted Volatility of σ² with spikes

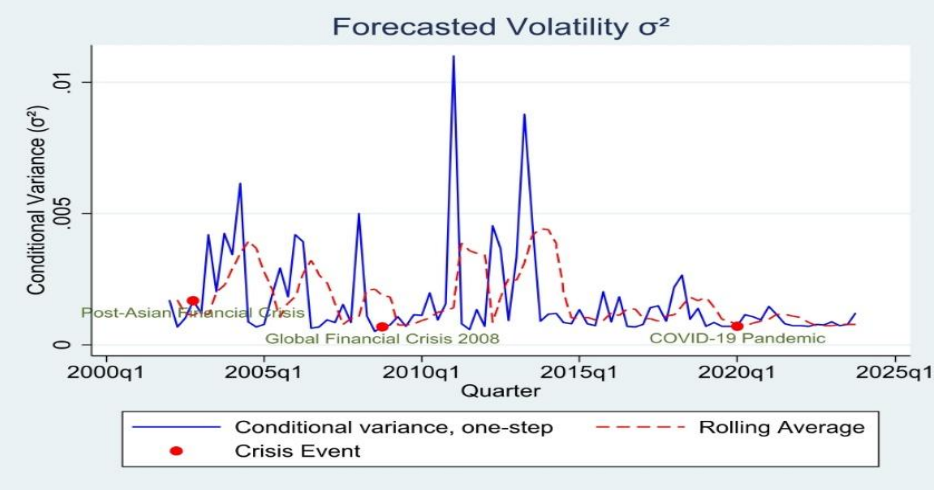


Source: Author's Stata

[20] See Appendix No.4

To gain better sight to the volatility, author's attribute the 4th quarter rolling average to the forecasted volatility graph. The rolling average which also known as moving average is a statistical technique used to observe underlying trends by using the average value of data points for specified period. Since this study utilize quarterly basis data, therefor the rolling average with a window size of 4. The windows size represents common accounting period which is 1 year/ 4 quarter. This method enables us to captures annual effects by balance smoothing. From the figure 4.4 the dashed red line represent moving average while the blue line represent conditional variance. By glance we could see rolling average provide smoother version of volatility trend. It happened because the rolling average act as a smoothing tools for the model which commonly used for figure descriptions intuitive considerations. Therefore, when it comes to previous question about weather 2008 and 2012 crisis effecting Indonesia or not, by observing the moving average graph we could conclude that Indonesia also effected by the event at that time. Things that interesting from the result is the prolonged fluctuations form 2002 until 2015. This prolonged fluctuations, often seen surrounded by well-known crisis event namely Post-Asia Tiger Financial Crisis (2002), SARS (2003), Oil Shock (2006), GFC (2008), Euro Crisis (2011), Taper Tantrum (2013), and lastly China Shock (2015). Among the crisis events, not all is due to finance, however most are coming from finance and trade sector. Thus, gives brief implications on the relevancy of Hedge, Speculative, Ponzi cycle in contributing to the volatility in the market confidence.

Figure 4. 4. Forecasted Volatility of σ² with Moving Average

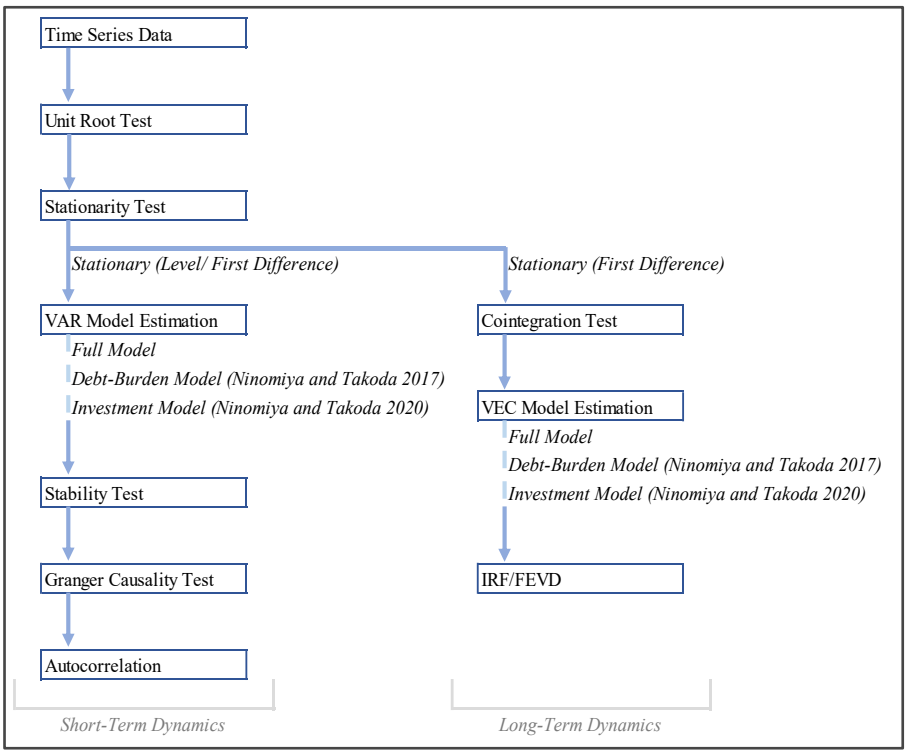


Source: Author's Stata

4.1.2 Estimation of Dynamic Relations (VAR/VEC Models)

In order-to-see weather instability of confidence has economic meaning in macroeconomics setting to explain the context of financial instability hypothesis, the vector autoregressive (VAR) or vector error correction model (VECM) utilized. Econometrically, VAR and VEC model often utilize to analyse the dependencies in multivariate data (Usman et al., 2022) in other-word enable dynamic relation between endogenous and exogenous variables (Sogi and Kumar Mittal, 2021). The analysis need to be conducted in a sequential step, to maintain statistical robustness (sequential steps describe on figure 4.5). Based on the analysis history, VEC model preferred in respect of the positive stationary at first-difference and cointegration. Therefor first the analysis started with fitting the VAR model before specifying the VEC model.

Figure 4. 5. VAR/VECM Framework



Source: Author's Data

The ground literature suggest the fragility that cause the financial instability hypothesis could be analyse through the lens of; first, debt-burden model (Kenshiro Ninomiya and Tokuda, 2017); second, investment model (Kenshiro Ninomiya and Tokuda, 2021). This study tested three model named debt-burden model, investment model, and combination of both.

This approach taken place aim to see the comparison from each in Indonesia settings. The additional model tested is the unified model. This consideration based on the curiosity to elaborate on the rationale for the model specification alteration that happened of Ninomiya and Tokuda works in 2021. Therefor author will firstly come with the discussion of combination model, then debt model, and lastly investment model, before the comparation section for this sub-chapter.

4.1.2.1 Unified Model

Prior stationarity test, lag-length test conducted. Author choose this approach to set a statistical threshold by using the optimum lag length of VAR model at level. Based on the lag-length test using the varsoc command in stata, author summary the computed result of Lag-Length test pre-stationarity test on table 4.4. The chosen optimum lag by Akaike information criterion of AIC was 2. Author choose to benchmark on AIC instead of other criterion like SIC and HQ because the underlying assumption of AIC which comprehensive but not too complex. Therefor the stationarity test of VAR model will be executed at lag 2.

Table 4. 4. Optimum Lag-Length Pre-Stationarity Test

Lag length	Final Prediction Error error (FPE)	Akaike information criterion (AIC)	Schwarz information criterion (SIC)	Hannan-Quinn information criterion (HQ)
0	1.3e-13	-15.4871	-15.3424	-15.4290
1	5.0e-18	-25.6423	-24.7742*	-25.2933*
2	4.7e-18*	-25.7195*	-24.1278	-25.0796
3	5.6e-18	-25.5546	-23.2395	-24.6240
4	5.5e-18	-25.6155	-22.5770	-24.3940

* indicates lag order selected by the criterion

Stationarity test conducted using the pre-stationarity test optimum lag-length and from the computed result summarize on table 4, it known that some variable stationary at level and some at first difference. The literature suggests that a variable is ideally stationary if the p-value less than 0,05, however if the p-value 0,10 author decide could also moderately accepted as stationary. The summary result shows on table 4 suggest that all variable that stationary level were accepted at p-value 0,05 namely r (0,0358), i (0,0289), and σ2 (0,0000).

Table 4. 5. Stationarity Test Computed Result

Variables		Augmented Dickey Fuller (ADF)				Phillips-Perron (PP)			
		Constant		Constant and Trend		Constant		Constant and Trend	
		t-statistic	p-value	t-statictic	p-value	t-statictic	p-value	t-statictic	p-value
y	Level	-1,626	0,4698	-0,876	0,9586	-1,524	0,5214	1,062	0,9352
r		-2,991	0,0358**	-4,081	0,0067***	-3,8890	0,0021***	-4,1910	0,0046***
i		-3,069	0,0289**	-4,751	0,0006***	-4,617	0,0001***	-7,061	0,0000***
b		-0,5230	0,8875	1,1340	0,9232	-0,3620	0,9162	-1,123	0,9252
σ2		-6,4740	0,0000***	-6,7970	0,0000***	-9,0330	0,0000***	-9,3610	0,0000***
D_y	First	-5,7440	0,0000***	-6,0370	0,0000***	9,0720	0,0000***	9,2240	0,0000***
r	dif.	.	.	.	.	.	.	.	.
i		.	.	.	.	.	.	.	.
D_b		-4,0440	0,0012***	-4,0330	0,0079***	-7,400	0,0000***	-7,357	0,0000***
σ2		.	.	.	.	.	.	.	.

Notes: when the p-value less than 0,05 means the data stationare, *=10%, **=5%, ***=1%

While for variables found to be non-stationary at level, namely income (y) and debt burden (b), were differenced to achieve stationarity and are denoted in stata by D_y and D_b. This state of stationarity of the VAR model could also be expressed in the form of linear equation as follows:

$$Y_t = \begin{bmatrix} D\_y_t \\ r_t \\ i_t \\ D\_b_t \\ \sigma_t^2 \end{bmatrix}$$, where t represents the optimum lag at stationary state.....(eq.9.1)

Utilizing the current stationary form of the VAR model as expressed on equation 9.1, author re-test the optimum lag-length test and summarize the findings on table 4.6.

Table 4. 6. Optimum Lag-Length Post-Stationarity Test

Lag length	Final Prediction Error error (FPE)	Akaike information criterion (AIC)	Schwarz information criterion (SIC)	Hannan-Quinn information criterion (HQ)
0	4.3e-17	-23.4962	-23.3505	-23.3505
1	6.1e-18	-25.4490	-24.5747*	-24.5747*
2	8.0e-18	-25.1849	-23.5821	-23.5821
3	7.8e-18	-25.2322	-22.90008	-22.9008
4	6.1e-18*	-25.5082*	-22.4483	-22.4483

* indicates lag order selected by the criterion

Thus, the estimated VAR model is defined over the following stationary state of the variable, that could formally express on equation 3.2 as follows:

$$\begin{bmatrix} D\_y_t \\ r_t \\ i_t \\ D\_b_t \\ \sigma_t^2 \end{bmatrix} = A_1 \begin{bmatrix} D\_y_{t-1} \\ r_{t-1} \\ i_{t-1} \\ D\_b_{t-1} \\ \sigma_{t-1}^2 \end{bmatrix} + A_2 \begin{bmatrix} D\_y_{t-2} \\ r_{t-2} \\ i_{t-2} \\ D\_b_{t-2} \\ \sigma_{t-2}^2 \end{bmatrix} + A_3 \begin{bmatrix} D\_y_{t-3} \\ r_{t-3} \\ i_{t-3} \\ D\_b_{t-3} \\ \sigma_{t-3}^2 \end{bmatrix} + A_4 \begin{bmatrix} D\_y_{t-4} \\ r_{t-4} \\ i_{t-4} \\ D\_b_{t-4} \\ \sigma_{t-4}^2 \end{bmatrix} + \varepsilon_t \quad \text{.....(eq. 10.1)}$$

Equation 10.1 basically summarize the findings of model estimation which represent the chosen VAR model where D_varlist represent difference form and t-2 represent the optimum lag chosen by AIC value (2) while A_1 until A_4 represent the coefficient metrics for lags 1 to 4 and ε_t error term.

.

Table 4. 7. VAR Model Summary

Model	recursive VAR in sequence y, σ², r, I, b			
Log likelihood	1037,486			
FPE	1,97E-17			
AIC	-24,27678			
	Equation			
Varlist	Parms	RMSE	R-sq	p-value
D_y	6	0,0105	0,032	0,7381
σ²	6	0,0014	0,056	0,4308
r	6	0,0167	0,397	0,0000
i	6	0,7035	0,533	0,0000
D_b	6	0,0231	0,139	0,0201

VAR regression done with the following order var D_y σ2 r i D_b, lags(4). Lags(4) choosen as the optimum lag for the model as suggested by AIC value from Lag-order selection criteria. The fittness of VAR model could be seen from FPE (Final Prediction Error). The litreature said, the lowest the value is indicate the lower forecast error variance implying the fittness of the model. Based on the computed result of VAR model D_y σ2 r i D_b, lags(4) FPE value is very small at value 1.97e-1 7, implies model fit. Another parameter of model fittness of VAR could be seen from the R-sq of each possible equation from each varlist. The computed result suggest from 5 varlist tested, there are 2 varlist with moderate R-sq namely r with R-sq 39,72% (0.0000) and i with R-sq 53,27% (0.0000), and 1 varlist with less R-sq namely D_b with R-sq 13,88% (0.0201).

Table 4. 8. Summary of Significant VAR Equation of Unified Model

Equation	Variable (L.4)	Coeff.	Std. Err.	P-value	Significant (10%)
D_y	Constant	0,309606	186	0,0960	Yes
σ^2	Constant	0,0042836	24	0,0780	Yes
r	r	0,3408652	83	0,0000	Yes
r	i	-0,0055499	19	0,0400	Yes
r	Constant	0,118526	295	0,0000	Yes
i	i	0,612328	809	0,0000	Yes
i	D_b	5,725215	31367	0,0680	Yes
i	Constant	5,504518	12422	0,0000	Yes
D_b	r	0,2512325	1148	0,0290	Yes
D_b	i	0,005146	27	0,0530	Yes
D_b	D_b	0,250018	1031	0,0150	Yes
D_b	Constant	-0,0753032	408	0,0650	Yes

In diagnostic test, combination model success to meet the stable condition however it failed to address the autocorrelation and heteroskedasticity. The occurrence of the problem has been anticipated as debt burden and investment might has identity relation. This relation refers to a common financial practice where financial conditions, includes debt, have a persistent impact on investment decision over time, which become the reason behind the persistence autocorrelation (Bruno, D'Onofrio, and Marino, 2018; Love and Zicchino, 2006). Therefore, the unified model terminated at this point and author proceed to analyse two model namely fragility debt-burden model and fragility investment model. As author have been done the statistical test to meet the first assumptions of VAR/VEC model namely stationarity test for each variable, therefore from this point onward, the model specification discussion will exclude the discussion of stationarity test. Imply will proceed to main model specification findings and diagnostic test.

4.1.2.2 Debt-Burden Model (2017)

Debt-Burden Model analysed by Ninomiya and Tokuda in 2017. In both researches, they focus to see the relation between their concept of financial fragility named instability of confidence to describe the contextual meaning of the z (animalistic spirit) in mainstream function investment in economic literature. This variable often overlooked in any financial analysis both pricing and policy, under the assumptions z were not countable. Major assumptions under neoclassical model were full rationality and perfect market.

This logic backed by Ricardian Equivalence in defining the equilibrium which suggest that government spending, whether financed by current taxes or future taxes through debt, has the same impact on the economy. RE is grounded on to the permanent income hypothesis and assumes that individual are forward-looking, fully rational, and consider the government's budget constraint (Busato, 2022; Ricciuti, 2003) which will affect the overall consumption habit of economic agents. Minsky and followed up by Ninomiya believe that the degree of confidence is crucial for buffer. Therefore, financial fragility introduced to present a countable way to estimate the instability in the system[21]. The debt-burden model focused on defining financial instability within economic system through the relation of fragility and debt. Imply how fragility and debt impact instability in macroeconomic settings proxy by income/ real gdp (y) and in monetary settings proxy by interest rate (r). Therefor in this section will mainly discuss the findings from the recursive VAR analysis on the dynamic between interest rate (r), income (y), debt burden (b), and instability of confidence (σ2).

Table 4. 9. Optimum Lag-Length Post-Stationarity Test (Debt Model)

Lag length	Final Prediction Error error (FPE)	Akaike information criterion (AIC)	Schwarz information criterion (SIC)	Hannan-Quinn information criterion (HQ)
0	5.1e-17	-26.166	-26.0495	-26.1192
1	8.2e-18*	-27.9882*	-27.4053*	-27.9882*
2	9.3e-18	-27.8654	-26.8162	-27.8654
3	1.0e-17	-27.7642	-26.2488	-27.7642
4	1.3e-17	-27.5563	-25.5746	-27.5563

* indicates lag order selected by the criterion

Source: Author's Stata

Given the condition stationarity test have been conducted when testing the unified model, therefor stationarity test no need to be test again as the unit-root condition has been satisfy with conditions; r at level, y at first difference, debt burden at first difference, and instability of confidence at level.

[21] Ninomiya & Tokuda (2017) implicitly mention in their research *"The instability of confidence is defined as the conditional variance of the rate of return in this paper. Therefore, it can be empirically measured using a GARCH model..."*

In addition, for variable that stationary at first difference has been transformed to new generated differenced variable named D_y and D_b. Lag-length test executed first to chosen the optimum lag for the model var r D_y D_b σ2 and the lag 1 chosen to be utilize as suggested by all criterion.

Table 4. 10. Autocorrelation, Stability, Heteroskedasticity Test

Classical Assumption Test		***Findings***
Autocorrelation (LM) Test		*(p-value > 0.05)*
lag	Prob > chi2	
1	0.68272	*Satisfied*
2	0.13565	
Stability Test		*(modulus < 1.00)*
Eigenvalue	Modulus	
.8664235	.866423	
.2023357	.202336	*Satisfied*
.09465792	.094658	
-0.4148081	.041481	
Heteroskedasticity (ARCH LM)		*(p-value > 0.05)*
Varlist	Prob > chi2	
r	0.0218	*Unsatisfied*
D_y	0.4991	*Satisfied*
D_b	0.31776	*Satisfied*
σ2	0.5940	*Satisfied*

To add more model's fitness justification of the utilization of VAR model, classical assumption had to be met. Unit-root and optimum lag has been satisfied, therefore auto-correlation, stability, and heteroskedasticity executed afterwards. Table 4.10 summary the findings of the last 3 classical assumption test. The data set satisfied the no autocorrelation with p-value greater than 0.05 imply we fail to reject the null hypothesis, similarly the modulus of stability test reside under the value of 1.00 imply the dataset satisfied the stable condition.

On the other hand heteroskedasticity test show partial satisfied condition where D_y (0.4991), D_b (0.31776), and σ^2 (0.5940) fail to reject the null hypothesis of no ARCH effects suggest the varlist residuals are homoscedastic. However, the r (0.0218) reject the null hypothesis of no ARCH effects implies ARCH(p) disturbance exist in the varlist (r) residuals.

In regards partial heteroskedasticity problem, utilization of data still acceptable under cautious approach (Pavlidis, Paya, and Peel, 2010) and the result still reliable especially when the model will be followed up by IRF and FEVD as these methods are fairly robust (Modarres and Ouarda, 2013).The classical assumptions have been met, therefor the analysis of VAR model could be continued further. From the general findings of VAR model estimation summarize on table 4.11 and the specific version on table 4.12, two significant equations at alpha 5% were found.

Table 4. 12. Debt-Burden VAR Model Summary

Model	recursive VAR in sequence r, y, b, σ^2			
Log likelihood	1037,486			
FPE	1.97e-17			
Log likelihood	1037,486			
FPE	1,97E-17			
AIC	-24,27678			
	Equation			
Varlist	Parms	RMSE	R-sq	p-value
r	5	.008833	0.8582*	0.0000*
D_y	5	.009942	0.0939	0.0634
D_b	5	.023942	0.0549	0.2881
σ^2	5	.001246	0.2103*	0.0001*

Table 4. 12. Summary of Significant VAR Equation of Debt Model

Equation	Variable (L.1)	Coeff.	Std. Err.	z-value	P-value	Significant (10%)
r	r	.8638522	.0393149	21.97	0	Yes
r	constant	.0077045	.0031389	2.45	0,014	Yes
D_y	D_b	.1237874	.0440778	2,81	0,0050	Yes
D_y	constant	.0071921	.003533	2,04	0,0420	Yes
D_b	D_b	.199	.1061477	1,87	0,0610	Yes
D_b	constant	.0143613	.0085082	1,69	0,0910	Yes
σ^2	D_y	-.0602438	.0130383	-4,62	0,0000	Yes
σ^2	constant	.0023128	.0004428	5,22	0,0000	Yes

First significant varlist equation is r (0.000) with R-sq 0.8582 imply around 85.82% of the variability of r could be explain by the model. The second significant varlist equation is σ2 (0.0001) with R-sq 0.2103 imply around 21.03% of the variability of σ2 could be explain by the model. As for the other two variable namely D_b and D_y didn't show a significant variable at alpha 5%, D_y could be moderately accept at alpha 10% however the R-sq is very small which only 9% of the variability could be explain. To illustrate the structure of each endogenous variable VAR equation and capture the direction as well as the level of influence (magnitude) of the relationship, therefore author presents the expanded linear form of the estimated VAR system. Based on the computed result the debt-led fragility dynamic model could be specify as follows:

$$r_t = 0.00770 + 0.8639 \cdot r_{t-1} + 0.0794 \cdot D_{y_{t-1}} - 0.0042 \cdot D_{b_{t-1}} + 0.0510 \cdot \sigma^2_{t-1} + \varepsilon_{r,t} \quad \text{(eq. 10.2.1)}$$

$$D_{y_t} = 0.00719 + 0.0363 \cdot r_{t-1} + 0.0060 \cdot D_{y_{t-1}} + 0.1238 \cdot D_{b_{t-1}} + 0.3014 \cdot \sigma^2_{t-1} + \varepsilon_{y,t} \quad \text{(eq. 10.2.2)}$$

$$D_{b_t} = 0.01436 - 0.0932 \cdot r_{t-1} + 0.1522 \cdot D_{y_{t-1}} + 0.1990 \cdot D_{b_{t-1}} + 0.4780 \cdot \sigma^2_{t-1} + \varepsilon_{y,t} \quad \text{(eq. 10.2.3)}$$

$$\sigma^2_t = 0.0023128 + 0.039673 \cdot r_{t-1} - 0.0602438 \cdot D_{y_{t-1}} + 0.0055385 \cdot D_{b_{t-1}} + 0.0530845 \cdot \sigma^2_{t-1} + \varepsilon_{y,t} \quad \text{(eq. 10.2.4)}$$

In summary the equation 10.2.1 until 10.2.4 represent the dynamic model of each endogenous variable. In equation 10.2.1 interest rate seen to be the most self-influence endogenous variable compare to other endogenous variable equation ($r_{t-1} = 0.8639$) with limited influence of *Dy, Db,* and σ^2. In contrast, income (*Dy)* past condition not significantly influence current *Dy* condition ($Dy_{t-1} = 0.0060$) while the other variable such as *r* (0.0363), *Db* (0.1238), and σ^2 (0.3014) gives more profound influence to current position of *Dy.*

Similar pattern seen on *Db* ($Db_{t-1} = 0.1990$) and σ^2 ($\sigma^2_{t-1} = 0.3014$) where it past values influence moderately to its current condition followed by weak to moderate influence from another variable. Interestingly on *Db* equation we could see that the lagged conditions of instability of confidence (σ^2) holds notable level of influence to current level of debt ($\sigma^2_{t-1} = 0.4780$) followed by moderate influence of *Dy* ($Dy_{t-1} = 0.1990$). This findings implies the current level of debt also highly influenced by the level of instability of confidence that might implies possible fragility in the debt structure.

Moving forward to the causal relation between endogenous variable in the debt-led fragility model, table 4.13 summarize the computed result of each varlist causal equation by describing the chi2 and the p-value as parentheses. The Granger test recognize two possible causal relation. First the causal relation between D_y and D_b with significant level at 99%.

Table 4. 13. Granger Causality/ Wald Test

Dependent variable	***Independent variables - Chi-square (Wald test)***				***Error Correction Term***
	r	***D_y***	***D_b***	***σ2***	***t-statistic***
r		.67356	.76492	.51175	.79186
		(0.412)	(0.382)	(0.474)	(.0.8510)
D_y	.73819		.36889	21.349	8.9006
	(0.390)		(0.544)	(0.000)***	(0.0310)**
D_b	.01166	7.8870		1.0053	1.1031
	(0.914)	(0.005)***		(0.316)	(0.7760)
σ2	.00732	.20208	.08765		22.8540
	(0.932)	(0.653)	(0.767)		(0.0000)***

Statistically, this finding imply there are a high chance of either income or debt-burden become a major variable force in each other dynamics due to its high significancy. Empirically, high causal relation between real gdp and external outstanding debt create a cautious alarm. Although it's undeniable empirical study have shown level of debt could boost economic growth (Woo and Kumar, 2015), however the level of optimum threshold of the debt always need to be concern (Jiang, Zestos, Winder, and Hamed, 2025; Lee, Park, Seo, and Shin, 2017; Mencinger, Aristovnik, and Verbic, 2015; Ren, Liu, and Jin, 2024; Son, 2023; Woo and Kumar, 2015).

Some might show at the level of where public debt were 50% economic still experience growth in a slower pace then restrained when it reach above 64% (Jiang et al., 2025). Some country might even has a least tolerant level to public debt with maximum threshold 30 – 40% (Lee et al., 2017; Son, 2023). The reversal effect of the relation between the level of debt and economy could be probably indicating a non-linear relation. This reversal refers to the trend where debt may support economic growth by financing expansionary fiscal policies, but as debt levels rise, the impact can turn negative due to fiscal imbalances and the need for fiscal consolidation (Mencinger et al., 2015; Ren et al., 2024). The second causal relation recognized in the row of instability of confidence.

The computed result suggests the instability of confidence does granger cause income y proxy by Real GDP with significant value at 99%, imply a high significancy. In addition it justify the existence of financial instability which can both cause and be caused by changes in economic. At this sense scholar's discussion divided into two, those who put this as externalities. Implies financial instability seen as externalities, therefor the instability in economy due to finance only happened in the time of financial crises (Balcilar, Ozdemir, and Arslanturk, 2010). Contrastingly, Minsky (1977, 1982) and later post-Keynesians argue that instability within the economic system is more structural and endogenous forces rather than externalities. Empirical works also support the hypothesis by describing expectations in financial and volatility in economics not only merely a respond but rather a real economic activity (Friedman and Kuttner, 1992).

> *The monetary theory of business cycles, suggests that fluctuations in the money supply, driven by bank lending and borrowing, are a primary source of economic fluctuations… In this case, consumption and investment expenses of capitalists determinate their profit, i.e.: capitalists earn what they spend although employees spend what they earn* (Bauvert, 2009)

4.1.2.3 Investment Model (2021)

Investment Model observed by Ninomiya and Takoda in 2021. If the focus of debt instability confidence model is in bringing anti thesis of Ricardian Equivalence by argues excessive leverage will create destabilizing effects in the system. On the other hand investment model pivots the focus towards the interpretation of the "z" or animalistic spirits suggest by Keynes. As Minsky suggest volatility in investment is not shaped by externalities rather endogenous forces that created from the system itself.

As Investment function form a ground theory of Minsky's Financial Instability Hypothesis. Therefor this model described the continuation of unsustainable debt impact to the economic system in which foster the fragile structure to unstable. Similarly with debt-model, investment model analysis also started by selecting optimum lag-length followed by robustness test (classical assumptions test).

Table 4. 14. Optimum Lag-Length Post-Stationarity Test (Investment Model)

Lag length	Final Prediction Error error (FPE)	Akaike information criterion (AIC)	Schwarz information criterion (SIC)	Hannan-Quinn information criterion (HQ)
0	7.4e-14	-18.8853	-18.7688	-18.8385
1	1.0e-14*	-20.8690*	-20.2861*	-20.6348*
2	1.2e-14	-20.7396	-19.6905	-20.3181
3	1.4e-14	-20.5665	-19.0510	-19.9576
4	1.2e-14	-20.7293	-18.7476	-19.9331

* indicates lag order selected by the criterion
Source: Author's Stata

Table 4.14 describe the computed result of lag selection test, based on the AIC value, the chosen optimum lag was 1. Therefor the model will utilize lag 1 to be analyse in Investment-Instability Confidence model.

In additions the classical assumption tests also suggest a satisfactory condition as described on table 4.15. In the autocorrelation test the p-value has-to be above the threshold of 0.05 to reject the null hypothesis of autocorrelation. Based on the computed result, lag 1 gives p-value of 0.20334 and lag 2 gives p-value of 0.24997, both above the threshold, means we able to reject the null hypothesis of autocorrelation, imply the model is well specified. The stability test done through the Eigenvalues Modulus test, the literature suggest VAR is stable when all eigenvalues reside inside the unit circle or below the modulus point 1.00.

Table 4. 15. Autocorrelation, Stability, Heteroskedasticity Test

Classical Assumption Test		***Findings***
Autocorrelation (LM) Test		*(p-value > 0.05)*
lag	Prob > chi2	
1	0.20334	*Satisfied*
2	0.24997	
Stability Test		*(modulus < 1.00)*
Eigenvalue	Modulus	
.8637183	.863718	
.4223298	.42233	*Satisfied*
.0135927 + .1734064i	.173938	
.0135927 - .1734064i	.173938	
Heteroskedasticity (ARCH LM)		*(p-value > 0.05)*
Varlist	Prob > chi2	
D_y	0.9007	*Satisfied*
σ2	0.8122	*Satisfied*
r	0.9854	*Satisfied*
i	0.4209	*Satisfied*

Based on the computed result on table 4.15, all eigenvalue's modulus resides under the modulus point 1.00 with the biggest modulus is 0.864718, imply the data VAR is stable. The last robustness test is heteroskedasticity test using ARCH-LM method. The literature suggests the residuals are homoscedastic if p-value is above 0.05, imply reject the null hypothesis of heteroskedastic. The computed result of ARCH LM suggests all the VAR-list namely D_y (0.9007), σ2 (0.8122), r (0.9854), and i (0.4209), are reject the null hypothesis of heteroskedasticity. At this point the investment model gained more justification on its robustness.

In-order-to give distinction, author summarize the general findings of the VAR model on table 4.16 and the specification of only significant VAR equation on table 4.17, while the rest will be described on appendix section. The computed result described on table 4.16 explain the significancy of VAR model through the log likelihood, FPE, and AIC value. Before coming into the hybrid model, author test again the variable in linear VAR model in the form of first difference then compared the log likelihood between the linear model[22] and hybrid model.

[22] See Appendix for comparison

The computed result suggested hybrid model gave higher log-likelihood, smaller FPE, and smaller AIC value rather than the linear model, this result give an implication that hybrid model is relatively better than the linear model, therefore author keep proceed with the hybrid model. In additions the hybrid model also gives better result on classical assumption test which strengthen the justification on the utilization of the hybrid model.

Table 4. 16. Investment VAR Model Summary

Model	recursive VAR in sequence y, σ^2, r, i			
Log likelihood	1037,486			
FPE	1.02e-14			
AIC	-20.86454			
	Equation			
Varlist	Parms	RMSE	R-sq	p-value
D_y	5	.010388	0.0108*	0.9187
σ^2	5	.00125	0.2055	0.0002*
r	5	.008516	0.8682	0.0000*
i	5	.847557	0.3675	0.0000*

The computed result of VAR regression shows in term of model fit, there are two moderately fit model and one high fit model across the four endogenous variables that have been analyse. Model fitness representing how the lagged values of all endogenous variable within the VAR model could explained dependent variable. The first VAR-list that exhibits a moderate fit is instability of confidence (σ2) equation with R-square 0.2055 and p-value 0.0002. This implies that, within the VAR model, the variation in σ2 as the dependent variable is explained by the lagged values of the four system variables by approximately 20%, with statistical significancy at the 1% level. The second moderate fit is investment (i) equation with R-square 0.3675 and p-value 0.0000.

This implies that, within the VAR model, the variation in σ2 as the dependent variable is explained by the lagged values of the four system variables by approximately 36.75%, with statistical significancy at the 1% level. The VAR-list that exhibits high fit is the interest rate (r) equation with R-square 0.8682 and p-value 0.0000.

This implies that, within the VAR model, the variation in σ2 as the dependent variable is explained by the lagged values of the four system variables by approximately 86.82%, with statistical significancy at the 1% level. In contrast, the equation for D_y (interpreted as income proxied by Real GDP) shows low explanatory power, with low R-square 0.0108 and low p-value 0.9187, indicating no statistical significance and very low explanatory at 1.08% of the variation in D_y. To illustrate the structure of each VAR equation in investment model author presents the expanded linear form of the estimated VAR system that, could be specify as follows:

$$D_{y_t} = 0.00845 - 0.00582 \cdot D_{y_{t-1}} + 0.49359 \cdot \sigma^2_{t-1} + 0.02460 \cdot r_{t-1} + 0.00007 \cdot i_{t-1} + \varepsilon_{r,t} \quad \text{(eq. 10.3.1)}$$

$$\sigma^2_t = 0.00390 - 0.06145 \cdot D_{y_{t-1}} + 0.05367 \cdot \sigma^2_{t-1} + 0.00143 \cdot r_{t-1} - 0.00010 \cdot i_{t-1} + \varepsilon_{r,t} \quad \text{(eq. 10.3.2)}$$

$$r_t = 0.04540 + 0.06328 \cdot D_{y_{t-1}} - 0.15260 \cdot \sigma^2_{t-1} + 0.81485 \cdot r_{t-1} - 0.00250 \cdot i_{t-1} + \varepsilon_{r,t} \quad \text{(eq. 10.3.1)}$$

$$i_t = 8.10804 + 0.49717 \cdot D_{y_{t-1}} - 71.34802 \cdot \sigma^2_{t-1} - 7.69611 \cdot r_{t-1} + 0.45053 \cdot i_{t-1} + \varepsilon_{r,t} \quad \text{(eq. 10.3.4)}$$

Table 4. 17. Summary of Significant VAR Equation of Investment Model

Equation	*Variable (L.1)*	*Coeff.*	*Std. Err.*	*z-value*	*P-value*	*Significant (10%)*
σ2	D_y	-.0614458	.0131015	-4.69	0,0000	Yes
σ2	constant	.0039049	.0022113	1.77	0,0770	Yes
r	r	.8148547	.0423682	19.23	0,0000	Yes
r	i	-.0025035	.0009794	-2.56	0,0110	Yes
r	constant	.0453985	.0150676	3.01	0,0030	Yes
i	r	-7.696112	4.216759	-1.83	0,0680	Yes
i	i	.4505323	.0974786	4.62	0,0000	Yes
i	constant	8.108039	1.49963	5.41	0,0000	Yes

Table 4.17 describe the detail version of the significance equation includes the estimated coefficient, standard error, and significance level. However, author also put the full version of the VAR regression in the appendix section. Overall, only 3 VAR-list that seen to has significant equation namely σ2, r, and i. On equation σ2, the coefficient of D_y on Lag 1 is significant at p-value 0.000 and influence negatively with coefficient -0.0614. The negative relation between σ2 and D_y might give an implication that higher income possibly reduced instability of confidence in the next period. The negative correlation between σ2 and D_y serve as empirical evidence which align with Minsky's Financial Instability Hypothesis, where capitalist economic system tend to be procyclical. Interestingly, when we look into the result of constant term in the σ^2 equation, it shows a moderate significant level at 10%.

In comparison to D_y with higher significant level attributed to σ2 equation, this might be an implication of a fragility in the baseline of the system. As σ2 serve as a proxy for deviation in risk perceptions and risk tolerance from the businesses, the evidence support the view that businesses' risk perceptions are shaped more by macroeconomic shocks and systemic forces than by the trajectory of their own portfolios, reflecting the influence of aggregate demand dynamics and debt-financed expansions (Mikiashvli, 2017; Pariboni, 2016; Setterfield and Kim, 2016). This findings give more nuance on Minsky idea about institutional structure relation to uncertainty, that not only structural institutional resiliency in the form of margin of safety level that define the uncertainty (Kregel, 1997; H. P. Minsky, 1996; Kenshiro Ninomiya, 2022) but also the anomaly in risk perceptions (Kenshiro Ninomiya, 2022; Nishi, 2012).

In contrast we could see a strong positive and significant predictionary level of the baseline of r_{t-1} in describing r_t with coefficient 0.8149 and p-value 0.0000. Besides i_{t-1} also give a significant result with p-value 0.0110 or significant level at 5%, but with negative influence with coefficient -0.0025. Similarly with debt-model, the significant and strong positive predictionary level of its own self r_t might indicate Bank Indonesia resiliency in maintaining their interest rate amidst economic volatility, however on the other hand it could also give a description that accounting ledger need times to adjust, imply under normal condition drastic change unlikely to happened. On the other hands negative significant influence of i_{t-1} to r_t suggest that investment might dampens interest rate.

In addition, D_y equation[23] did not exhibit any statistical significant equation as all of the p-value exceed the threshold 0.05 and even 0.10. However if we look into the direction of the coefficients, the computed result shows that D_y_{t-1} negatively influence D_y, but the rest of the var list ${\sigma^2}_{t-1}$, $r_{t-1}, and\ i_{t-1}$ positively influence D_y. Overall, the findings posit interesting implications as we aiming to define the instability of confidence significancy to the macroeconomic variables, therefore it leads me to question, on how fragile Indonesia Business's risk perceptions.

Table 4. 18. Instability of Confidence VAR equation

Equation	*Variable (L.1)*	*Coeff.*	*Std. Err.*	*z-value*	*P-value*	*Significant (10%)*
σ2	D_y	-.0614458	.0131015	-4.69	0,0000	Yes
σ2	σ2	.053666	.0846285	0.63	0,5260	No
σ2	r	.0014326	.006218	0.23	0,8180	No
σ2	i	-.0000988	.0001437	-0.69	0,4920	No
σ2	constant	.0039049	.0022113	1.77	0,0770	Yes

Even though r and i shows unsignificant result, the overall direction of the result posits interesting implication. The result suggests a path when; $y \uparrow \Rightarrow \sigma 2 \downarrow \Rightarrow i \uparrow \Rightarrow r \downarrow$ (cautious interpretation needed as the relation σ_r^2 and σ_i^2 are not significant). The recognised conditions of σ2 sensitive to y aligned with the proposition describe by Ninomiya and Tokuda (2021). However, further elaborations needed as the other assumptions did not significantly recognise in the VAR regression and this study did not observe the macro-structure through Jacobian matrix as demonstrated (ibid). Table 4.19 describe the causal relation from the investment – confidence of instability model.

Table 4. 19. Granger Causality/ Wald Test

Dependant variable	*Independant variables - Chi-square (Wald test)*				*Error Correction Term*
	D_y	*σ2*	*r*	*i*	*t-statistic*
D_y		.49242	.22658	.00310	.93154
		(0.483)	(0.634)	(0.956)	(0.818)
σ2	21.996		.05308	.47264	22.188
	(0.000)***		(0.818)	(0.492)	(0.000)***
r	.50241	.07003		6.5338	7.3731
	(0.478)	(0.791)		(0.011)***	(0.061)*
i	.00313	1.5455	3.3311		5.5126
	(0.955)	(0.214)	(0.068)*		(0.138)

[23] See appendix

The computed result suggests that; from the first row none of the excluded variables significantly Granger-cause output (D_y), the second row D_y granger-cause instability of confidence, strengthen the previous findings that instability confidence more sensitive to macroeconomic variable (D_y).

On the third row we could see that investment (i) granger-cause interest rate (r) and on the fourth row we could see that interest rate (r) granger-cause investment (i). The bidirectional causal relations give more additional implication to the interpretation of the VAR equation of r and i, where there is a context-dependent and possibility of marginal relation besides dynamic shapes by the confidence strength, where in specific the relation could be described as follows:

1. VAR equation suggests, $i_{t-1} \rightarrow r_{t-1}$ is statistically stronger with p-value 0.011 with coefficient -0.002, rather than $r_{t-1} \rightarrow i_{t-1}$ with p-value 0.068, however the magnitude of the effect is higher with coefficient -7.691
2. Granger Causality Test suggests, r Granger-causes i stronger with significant p-value below the threshold 0.05 (0.011) than i Granger-causes r with marginal significant p-value below the threshold 0.10 > p-value > 0.05 (0.068).

As we observed from both models being tested in this study. The interest rate variable (r) consistently shows significant results across the model. These findings highlight the VAR model's ability to capture the dynamic dependencies that explain movements in interest rate. Furthermore it also highlight the more niche descriptions of Financial Instability Hypothesis, where, manifestation of instability phase (Hedge, Speculative, Ponzi) not merely define by the erosion of margin of safety (Kregel, 1997) but also or even amplify the manifestation through momentum called instability of confidence. It encompasses relevancy of lender's risk attribution in creating instability (Nishi, 2012), which manifested as risk premiums embedded in interest rate. Jamie Dimon, CEO of JPMorgan in his latest interview on June 3rd, 2025[24] comment on possibility of bond's market turmoil and leaves remarkable remarks:

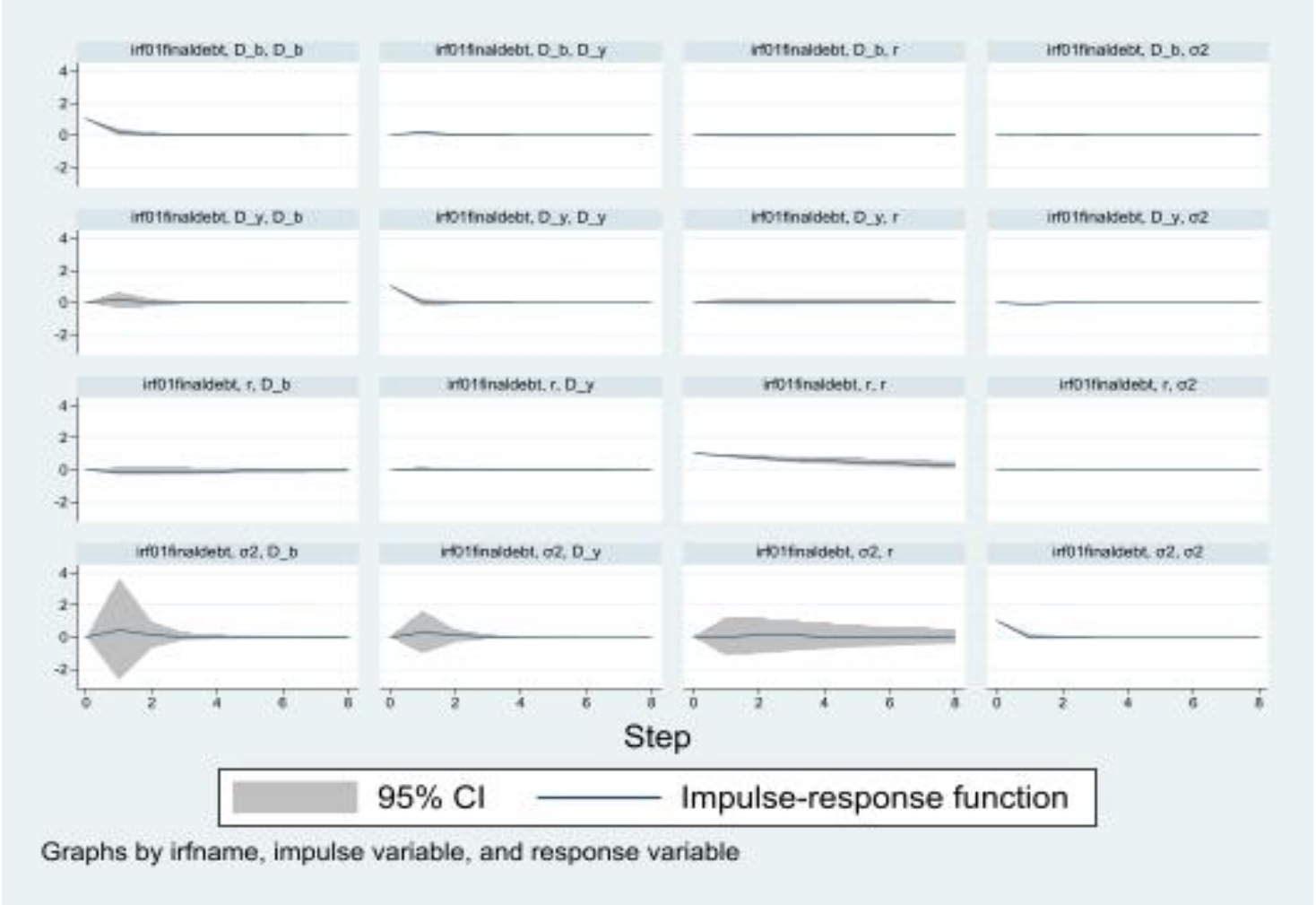
"a reform in the ability of market makers to make markets" – (Dimon, 2025)

4.1.2.4 Impulse Response Functions (IRF)

Impulse response executed to see the stress dynamic from each variable. Figure 4.6 describe the IRF result from debt model. The first row presents the result of debt stress. Interestingly all variable except the debt itself didn't give significant response to the debt impulse. Debt response the debt stress directly right after the stress given, then stable across the period of 8 quarter. Income or Real GDP is the second variable that give response to the stress, the movement considerably slight, imply when there is a debt stress, the economy only response slightly. This condition could be linked to the proportion of debt in the economy, where Indonesia's Debt contribute only around 35%. This finding also could be an implication of the resistance threshold of 35% statistically still in the acceptable level in Indonesia.The second row describe the stress dynamic response of income (y) stress/impulse. From the computed result we could again see the similar pattern with debt impulse, where the higher response of impulse in income gives more significant impact to the income itself, followed up by the response of debt. However, there is a unique response in respect of the confidence bands of income y, it describes that the span of the response could move to either +1 or -1. Suggest the interplay of externalities.

The third row describe the stress dynamic response of interest rate which in this study proxy by Bank Indonesia's base rate. This stress test also gives similar patter where the response of the stress only significantly effects the variable itself and the level of debt. Interestingly looking into the interest rate response to the shock of itself, rather than giving a sharp shock followed by the flat trend like the other two previous shock variable, it gives declining trend after receiving shock. This phenomenon could describe that whenever there is a shock in interest rate either coming as an external force or internal force, the adjustment of r takes time to be corrected to the initial level. Imply Bank Indonesia will take another approach to incentivise the stressed through other fiscal and monetary tools to control r back to the initial level. In additions the not drastic movement also an implication of prudent and performed policy set by Bank Indonesia. The last row describes the instability of confidence stress testing. This row considerably shows the most responsive dynamics. From the computed result the level of debt burden gives more churn response to the instability of confidence stress with shorter period, imply debt tend to correct itself immediately to response to the behavioural changes.

Figure 4. 6. Debt-Burden Model Impulse Response



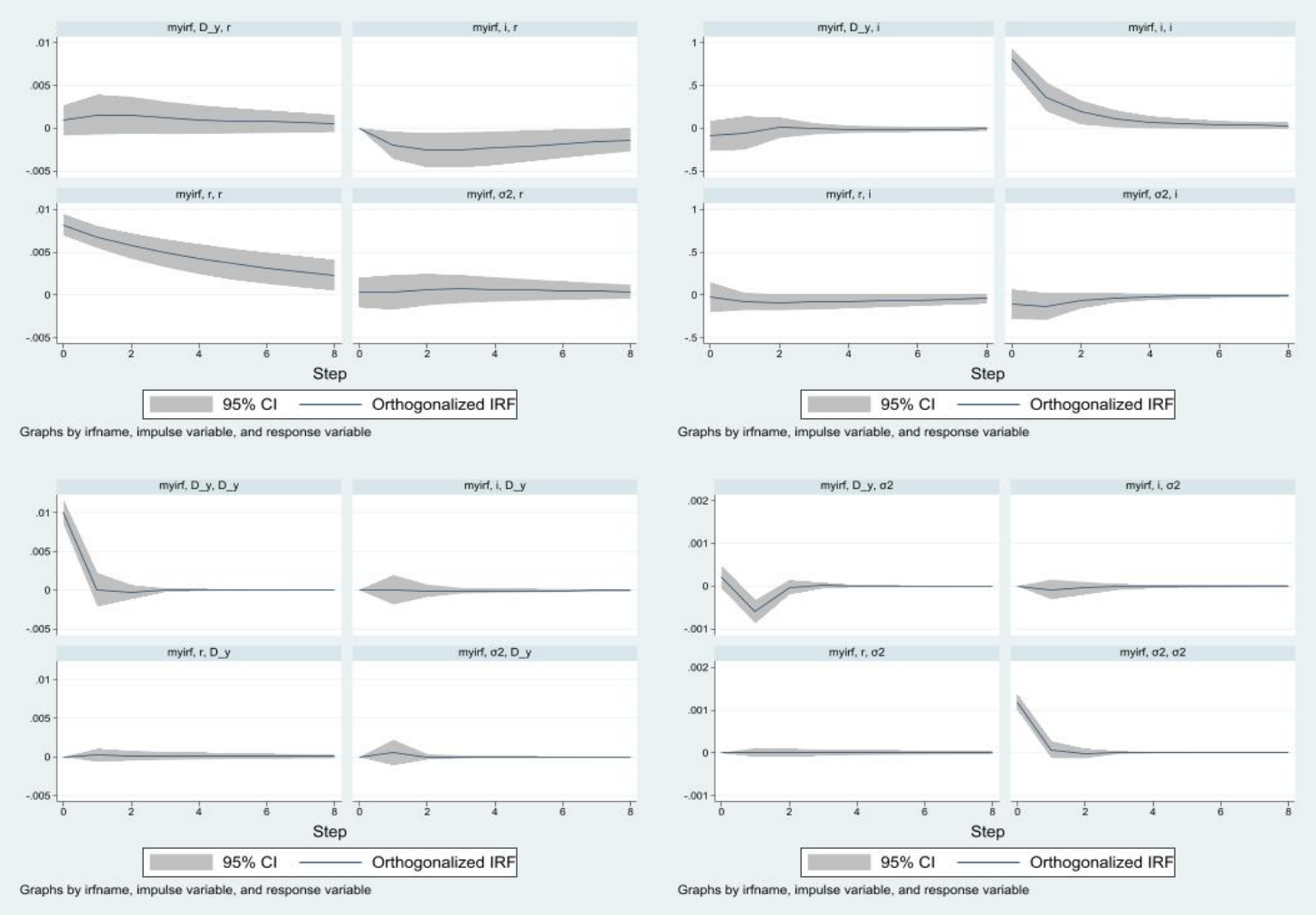
Source: Author's Stata

Figure 4.7 describe the impulse response test result from the investment model. IF we look to the detail result, figure 4.7 shows different pattern with figure 4.6, even though it consists mostly similar variable but different Cholesky ordering. Different VAR model will produce different IRF unlike granger causality test which Cholesky order do not intact in the measurement. On IRF test of VAR model the shocks are orthogonalized using the Cholesky decomposition (Palma, 2017), imply ordering of variables determines which variables are assumed to contemporaneously affect others. Investment (i) demonstrates a more pronounced response pattern to macroeconomic shocks, reflecting its sensitivity and role as a key adjustment mechanism in the system.

In contrast, the debt model suggests that macroeconomic shocks (e.g., to output or interest rates) predominantly drive system dynamics, with the responses of debt (D_b) being more passive. This indicates that financial fragility in Indonesia may be more influenced by external macroeconomic disturbances than by endogenous debt behavior, consistent with the findings of Ninomiya and Tokuda (2020) and Minsky's financial instability framework.

The computed IRF result of (D_y) in table 4.7 shows consistent result with the VAR equation and Granger result. D_y response limitedly to the shocks of all the variable except D_y itself followed by short-term adjustment. The graph shows when D_y experience shock of D_y itself, D_y will experience sudden and sharp upward spikes, then it will decline after experiencing shock on period 0 – 1, followed by quick adjustment on period 1 – 2. This finding could be an implication that governor more sensitive to response to income proxy by real GDP shock rather than monetary channel, however due to economic structure dominate by consumption, income (D_y) will experience small recession period due to economic constraint (possibly related to money supply). In addition this findings could be additional support from previous assumptions derived from findings where "Indonesia's interest rate greatly influenced by It's Economic Growth or GDP as common characteristic of emerging markets Monetary Transmission Mechanism" (Clarida, Galí, and Gertler, 2000).

Figure 4. 7. Investment Model Impulse Response



Source: Author's Stata

Clarida (2000) research and the findings create broader implication and support to modern definition of cyclicality in capitalist economic system. Initially Minsky define that all economies effected by procyclical force of capitalistic economic system however the divergence in level of the procyclical force define by economies institutional resilience. Prof. Martin Guzmán (2025) on the other hand argues that the system it's self that create un-avoidable cyclical relation to the economies in relation to their economic size and structure. Therefor by this findings author agree that capitalistic economy gives procyclical force to the emerging economies and countercyclical to the developed one.

The computed IRF result of instability of confidence (σ2) response to the shock describe on figure 4.7 show varies pattern but shallow depth. Instability of confidence most sensitive to the shock in D_y followed by the response in instability of confidence itself. In respect of the shock in D_y, after receive shock it takes a light downturn with depth around $n < 0.001$ and adjusted on initial track on the second period (step). The next notable shock responded by σ2 is the shock in σ2 itself. However different from D_y shock to σ2, the shock in σ2 to σ2 itself will create a sudden inflation in σ2 around $.002 < n < .001$ then followed by direct adjustment to initial level rather than experiencing downturn shock before adjusted to base (like D_y).

On the group of r response describe on figure 4.7, generally r seen to be most sensitive to its own shock by sudden upward spikes around .01 and followed by slow adjustment toward base level in period possibly more than 8 period as described. The next visible pattern of shock response of r is investment shock (i). The graph shows that a slight downward pattern in interest rate (*r*) when given shock of investment (*i*). It implies interest rate might reduce when there is a shock in investment. On the other hand, interest rate (r) does not show visible response to the shock in instability of confidence (σ2) and income (D_y) by consistently reside around the base with slight movement on 0 – 1 period. An interesting result of response in r compare to another variable response in on the widening area of confidence band. Statistically, this might indicate an outliers, means a limitation of the VAR model to precisely forecast the dynamic path of r towards shocks.

However previous studies have interpreted the decreasing confidence level in monetary data forecast as a potential indicator of asymmetric transmission mechanism or policy inertia (Clarida et al., 2000; Sonsino and Roth, 2025). To see the closer implication of each model in defining fragility momentum in Economic system, Author summarizes the findings on table 4.30. As previously mention, Impulse Response Forecast in VAR model effected much by the recursive ordering of VAR model. Therefor the result could also interpret in the form of systemic response by attributing the recursive form of each model. The recursive nature (orderings) reflects the contemporaneous causal assumptions embedded for each model, thus should use as a guidance to interpret the impulse responses. Income (D_y) response in debt model and investment model IRF show a similar pattern. There is consistency on income sensitivity where income remains self-driven by its own shock despite the recursive order on debt model income put on the second order.

Table 4. 20. Impulse Response Summary Result

Response	***Debt Model*** ***(r → D_y → D_b → σ²)***	***Investment Model*** ***(D_y → σ² → r → i)***
Income (D_y)	Shocks Sensitivity in order: D_y > σ2 > D_b > r Forecast Precision in order: r = D_b > D_y > σ2	Shocks Sensitivity in order: D_y > σ2 > r > i Forecast Precision in order: r (long tail) > σ2 > i = D_y
Interest Rate (r)	Shocks Sensitivity in order: σ2 > r (long tail) > D_y = D_b Forecast Precision in order: D_b > D_y > r > σ2	Shocks Sensitivity in order: r (long tail) > i (long tail) > D_y = σ2 Forecast Precision in order: similar across variable
Instability of Confidence (σ2)	Shocks Sensitivity in order: σ2 > D_y > D_b = r Forecast Precision in order: similar	Shocks Sensitivity in order: σ2 > D_y (negative shock) > i > r Forecast Precision in order: r > σ2 > D_y > i
Debt Burden (D_b)	Shocks Sensitivity in order: D_b > σ2 > D_y > r Forecast Precision in order: D_b > r > D_y > σ2	-
Investment (i)	-	Shocks Sensitivity in order: i > D_y (negative shock) > σ2 (negative shock) > r Forecast Precision in order: similar

Similarly, consistency also seen on instability of confidence ($\sigma 2$) where in both model, ($\sigma 2$) give substantial shock to income (D_y). In both model income also seen to be relatively muted to the shocks in debt-burden (D_b), interest rate (r), and investment (i). This pattern implies that economic income or output in Indonesia are firmly influenced by it's own performance and the confidence level of the business in sustaining their output.

Conversely, interest rate (r) responds differently to the shocks in debt model and investment model shows a possibility of interest rate (r) structural roles in the system. In debt model where interest rate (r) comes first in the chain (recursive order) it become most sensitive to instability of confidence ($\sigma 2$) by more volatile responds, then followed by moderate-low sensitivity to its own shock but with persistent effect. On the other hand in investment model where interest rate (r) in the third order of the chain shows that, even though shock transmit towards income (D_y) first, interest rate (r) still respond most sensitive to its own shock, then followed by another (less) significant response to investment (i) and mild responds to instability of confidence ($\sigma 2$). This finding could give two implications. First by the way shocks responded on debt model from instability of confidence ($\sigma 2$) to interest rate (r) given the recursive order of debt model. This finding describes that the risk in stability (instability confidence) will be attributed to the increase of financing cost that reflected on interest rate before giving systematic impact to income and debt-burden. This finding of instability confidence relation to interest rate known as risk premia.

Risk premia are defined as risk's component to which represent the additional risks from risk-free investment that need to be compensate by the investor. In the country level, interest rate use as a monetary tools to control the balance of money supply and demand (Andrade, Ekponon, and Jeanneret, 2023; H. Zhang, Guo, and Liu, 2022; Y. Zhang, Zhu, and Zhu, 2021), in which created either from central bank or commercial bank, therefore interest rate need to reflect the forecasted economic conditions. The forecasted economic conditions convers macroeconomic trends and specific risks exposure e.g. inflation, real interest rate, and some degree of uncertainty (ibid.). On that understanding, it implies risk premia represent compensation for the additional risks beyond a risk-free investment, therefore interest rates especially at the country level is function not only as monetary tools to regulate money supply and demand (Andrade et al., 2023; H. Zhang et al., 2022; Y. Zhang et al., 2021), but also as

forward-looking indicators that embed macroeconomic expectations and uncertainty. As such, the determination of interest rates in essence reflects what is anticipated includes, anticipated trends in inflation, anticipated real activity, and anticipated financial stability. All has the element of perceptions that economist usually categorize as rational behaviour. However, as the dynamic relationship concern, the volatility that not anticipated might occur as a result of causal relation (Huybens and Smith, 1999; Pivetti, 2024).

Therefore, it's both influence and influenced. This theoretical framing aligns with Ninomiya (2017, p. 40), who emphasized that the burden of interest-bearing debt (iD) is a key contributor to financial instability. However, as Ninomiya & Tokuda (2017, p. 58) further clarify, this debt burden does not arise ex nihilo but is the cumulative outcome of deteriorating confidence and macro-financial fragility which recorded in the 2008 Global Financial Crises. Thus, the interest rate simultaneously reflects and reinforces systemic risk which linked the pricing of risk premia (or how risk premia constructed) to the structural evolution of financial instability. As the most endogenous variable, σ^2 captures cumulative fragility. In both models, D_y leads to increased instability, revealing that real economy health is crucial for systemic confidence. The different reactions to D_b (in debt model) vs i (in investment model) suggest that debt burdens create more inertia than investment flows in triggering perceived risk. Since D_b is endogenous in the debt model, it reflects accumulated impact from r and D_y. Minimal response to r might indicate a nonlinear, delayed debt cycle, aligning with Minsky's post-Keynesian fragility thesis.In the investment model, with i last in the recursive order, the sensitivity of investment to its own shock is expected, but the negative response to D_y suggests the existence of procyclical investment restraint, which might potentially become a sign of confidence-linked credit channel (Bernanke, Gertler, and Gilchrist, 1994). The low response to r might implies monetary policy might be less effective in stimulating investment directly.

The presence of positive income shocks, resonate with (Iljas, 2017) description of Indonesia's evolving credit market, which particularly pointed to the rise of non-bank financial institutions and securitization mechanisms. These shifts, while broadening access to finance, also dilute the predictability of traditional policy tools and the responsiveness of real sector investment to monetary impulses (ibid.).

4.1.2.5 Forecast Error Variance Decomposition (FEVD)

FEVD enable analysis to see the relative contribution of structural shock for each variable over the selected time horizon, in order to gain direct insight of each model which being tested, author summarize the FEVD result with no confidence interval of FEVD in comparison table described on table 4.21.

Table 4. 21. FEVD Debt-Burden (left) and Investment Model (right)

Variance Decomposition of r				
Period	r	D_y	D_b	σ2
0	0	0	0	0
1	1	.012613	.000149	.00495
2	.99524	.01293	.000654	.004317
3	.994001	.013266	.00167	.004272
4	.99337	.013463	.002598	.004319
5	.993007	.013599	.003325	.004375
6	.992779	.013698	.003877	.00442
7	.992629	.013772	.004291	.004456
8	.992526	.013828	.004603	.004482
Variance Decomposition of D_y				
Period	r	D_y	D_b	σ2
0	0	0	0	0
1	0	.987387	.010216	.020295
2	.004672	.902429	.011833	.201658
3	.005778	.898436	.011823	.199458
4	.00629	.898064	.011827	.199297
5	.006577	.89793	.011827	.199279
6	.006754	.897839	.011826	.19927
7	.006871	.897772	.011824	.199263
8	.006951	.897721	.011824	.199258
Variance Decomposition of σ2				
Period	r	D_y	D_b	σ2
0	0	0	0	0
1	0	0	0	.952975
2	.000028	.001242	.000565	.766196
3	.000059	.001321	.000626	.75771
4	.000078	.001326	.000628	.757103
5	.000089	.001326	.000628	.75703
6	.000096	.001326	.000628	.756994
7	.000101	.001326	.000627	.756967
8	.000104	.001326	.000627	.756947
Variance Decomposition of D_b				
Period	r	D_y	D_b	σ2
0	0	0	0	0
1	0	0	.989635	.021781
2	.00006	.083398	.986948	.027829
3	.000162	.086977	.98588	.03856
4	.000261	.087147	.984947	.039281
5	.000327	.087145	.98422	.039316
6	.00037	.087137	.98367	.039316
7	.000399	.08713	.983257	.039314
8	.000418	.087126	.982947	.039313

Cholesky Ordering r D_y D_b σ2

Variance Decomposition of r				
Period	D_y	σ2	r	i
0	0	0	0	0
1	0	0	.986928	.001165
2	.000392	.000115	.937331	.007809
3	.000666	.000132	.896875	.015982
4	.000848	.000157	.870844	.023353
5	.000982	.000185	.853819	.029316
6	.001082	.000209	.842459	.033919
7	.001156	.000229	.834738	.037395
8	.001211	.000243	.829394	.039996
Variance Decomposition of D_y				
Period	D_y	σ2	r	i
0	0	0	0	0
1	1	.030378	.012022	.012019
2	.996181	.218461	.027224	.013683
3	.995858	.218492	.034419	.012982
4	.995625	.218546	.036292	.012767
5	.995447	.218525	.036871	.012825
6	.995313	.218514	.037107	.01294
7	.995212	.218507	.037221	.01305
8	.995136	.218503	.037284	.013142
Variance Decomposition of σ2				
Period	D_y	σ2	r	i
0	0	0	0	0
1	0	.969622	.00105	.017669
2	.003398	.777946	.001389	.036538
3	.003405	.776728	.003397	.039982
4	.003404	.776424	.005229	.040435
5	.003407	.776354	.006527	.040433
6	.003409	.776317	.007419	.040347
7	.00341	.776292	.008035	.040257
8	.003412	.776275	.008466	.040181
Variance Decomposition of i				
Period	D_y	σ2	r	i
0	0	0	0	0
1	0	0	0	.969147
2	.000028	.003478	.034055	.941970
3	.000070	.004648	.065309	.931054
4	.000122	.004873	.087634	.923445
5	.000164	.004936	.102783	.917426
6	.000197	.004960	.113014	.912794
7	.000222	.004972	.120005	.909298
8	.000241	.004979	.124857	.906682

Cholesky Ordering D_y σ2 r i

A) Interest Rate (r)

The variance of interest rate r in debt-burden model mostly self-influenced, means it majorly affected by its own shocks, and the patter persist across period. At horizon 1 r shock to r account for 100% leave no rooms for other variable in the model to be part of the variance. At the rest of the horizon (2-8) the variability of r includes r around +/- 99% and D_y around +/- 1%, while D_b and σ^2 seen to give unsignificant variability with value below 1%.

The variance of interest rate (r) in investment model gives similar result to debt-model where it seen to be mostly self-influence at the first horizon and gradually decrease along the period. Instability of confidence (< 0.0005) and D_y (<0.005) give unsignificant variance decomposition to r similarly with the FEVD result of r in debt model. However, the investment (i) variance decomposition r more significant than r and σ2, through gradual increasing pattern from period 1 (0.001) to period 8 (0.39). From the debt model self-influence of r tend to persist across the period, while in investment model the longer the period is the lesser the power of r influencing itself with the bigger the influence of investment (i). This finding imply that interest rate dynamics in Indonesia is largely driven the internal monetary policy adjustment rather than shock to income, debt, and or instability of confidence. It reflect the typically systematic and rule-based dynamics of interest rate (Gil, Iglésias, and Guimarães, 2023). A well-defined interest rate can help maintain stability and reflect monetary policy effectiveness (Clausen and Wohltmann, 2005; Gil et al., 2023).

B) Income (D_y)

The variance of income D_y had shown a variability since the horizon 1 with D_y 98.73%, D_b 1.02%, and σ^2 2.02%, while r seen to give unsignificant variability with value below 1%. Notable change seen starting at horizon 2 where the variance of D_y, σ^2 experience sharp increase 10 times the initial level to 20.16% while D_y itself still account for major attribution at 90.24%, D_b 1.11%, and r below 1%. The composition at horizon 2 continue until the horizon 8 with slight decrease.

This pattern suggest in the short-run variance of D_y majorly attributed by its own shocks and σ^2 with delay. This pattern reflects the behavioural aspects of economy where economic agents often respond based on recent experiences and expectations form past data (Brown, 2024; da Silva Bichara and Pérez Ortiz, 2020; Dellavigna, 2011). Similarly, the variance decomposition of D_y in investment model seen to be mostly self-influence with slightly higher degree around 99% and persist across the period. The second most influential variable is instability of confidence, starts by 0.03 at initial period then experience sudden increase to the level around 0.21 which persist until the later period. Interestingly putting the variance decomposition D_y result in debt model as benchmark, the way r behave as variance decomposition of D_y in investment model posits different pattern. Interest rate (r) didn't significantly variance decomposition D_y in debt model with value around 0.005 however in investment model r variance decompose D_y moderately around 0.01 - 0.0373. The findings of r over D_y in investment model might be correlated with monetary transmission mechanism in Indonesia. While D_b variance decomposition D_y in debt model seen to be on similar level with investment (i) variance decomposition D_y in investment model which is around >0.10 with i slightly higher, this finding of higher explanatory power over D_y in the investment model also align with the theory of Business Cycle of Economy by Kaldor where, investment propagate economic output.

C) Instability of Confidence

Another interesting FEVD pattern seen on the variance decomposition of instability of confidence (σ^2). Initially from the debt model, instability of confidence (σ^2) seems to shows consistent pattern with moderate unpredictability around +/- 25%. This pattern described from the computed result where from the time horizon 1 until 8, σ^2 is self-influence at the level >0.75, however the other variable in the debt model, unable to give notable decomposition to the σ^2, where interest rate, income, and debt burden are shown to influence the instability of confidence at a level less than 1%.

However, the variability over σ^2 becomes clearer when we look into the FEVD result of σ^2 in investment model. Despite being self-influence at the level around >= 0.75 across the period with low explanatory level of interest rate and income, investment on the other hand gives more explanatory power at the level 0.01 at period 1 and gradually increase to the level 0.04 at the later period. This contrast underscores a key empirical insight of business confidence which captured by σ^2, that from macro perspective businesses is more responsive to investment movements of the country rather than to debt accumulation of the country.

D) Debt-Burden (D_b)

In the case of variance of debt burden D_b, the computed result shows the variance composition relatively similar across the time horizon with slight difference over time. Major composition held by its own shock at +/- 98% followed by income D_y +/- at 8% and instability of confidence σ^2 at 2% - 4%. This finding suggest while debt burden steadily response to macroeconomic and behavioural variable the level still minor and the major influence still held by its own shock.

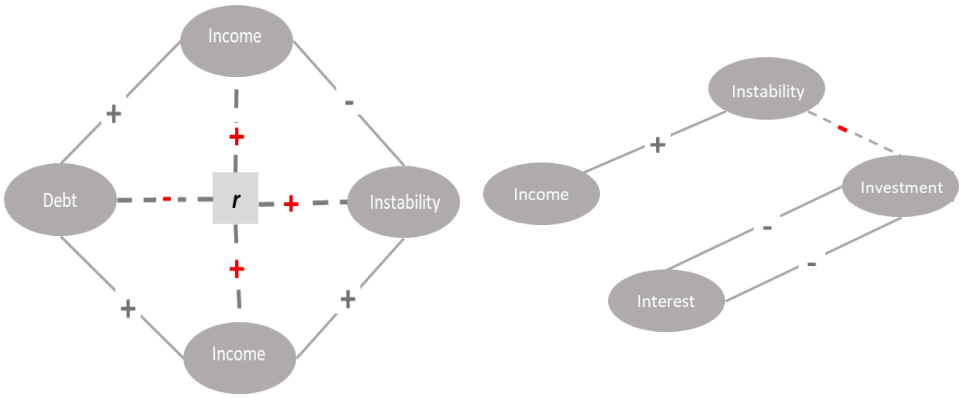
E) Investment (i)

The variance decomposition of investment (i) shows a straight forward result. On period one investment mostly self-influence at the level 0.96 then slightly decrease overtime until 0.90 at the later observed period (period 8). Income (i) and instability of confidence (σ^2) describe to give influence less than 0.05 across the period left interest (r) with notable result at the level 0.03 at period 1 then gradually increase to the level 0.12 at period 8.

In summary, by looking into the overall result of VAR modelling, author present a visual interpretation to give intuitive relations, based on author's reasoning of VAR result. Figure 4.8 (separated dynamics) and 4.9 (combined dynamics) describe author's perceived dynamic system within Indonesia Financial Economic system.

The dynamic relation visualized on figure 4.9 describe the distinguished significant relation between p-value 0.25<n<0.05 both in debt and investment model, the solid line (p-value<0.05) describe stronger relation than the dashed line (p-value<0.25). The figure made through statistical support considerations which synthesize from the VAR equation, causal relation, IRF as well as FEVD. Left figure derived from Debt model while the right figure derived from investment model.

Figure 4. 8. Visualization of Dynamic Relations



Source: Synthesize from VAR equation, causal, IRF, and FEVD result of each model

The dynamic model describes in figure 4.9 present the combined dynamic relations derived from figure 16. In terms of its proposition in describing fragility in a broader context, initially, the author derived an implication that the fragility affected the system through the path $y \rightarrow \sigma^2 \rightarrow y \rightarrow b \rightarrow r \rightarrow i$ as described by the sensitivity order of y to the other VAR-list shocks. However, given the absence of statistically significant pathways connecting debt (b) to interest rate (r) and also investment to other variables in the system, this study draws on the IS-BB[25] extension framework Ninomiya and Tokuda (2021, p.5).

[25] Ninomiya and Tokusa (2021) demonstrate the dynamic system by considering IS-BB framework demonstrate by Okishio (1986). As access to actual works of Okishio limited due to language barrier, therefore author quoted from Ninomiya and Tokuda descriptions; "*S* and *I* are factors of the market for goods (and services) and are also deeply related to financial markets. Investment is the demand for loanable funds and savings are part of the supply of loanable funds. The investment also indicates the behavior of firms as borrowers. The interest rate is affected by investment and saving unless the goods market is equilibrium". (p.5)

Although, empirically this study did not include, the macro-dynamic observations through Jacobian trace (J-trace) as demonstrated by Ninomiya and Tokuda (2021, p.6). Author identifies the information describes on figure 1.2 of sectoral economics share of GDP might indicate the relation between goods market with financial market as IS-LM-BB theoretically describes. IS-LM-BB suggests deep and necessary bond between finance and real production (Bellido, 2016; Leclaire, 2020; Okishio, 1986).

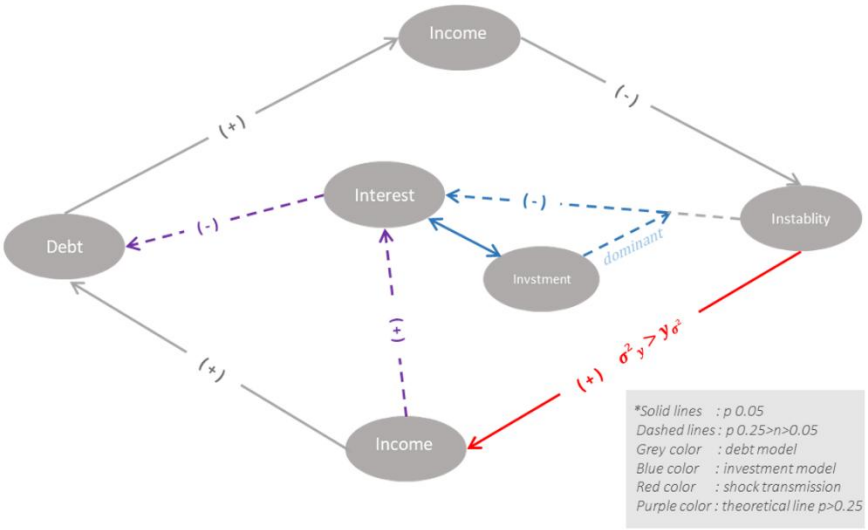
Therefore, the divergence between the real sector and the finance sector in the economic structure may indicate this connection. This can be observed by analysing historical data, comparing periods before and after financial crises. Typically, the pattern shows that disruptions in the financial system can significantly affect real economic activities, through job creation and aggregate demand (Bellido, 2016). Align with Steve Keen (1995) descriptions of "job-less recovery" and Costas Lapavitsas (2014) descriptions of "profiting without producing", in regards Minsky's Financial Instability phenomenon. Therefore, author extended the interpretation by incorporating unstable path 1, where $y \uparrow \Rightarrow \sigma^2 \downarrow \Rightarrow \mu \uparrow$, $L \downarrow \Rightarrow i \uparrow \Rightarrow y \uparrow$ with "specific additional emphasis on money multiplier (μ) and lender's risk (L) role on debt". The author considered this unstable path due to several considerations as follows:

1. Income to debt relation is clear through the Granger causality test, where $y_b > 0$ (p-value < 0.05) (H1C partially accepted[26])*, instability to income relation is clear through the equation as well as a bidirectional causal relation where $\sigma_y^2 < 0$ (p-value < 0.05), and no clear direct relation of interest rate to other var-list. However, we found IRF in debt model suggests *r is* most sensitive to σ², while σ² is most sensitive to $\sigma^2 > y > d \approx r$, and debt is most sensitive to $\sigma^2 > y > r$. Then interest rate propositions become clearer in investment model, whereas,

[26] H1C: Debt burden significantly influences the instability of confidence which transmitted to macro-financial indicator. Hypothesis 1C partially accepted because there is no direct relationship between debt and instability of confidence, however the findings suggest a possible indirect relations scenario through the path $y \rightarrow \sigma^2 \rightarrow y \rightarrow b$.

2. Investment sensitivity to change in interest rate less than 0 (negative significant) $i_r < 0$ (p-value < 0.05) and bidirectional causal relation r ↔ i exist with $r_i < 0$ (p-value < 0.05). In addition, IRF in investment model suggests r is most sensitive to r > i > y, while i is most sensitive to i > y > σ^2 > r, and holds σ^2 similar (σ^2 > y > i > r) (H1D partially accepted27)*.

Figure 4. 9. Visualization of Combined Dynamic Relations



Source: Synthesize from VAR equation, causal, IRF, and FEVD result in combine

[27] H1D: Investment decision significantly influences the instability of confidence which transmitted to macro-financial indicator. Hypothesis 1D partially accepted because based on the findings there is no direct relation between instability of confidence with investment. Both H1C and H1D still relevant and could be partially accepted because the possibility scenario through the role of interest rate in creating liquidity in market which theoretically sound and described by Ninomiya and Tokuda in 2021 (which describe the scenario of direct causal relation $\sigma^2 \rightarrow y$ that aligned with the findings in this study).

4.2 Findings Observations on Financial Policy in Indonesia at the Period Around Recognized GDP Contractions

The empirical findings from the GARCH and VAR/VECM models in this study have provided quantitative evidence of financial fragility in Indonesia, with cyclical volatility represent by instability of confidence (σ^2), interest rate asymmetry shock response across model, and the sensitive investment responses to volatility of σ^2 but more muted response macroeconomic stimuli. These finding is better understood through regulatory studies other than the econometric interpretation approach, by doing so we can see how regulatory aspects affect the economic structure, especially because the chosen model places structure as the axis. In the literature review author briefly discussed the volatility in GDP pattern of Indonesia which could be visual descriptions of history of financial crises and see how the early laxation in financial sector imposed and effect the level of GDP at that time. At this section author adopts problem-based approach to the regulatory study, author assume that one aspects which create macroeconomic contractions is the regulatory shift.

This method aligns with the principle in regulatory priorities which usually in shaping the priorities it's often anchored in disruption, not through continues or equal-interval monitoring (Baldwin and Black, 2016). Thus, in the case of this study, policy responses are assessed based on their reaction to instability rather than through equal time intervals. Therefore, the discussion divided according to the spotted sharp shock on the level of Indonesia's Real GDP (as described on Figure 2.3 in literature review), which author recognized 3 contractions from the graph that characterized by sharp moves around $\pm 5\%$, there are 1982, 1998, and 2022. As the decline on the period around 2019 – 2022 were a responds to a force major of Covid-19, therefore author assumes the decline generally happened not majorly driven by financial prudential factors, but force major. Consequently, the regulatory responds observed from GDP contractions will be examined through three sub-section named; contraction at 1982, contractions at 1998, and contractions at 2022.

4.2.1 Contractions in 1982

Historically Indonesia experienced two major deregulations before the cumulative effect exuberated as Financial Crisis in 1998, but to understand the background on how the crisis could happened and understand what happened in 1982, before Indonesia decide to loosen the financial sectors in the next year (1983), author summarize the historical event recorded by Prof. Boediono in his book Ekonomi Indonesia.

> *On the period of 1950-1965 he described this part as consolidation period where at this period the economic of Indonesia characterised by stagnation and hyperinflation, this happened not only because the political un-stability that comes from the premature system of Indonesia but also the weight on Financial-Economic Conditions that need to be done and full-filled as a priced for Indonesia's independence. Things turned into new stages on the period between 1966 – 1981, where Indonesia economic start stabilizing and anchor the economic into energy (oil and gas) and was part of OPEC since 1962 until 2008. The grace coming from energy sector (high international oil prices) then utilize to another real economic sector, at this stages the Indonesia's economic booms flow through various sector, Prof. Boediono describe this moment as all out initiations. The massive development both in real sector and later in financial sector were seen as a form of effort to detach from colonialism power and cope up with the big economy gap at that time. It's recorded that the initiations to developed non-energy sector were also includes the financial sector both Bank and Non-Bank entities* (Boediono, 2016)

The summary above, gives a background story on how first deregulation in 1983 named PAKJUN or PAKTA JUNI happened. Prior to the deregulation, specifically in 1982, a crisis occurred due to collapse in global commodity prices, which effects Indonesia significantly as nations which rely on energy sector. Thus the deregulation in Banking sector in 1983 seen as a form of responds on macroeconomic conditions.

Initially the liberalization of autonomy in Banking sector mainly aim to accelerate the financial inclusion. Prof. Boediono in his book implicitly mention, business funds and community funds are expected to be the driving force of the economy, no longer the government and oil money (Boediono, 2016). If we compare to the graphic describe on figure 2.3, the 1983 deregulation successfully heal the contracted GDP, we could see from the steady upward slope between 1982 to 1984. However, in 1986 Indonesia's GDP experience a negative slope, but immediately corrected and reach stable phase in 1987 until 1988.

As the economic experience a positive stable phase post 1983 deregulation, it creates a optimism conditions. The second deregulation took place to loosen several part which not been loosen on 1983 deregulation. McLeod (1999) documents how deregulation packages in 1983, 1988, and 1990 allowed for explosive growth in banking activity without proper prudential controls, resulting in a fragile financial system prone to moral hazard, corruption, and inefficient capital allocation (McLeod, 1999). However, the optimism not happened in specific area, it were massively spread as a world-wide communicable disease which marked by widespread belief that financial markets could self-regulate, and that market forces, foreign investors, and credit rating agencies would effectively manage risks without heavy government interventions (Arestis and Glickman, 2002; Bennett, 1999; Cole and Slade, 1998; Kenshiro Ninomiya, 2006; Sadli, 2015) Minsky in his article "it Happened again" on 1982, linked currency-dominated debt as the form of systemic ponzi. These refer to his descriptions of financial fragility, where speculative and Ponzi units amplify shocks in an open financial system under floating exchange regimes (Minsky, 1982, pp.20).

4.2.2 Contractions in 1998 - 1999

Business cycle theory, especially from Austrian perspective, explained as the recurring pattern of unsustainable growth, which characterize by a period of overinvestment and misallocation that followed by busts as a correction (Gali, 2008; Garrison, 2004; H. Minsky and Vaughan, 1990). Thus, the crisis in 1998, were a perfect example of a burst which a result of accumulations a series of booms in the previous period. In the case of Indonesia, it was a culmination of fragility introduced by PAKJUN 1983 and PAKTO 1988, which create a burst in finance.

By a big number of financial institutions at that time which encouraged by the more laxation resulted by PAKTO 1988 forced Indonesia to make a reformation in their finance industry. IMF at this point supported post-crisis reforms which initiated in November 1997, followed by negotiation in 1998 and further consolidation in 2002 (Bennett, 1999; Boediono, 2016).

The statistical trajectory of Indonesia's real GDP from 1997 to 2002 described on figure 2.3 on literature review, clearly reflects the historical dynamics that been discussed. Thus, the characterized by sharp contractions in 1998, corrected on 1999 and start stabilize in 2002 which marked the effectiveness of the consolidation of post-crisis recovery and financial sector reformations at that time. However, still

the Srinivas (2013) argues that these interventions not sufficient, he implicitly describe that the IMF's standard prescription of fiscal austerity and banking recapitalization could not resolve the underlying problems rooted in ownership concentration, political connections, and structural opacity (Yanamandra, 2013, pp.21). These were very interesting argument as looking into the findings, we could spot the difference on the pattern described by Real GDP historical data with the forecasted fragility through instability of confidence.

On the GARCH findings of fragility forecasting through instability of confidence, author found an increase in business confidence in 2002 q1 and peak in 2002 q2, interestingly it followed by sharp drop in 2002 q3 and start corrected in 2002 q4. However, it's immediately reach the peak of corrections in 2003 q2 and fall back again in 2004 q4. Implies the fragility persist as described by the volatility in instability of confidence, unlike real GDP which experience relatively stable pattern after reforms in 2002.

This pattern gives essential descriptions, where, although there are visible improvements in macroeconomic indicators, which might seen as a success story of financial reformations at that time such as such as the establishment of IBRA (January 1998) and the formal independence of Bank Indonesia (Law No. 23/1999) (Boediono, 2016; Hendartono, 2017), thus create a sense of political stability that reflect on the GARCH pattern in mid 2002. However given the volatility persist in the GARCH model implies the relevancy of Minsky's argument on surface-level stability and the opinion about essential structural reforms. Furthermore Hendartono (2017) add, the benefit of recovery were concentrated among capital owners and large business groups, while labour absorption remained stagnant (Hendartono, 2017, pp.22). These phenomenon align with Minskyian economist position on regards the financial instability hypothesis description on labor market, where described as growth fails to translate into social cohesion or employment expansion (Hendartono, 2017; Keen, 1995). These become the underlying reason on Minsky emphasize on the need of countercyclical mechanisms in the form of buffer (Minsky, 1982) which Islamic economist argues the ideal form of buffer are redistributions mechanisms (Asfarina, Ascarya, and Beik, 2019; Asutay and Yilmaz, 2024; Mahomed, 2017; Muhammad Firdaus, Irfan Syauqi Beik, Tonny Irawan, and Bambang Juanda, 2012; Suharto, 2017), to maintain the magnitude of confidence on the healthy level over risks (Seebauer and Babcicky, 2020; Slovic et al., 2013; Slovic and Peters, 2006).

In addition, the earlier findings on Impulse Response Forecast, gives broader implications, on the way we perceived the persistent volatility in confidence which in this model assumes as fragility force, by looking into the earlier findings on impulse response forecast. The IRF result shows that, interest rates were most sensitive to σ^2 shocks, despite being last in the recursive structure, revealing how monetary instruments absorbed fragility without effectively transforming its sources. In addition, author also found that the FEVD results suggest that debt burden (D_b) and interest rate (r) remained self-reinforcing, which reflect the conditions that supports Minsky's view of policy delay in stabilizing endogenous fragility.

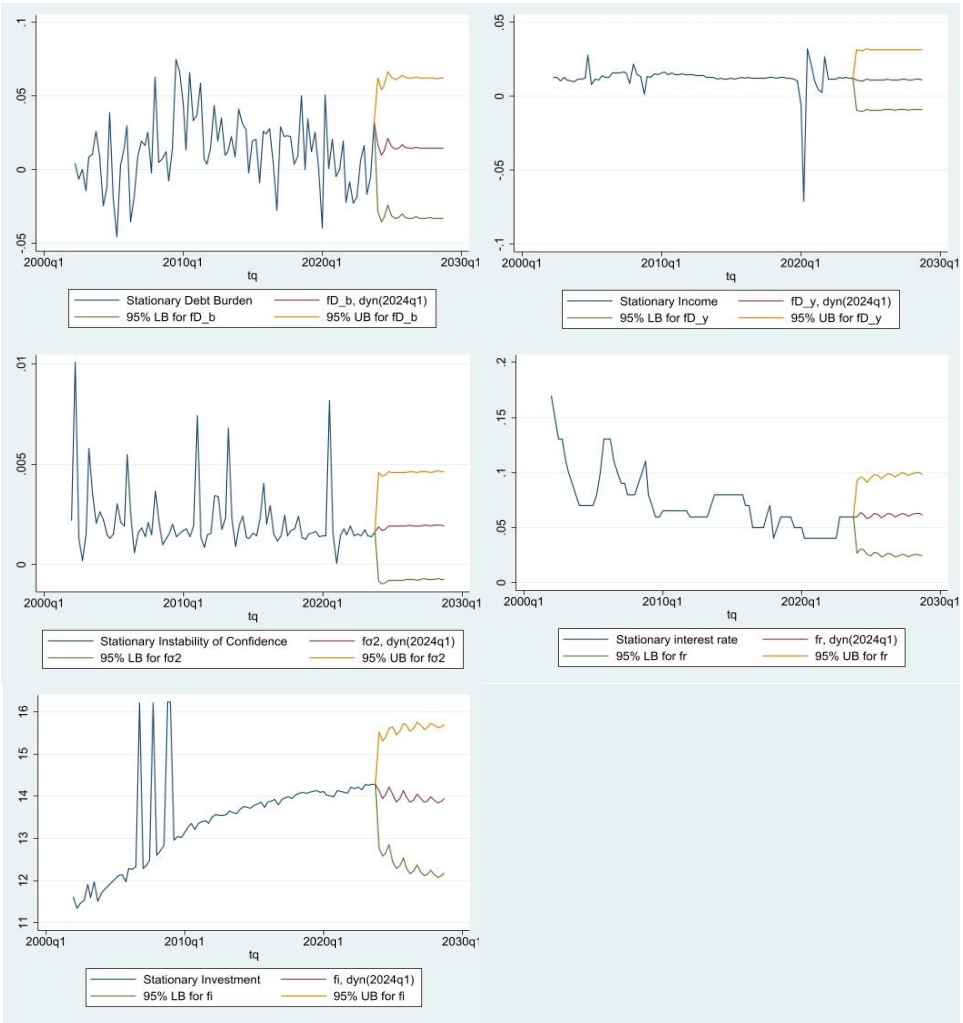
4.2.3 Contractions in 2020 - 2021

Based on GDP pattern span from 1980 until 2024, severe economic contractions only happened three times in 1982, 1998 – 1999, and 2020 – 2021. The first two contractions were majorly driven by the laxation in fiscal policy, while the contractions that happened in 2020 – 2021 were subject to force major event of communicable disease. The GDP pattern suggest Indonesia's GDP start corrected at the end of 2021. This correction could be seen as market response to fiscal policy enforce at that time name *Program Pemulihan Ekonomi Nasional (PEN) 2021* or in English called National Economic Recovery 20221 (Indrawati, Satriawan, and Abdurohman, 2024).

Previous study conducted by Ministry of Finance in Indonesia suggest, several stimulus given to the business as well as citizen in the form of Central Bank rate cut to 3.75% by the end of 2020 and intensive social protection enable Indonesia to maintain the welfare of the 40% of the poorest and some middle-income earners based on *Badan Pusat Statistik* (BPS) poverty rate which also supported by the growth pattern in consumptions despite relatively tight conditions (Indrawati *et al.* 2024, pp.18). Recent study supports this argument, where empirically inflation level of Indonesia remained under control post-PEN 2021 (Indrawati et al., 2024; International Monetary Fund. Asia and Pacific Dept, 2024). However, author argue the elasticity in that happened during 2020 – 2021 consumptions and the recent condition of controlled inflation level, need to be approach cautiously. The forecasted trajectory path (see figure 4.10) extract from the data in this study suggest a possibility of huge gap of confidence level from the expected trajectory that might happened around 2024 quarter 1 and persist for some time.

The forecasted trajectory path suggests despite expected to be stable the effects were not deterministic. This cautious warn, also described by several scholar through various lens, for example the rising trend in Non-Performing Loans (NPLs) in the financing sector (bank and non-bank institutions) in recent years that argues that the increasing pattern in NPL is the aftermath of unsupervised fiscal laxation, that mainly comes from non-bank financing institutions as bank retain its conservative position (Aziz and Maulida 2024, pp. 194 - 195). Despite the rose of NPL it also observed bank deposits grew significantly during the post-2021 laxation period. Consequently, it might be perceived as a stable condition where deposits cover the NPL negative influence to credit growth, therefore credit expansion perceived as acceptable during this phase despite the rose in NPL.

Figure 4. 10. Forecasted Trajectory Path



4.3 Islamic Finance and Financial Instability Hypothesis (Simulations of Stabilizing Role of Zakat)

4.3.1 Maysir, Gharar, and Riba

Earlier in this study we have been discuss how the definitions of risks developed, which in essence describe the confusion that transform into excessive uncertainty. Frank Knight (1921) distinguished risk (measurable, calculable) from uncertainty (immeasurable, unknowable), then D'Alvia (2020) extends this distinction by arguing that the formalization of risk in financial systems through probabilistic models (GARCH included) masks its ontological instability. Marx describe capitalistic market as "imbalance and maladjustment" and Hayek describe the excessive risks as "intrinsic dilemma" (Guzmán, 2025). These perspectives conceptually aligned with Minsky as he described growth need to be align with egalitarian society, which described the moral and ethics on how economy structure and capital is produced is needed to prevent the growth of economics due to relative need which undermine productivity and might end up by producing systemic fragility (Minsky, 1975, pp. 152-166). Furthermore in regards to D'Alvia critics of masked instability, Minsky furthermore described, there is an essential different between each instability that happened due to an altered financial landscape (Minsky and Vaughan, 1990, p. 28), however one thing is sure that business cycle has not been banished by policy (Minsky, 1975, p. 60). Therefore, the discrepancy happened lead by the "motives" over investment-debt-distributions over economic grows are persists. Author saw, Ninomiya and Tokuda's model potential in describing Islamic Finance positions over the descriptions of "uncertainty", where, confidence see as dispersion not as level, therefore, the focus is more to the deviations and its impact to macro-financial conditions.

In this study we observed the sensitivity of instability of confidence to the level of income *Dy*, investment *i,* debt *Db,* and interest rate *r*, offer a critical relevance when interpreted through the Islamic Finance framework especially regarding the concept of strict prohibition in *financial muamalah* which are (i) prohibition of *maysir* (speculation), (ii) prohibition of *gharar* (excessive uncertainty), and prohibition of *riba* (excessive interest). Given this study considering IS-LM-BB extension to describe the relations gap between findings on debt model and investment model[28].

[28] See page 80 - 83

Author argues, the persistent of *no savings culture* but on the other hand high level of investment participations of Indonesia citizen need to be taken into concern, as it might indicate a structural fragility due to structural divergence in real and finance sector. It is supported by the findings of interest rate behaviour which persistently self-influence, with minimum interventions of another variable. In addition, by putting IS-LM-BB theory into perspective, the recent issues of rising non-performing loan, restructure, and decreasing labour participations due to restricted labour market might form as an aftermath of laxation-policy took place in 2020-2021. The financial laxation were aimed for address medium-high income by providing higher access to credit while the lower-lower medium income supported mainly through social-aid (Aziz and Maulida, 2024).

In parallel to the financial aid, the policy also leads to an increasing supply of Innovative Finance in Indonesia as a response to increasing demand for cash due to contracted conditions during the period. As previously mentioned, financial aid comes through two channels, social assistance and financial laxation (ibid.). However, many argue that the cost of finance of Innovative Finance (*IF)* was too high (around 19% per year) to be a burden to the end consumer (Pramesti, 2019).

The phenomenon observed between 2019 – 2025 illustrates a paradoxical pattern of innovations and regulations catch-up. By means, although the financial laxation was intentionally made to support the economy, in certain circumstances, innovations might outpace regulations. Therefore, regulators need to consider more effective control over financial institutions' practices holistically (Aziz and Maulida, 2024; Pramesti, 2019; Siregar, Masyita, et al., 2024). Additionally, the phenomenon also highlights the importance of Islamic Economics and Finance principles, particularly the prohibitions of *maysir, gharar, and riba*, which can lead to disparities and hinder the achievement of socio-economic justice (Chapra, 2009). Author acknowledged the apparent contradiction of the utilization of linear stochastic dynamic model to described the deviations, while simultaneously put D'Alvia ontological risk critics as the ground study as well. However, author see, when the instability of confidence treated as dispersion (Ninomiya and Tokuda, 2011, 2012, 2017, 2021), it makes it framed not as a fixed measure, but inherent variability instead. Thus, bounded rationality is acknowledged, as variance in essence could be possibly to be undefined.

4.3.2 Compulsory Redistribution Simulation

In the previous section, the author also discussed the empirical analysis of the existence of financial instability within the Indonesian economic system, which appears to periodically (Aziz and Maulida, 2024) re-occur every four-year time window (as described in figures 3 and 4). Hyman Minsky, in his way to study the re-occurrence of instability within the capitalistic economic system, defines the panacea of the instability in the form of a safety belt, while Ninomiya in his journey to study the same subject which is instability, took the Nicholas Kaldor's ideas that the panacea should be in the form of more substantial subject. Similarly to Kaldor, Ninomiya also found that subjectivity which drives the *behaviour* in investment not merely driven by it but also shaped it.

Another economic thought merged the Islamic principles into the system, it provide a comprehensive system where safety belt as suggest by Minsky and also substantial subject by Kaldor were merged in harmony, which create a natural force of stabilizing agent (Suharto, 2017). Scholars described the stabilizing agent created through a comprehensive system, which is a combination of ribawi and usury-free, and redistributions of wealth tools.

This idea align with one of the characteristic which become the determinants for who belong to pro-cyclical and counter-cyclical country. The characteristics that mentions is the growth in real economic sector of a country which would lead to mature financialization conditions, where finance contributes more to productive sector like rural development, poverty alleviation, and welfare project. In addition, Ninomiya in his follow-up paper on 2023, conduct a study by incorporates a profit sharing into his financial instability study by using Kaleckian framework by considering also the level of debt-burden and investment. Ninomiya (2023) mentions several studies that gives contrast argument about profit sharing policy, quoted from his study, he mentioned that Taylor and O'Çonnell (1985) find that profit sharing able to stabilize the economy with the characteristics the economy must in the stable financial structure. Conversely, Ninomiya on 2023 empirical study in the case of Japan Economy suggest the Japan's profit-sharing mechanism, might be seen stabilize the economy in macro perspective, but the instability still persist through the proxy of instability of confidence (diffusion index of financial position and rate on return) (Ninomiya, 2023, pp. 288-289). The contrast argument led author to examined how this setting applied in Indonesia case.

This very relevant to Indonesia case, where its GDP contributed massively from the consumptions sides, which lead to unmature financialization where financialization absorbed more in the consumer sector rather than productive sector like investment. These what makes many Economist criticizing the way economic system has forced nations to become indebted in order to seen as liberated from economic power suppressors, which paradoxically strains their economic power (Merrifield and Sayer, 1996; Schmelzer, 2022; Shefner and Blad, 2025). Quoted from The Economist (2003), William Gibson gives a remarkable statement in describing our current economic conditions, he said that,

"The future is already here – it's just not evenly distributed"

It becomes the basic idea on why many critics have emerged regarding the GDP-centric economic paradigms as the major explanatory of economics conditions. The critiques touch the deeper implications on how GDP proxy by growth processed into the paradigm, cultural, and social aspects (Schmelzer, 2022). It is materialized to the idea of creating a sustainable economic system due to ecological, social-economic, and power domination concerns.

Thus, essentially aligned with redistributing the world's wealth. These objectives run deep in the core of Islamic Finance through a holistic mechanism that includes the elimination of riba, maysir, and gharar, as well as the centrality of the wealth distribution mechanism named zakat, which many scholars emphasize as a stabilizing agent (Suharto, 2017).

Therefore, this section examines the idea of zakat as a stabilizing agent of Islamic finance to counteract economic instability. It explores the potential stabilizing effect of zakat as a countercyclical redistribution mechanism to reduce financial volatility. Due to the limited availability of quarterly national zakat data in Indonesia, which is accessible in the public database for the period studied, the author analyzes the relationship between zakat and volatility amid observed instability through a simulation. The term 'simulation' is used because the zakat data are derived from a simulated process where we assume a certain level or rate of zakat over time GDP.

Generally, the compulsory zakat level is at 2.5% of wealth, however by definitions of wealth, however, considering the structure of GDP, the level or rate of zakat could be vary depends on the assumptions and approach in calculations. Therefore, for methodological soundness, in choosing appropriate rate to be use in the simulation, author observed the literature which study about the potential zakat level in Indonesia.

Two literatures being observed as the ground assumptions in generating simulated zakat data, one research done by Muhammad Firdaus et al. (2012) suggest a level of 3.40% of Total Potential Zakat over GDP and Asfarina et al. (2019) which suggest the level of 1.75% of Total Potential Zakat over GDP. In the simulation process, the author initially generates the simulation zakat data based on the general principle of nisab, which is 2.5% of wealth or income. However, for comparison and methodological justifications, the author also generates the simulation zakat data with 3.40% (Firdaus et.al, 2012) and 1.75% rate (Asfarina et.al, 2019). The simulation data was generated by assuming a proportional relationship between national income (Y) and zakat potential (Z), which could be formally expressed as follow:

$$Z_t = \theta \cdot Y_t$$

Where:

Z_t = Potential Zakat amount at time t

θ = Zakat rate (1.74% or 2.5% or 3.40%)

Y_t = Real GDP (the same data used in VAR model)

The author tested the three rates to be generated as zakat simulation data, which are named according to the simulated rate imposed, e.g., zakat_1_75 for a 1.75% zakat rate. This approach mainly to test weather each rate would gives different influence to volatility of *rr* which represent the instability. In the beginning author compare the statistical summary of each simulated data, from the preliminary comparison, the data statistic summary describes different statistical descriptions, therefore author proceed by to next step by GARCH model estimation. The GARCH model was estimated for each simulated rate of zakat data. In the model estimation process, the author found the same GARCH term applied for all the simulated rates, which is GARCH(1,2) with ARMA(1,2) terms.

To gain more justifications for the pattern produced by the rate, the author executes the volatility forecasting through the variance of the simulated rate of Zakat data. (1.75%, 2.5%, and 3.4%) produced nearly identical conditional volatility paths, the 1.75% zakat simulation is presented as the representative result (see table 4.22). Therefore, to avoid redundancy, this study will utilize only one simulated rate of zakat data to be interpreted further (the 1.75% rate).

Table 4. 22. Simulated Zakat Data Statistical Summary Comparison

Variable	Obs	Mean	Std. dev.	Min	Max
volatility~1	88	.0021459	.0015998	.0000829	.0100622
volatili~175	88	.0018854	.0014601	.0007641	.008792
volatili~250	88	.0018856	.0014602	.0007642	.0087882
volatili~340	88	.0018856	.0014605	.0007642	.0087905

4.3.3 Volatility Model Response to Zakat

To test our hypothesis on zakat as the counter-mechanism of capitalistic volatility, we generate the stacked graph as describe on figure 4.11 to compare two volatility trends with and without zakat. The forecasted volatility of rr – only GARCH model that have been generated in the earlier section, use as the base volatility trend visualized with blue line, stacked with the rr – zakat simulation GARCH model visualized with red line. Based on visual observations we could see the blue line generally more volatile compare to the red line. It implies that the zakat-simulation does has dampening effect to base volatility model. To verify this finding, the author checks the variance statistical properties through variance ratio test.

Figure 4. 11. Comparative Forecasted Volatility (Zakat Rates 1.75%)

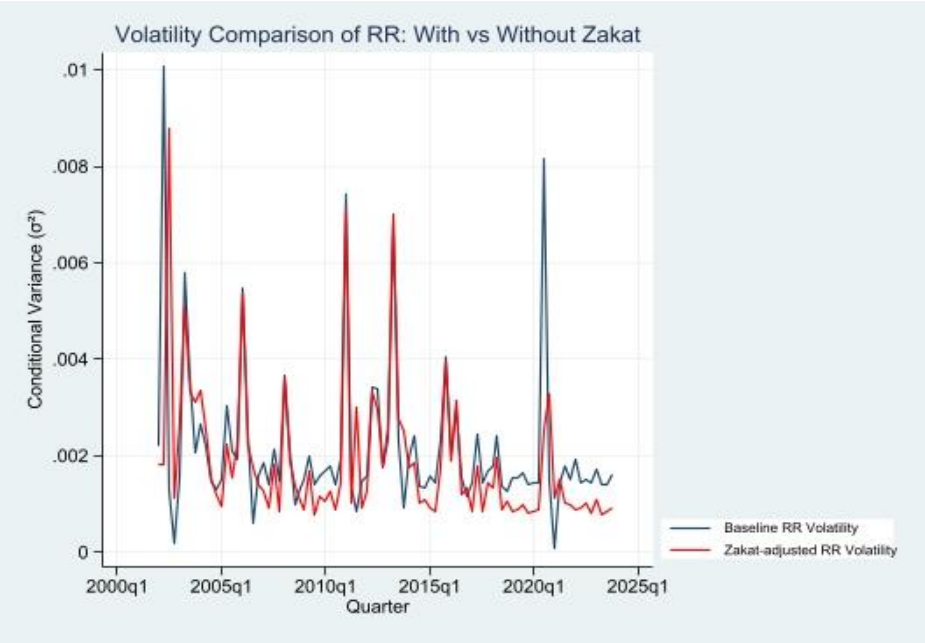


Table 4. 23. Variance Ratio Test

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Variance ratio test
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Variable	Obs	Mean	Std. err.	Std. dev.	[95% conf.	interval]
volati~1	88	.0021459	.0001705	.0015998	.0018069	.0024849
vola~175	88	.0018854	.0001556	.0014601	.001576	.0021948
Combined	176	.0020156	.0001155	.0015327	.0017876	.0022437

```
    ratio = sd(volatility_for~1) / sd(volatility_f~175)          f =   1.2004
H0: ratio = 1                                     Degrees of freedom =   87, 87

    Ha: ratio < 1               Ha: ratio != 1                 Ha: ratio > 1
  Pr(F < f) = 0.8021         2*Pr(F > f) = 0.3959           Pr(F > f) = 0.1979
```

The variance ratio test, as described in Table 4.23, confirmed the existence of a reduction in standard deviation of conditional volatility from 0.0015998 (base) to 0.0014601 (with zakat). However, author found there are two aspects need to be approach with cautious; (1) the p-value of alternate hypothesis Ha: ratio > 1 does not reach conventional levels of statistical significance of 0.05 (p-value = 0.1979), (2) the p-value of alternate hypothesis Ha: ratio > 1 from different percentage of zakat shows the smaller the level of zakat will lead to the higher the significancy level of zakat as volatility dampening tools. This finding aligned with scholars descriptions that zakat is both a political and religious tools, therefore the feature of zakat which is distributions more significant than its collection mechanism (Suharto, 2005, p. 183)

CHAPTER V
SUMMARY

5.1 Summary and Conclusion

This study aimed to empirically evaluate the fragility of Indonesia's financial structure within the hypothesis of Minsky's Financial Instability Hypothesis (FIH) through Ninomiya's empirical framework. In essence, the objective of this study was to explore the visibility of measuring instability by proxying business confidence through its degree of dispersion, and to conduct a system diagnostic by measuring fragility in a broader economic context. This was done to attribute policy responses to capture Minskyan fragility characteristics and review zakat as a stabilizing moral buffer.

5.1.1 Minsky's Hypothesis and Ninomiya

From the findings, we found that the proposed model by Ninomiya and Tokuda (2012; 2017; 2021) is capable of capturing the instability episodes observed from its evolution over time, which synchronized with recorded financial contractions (crises) that happened in Indonesia, which were captured by GARCH analysis. The mean equation of RR-FP suggested perceived internal confidence of (Diffusion Index on Financial Position, FP) has significant contribution to the state of economic expectations related to borrowing cost (Diffusion Index on Interest Rate on Loans, RR) (H1A accepted)* and it has a possibility where short term pattern to be keep recurring in a longer period of time (describe by significant GARCH term in RR-FP model) (H1B accepted)*. In reference to Keynes's descriptions of the business cycle's boom and bust phase, the author extends the forecasted conditional variance graph (RR only model) with a rolling (moving) average with a window size of 4 quarters (1 year).

The rolling average reveals the presence of volatility clusters that are divided into 3 areas, namely: (i) 2002 – 2009, characterised by a persistent volatility pattern with $\leq \mathbf{0.005}$ point of dispersion and a recurrent pattern approximately every $\pm \mathbf{6}$, (ii) 2009 – 2014 characterised by pre (2009) - post (2014) stable conditions with intense heated conditions (n) with $\mathbf{0.011} \geq \boldsymbol{n} \geq \mathbf{0.005}$ point of dispersion in the middle (2010 – 2013), (iii) 2015 – 2023 considerably stable volatility with no heavy spikes except 2020 Q1 when Covid-19 first hit Indonesia (H1B accepted)*. In addition, regarding the findings and Ninomiya and Tokuda's descriptions of each model's assumptions and propositions, this study captures that there are two types of chains: (i) a distinct chain, and (ii) an indirect chain.

Distinct chain appears to be; first $y \uparrow \Rightarrow \sigma^2 \downarrow \Rightarrow y \uparrow \Rightarrow b \uparrow$, and second the closed tied between $\boldsymbol{r} \uparrow \leftrightarrow \boldsymbol{i} \downarrow$. The indirect chain appears to be the gap between the first chain and the second chain; the author sees this might indicate a partial independent dynamic that might influence the distinct chains. Thus, the disconnections between two distinct might be bridged through $\mu \uparrow$, $L \downarrow$ relation. As theoretically, debt (b) and interest (r) were a component that affects and affect money multiplier (μ) and lender risks (L). In addition, as per se instability of confidence (σ^2) has only one significant relation to income, the interpretation through μ and L unstable paths is preferable. Therefore, at this point, as the indirect-relation considered, H1C*, which describes debt influence instability, might be partially accepted, and H1D*, which describes investment influence instability, might also be partially accepted[29]. Nevertheless, the author acknowledges the limitations of the model coverage and data to proxy the indicator; therefore, further studies are needed to address the relationship gap issues and obtain a clearer relationship between macro-financial indicators.

5.1.2 Ethical Imperatives of Islamic Finance

Previously, we have seen how the financial laxation aftermath led to several socio-economic issues. Even though financial laxation took place aiming to correct the economic conditions that had been contracted, from the case study (1982, 1998–1999, 2020–2021), each policy laxation seems to be followed by less supervision of credit growth (H2A accepted)*. The empirical findings also suggest that, even under stable economic growth and controlled inflation, the fragility persists within the system, highlighting the importance of behavioural control. Furthermore, Islamic Finance and Moral Economy critiques *speculative* motives in economic activity, where economic activities are detached from their fundamental aspects; social purpose, and morality by the shifting paradigm in reimaging risks and uncertainty (Asutay and Yilmaz, 2024; D'Alvia, 2020; Suharto, 2017). Thus, the empirical evidence that has been observed in this study confirms and deepens the rationale behind the prohibitions and encouragement of Islamic Economic and Finance Principles which anchor into the objectives of ihsan (beneficence), adl (justice), and rububiyah (belief in the Oneness of God, essentially implying human bounded rationality and responsibility) (Asutay and Yilmaz, 2024).

[29] See page 83 for more elaborations of the decisions.

5.1.3 Islamic Finance (Zakat) as Stabilizing Alternatives

Finally, the paper introduces Islamic economic perspectives as a conceptual corrective to interest-rate-based, debt-founded capitalist fragility. The rule of profit-and-loss sharing (PLS), enforced risk-sharing, and the zakat mechanism are proposed as structural fixes to the speculative mechanism and wealth concentrations (unequal wealth distributions). Unlike classical systems that are highly vulnerable due to their nature that rely on the boom and busts in the economy, Islamic finance offers stability through real-asset provisioning and moral risk constraint. The paper argues that Islamic finance instrument, particularly in redistributing surpluses through Zakat, has the possibility to dampen the volatility in the market as the discrepancy happened between perceived confidence and expectations (H3A accepted)* measure through simulations by imposing Zakat on the base volatility pattern of our instability of confidence model (see figure 4.11). However, based on our findings, the magnitude of zakat imposed on society needs to be approached with caution. In this study author tests three rates of zakat over GDP[30] the simulation result suggests the 1.75% (Asfarina et al., 2019) works better to stabilize the system rather than the 2.5% and 3.4% (Muhammad Firdaus et al., 2012) (H3B accepted)*. Further interpretations on the contextual and technical meaning behind the proposed rate are needed to enhance the elaboration of the findings.

5.2 Policy Recommendations

Previously, we discussed how fragility is transmitted into the system and its impact on other macro-financial data. Both debt and investment have a high correlation with instability of confidence; however, instability of confidence has a greater influence on investment. From these findings, we can assume that herding and speculative behaviour may dominate investment activity in Indonesia, at both the institutional and individual levels. From a narrower micro perspective, this assumption is consistent with recent studies highlighting the low savings rate among Indonesian citizens (Andriansyah, 2016). This implies that citizens, being closer to speculative activity due to the absence of a safety buffer, could further explain how fragility develops.

[30] Three rate of Zakat are observed in this study due to the considerations (i) avoid over generalization by using the zakat's nisbah 2.5% and (ii) to ensure methodological robustness by incorporating alternative rates, author attribute two studies which demonstrate 1.75% and 3.4% optimum zakat rate over Indonesia's GDP based on specific characteristic that differ from both studies.

Therefore, specific regulations are needed to reduce herding investment tendencies and promote healthy, rather than speculative, investment. However, the persistence of a "low savings culture" also requires further exploration—why does this culture persist? Is it driven by speculative motives or by needs? Furthermore, as instability of confidence is a proxy derived from business sentiment, does this suggest that businesses tend to be more speculative in their overall management? This question requires a further approach by the Indonesian government to address the underlying fragility that persists over time. Additionally, the simulated compulsory zakat GARCH model suggests its effectiveness in reducing confidence instability. However, examining how the zakat simulation data was generated indicates that the structure is more critical than the magnitude or level of zakat. Furthermore, these findings suggest that the structural formation of social aid programs may need to be approached differently to develop more effective poverty alleviation mechanisms.

5.3 Study Limitation and Future Research

Initially, this study aimed to answer Ninomiya and Tokuda's (2021) suggestion on the broader investigation by combine debt and investment into one model, however, due to model fitness considerations, the author was unable to address this suggestion. Furthermore, this study also only attributes one type of debt, which is outstanding external (public + private) debt, this limits the exploration of structural fragility in the debt that occurs from overconfidence of lenders in the local market dynamics. Therefore, the utilization of another debt data might give more nuance on the dynamics, as suggested by a scholar who described 2008 GFI as Minsky's moment. In addition, as the comprehensive nature of Islamic Finance concerns, the comparative study needs to be broadened by incorporating another Islamic Finance instrument, such as how the prohibition of *riba* empirically could reduce the speculative behaviour tendencies. Therefore, the description of how Islamic Finance could dampen the volatility in the capitalist economy could be described in a more comprehensive discussion. Furthermore, as the zakat data were mainly derived from a simulation process, by assuming it is tied to the level of GDP, further study could consider utilizing actual zakat data to see the actual effectiveness in combating the speculative tendencies of economic agents. In addition, the author acknowledged, possibilities of incomplete representations, as author focus on the model-based dispersion.

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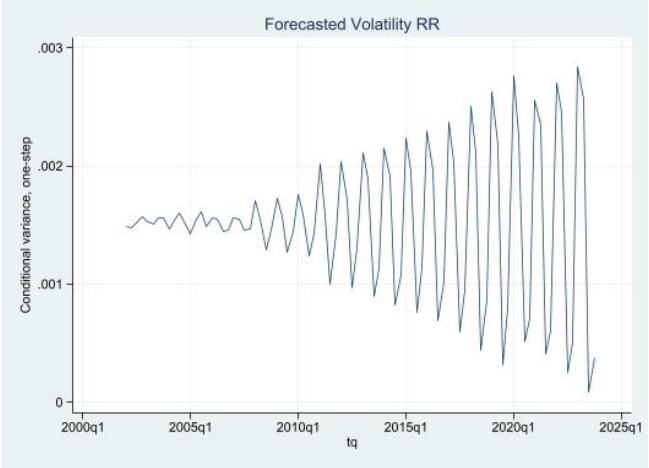
APPENDICES

Appendix 1. RR FP GARCH Model Estimations.

```
. arch rr fp, arch(1) garch(1) ar(1)

(setting optimization to BHHH)
Iteration 0:   log likelihood =  156.28938
Iteration 1:   log likelihood =  161.14035
Iteration 2:   log likelihood =  163.01585
Iteration 3:   log likelihood =  164.90625
Iteration 4:   log likelihood =  166.84668
(switching optimization to BFGS)
Iteration 5:   log likelihood =  167.41419
Iteration 6:   log likelihood =  167.52959  (backed up)
Iteration 7:   log likelihood =  167.58692
BFGS stepping has contracted, resetting BFGS Hessian (0)
Iteration 8:   log likelihood =  167.72122
Iteration 9:   log likelihood =  167.74602  (backed up)
Iteration 10:  log likelihood =  167.75253  (backed up)
Iteration 11:  log likelihood =  167.77065  (backed up)
Iteration 12:  log likelihood =  167.78578  (backed up)
Iteration 13:  log likelihood =   167.8058  (backed up)
Iteration 14:  log likelihood =  167.80699
(switching optimization to BHHH)
Iteration 15:  log likelihood =  167.83801
Iteration 16:  log likelihood =  167.84932
Iteration 17:  log likelihood =  167.85505
Iteration 18:  log likelihood =  167.85549
Iteration 19:  log likelihood =  167.85549
(switching optimization to BFGS)
Iteration 20:  log likelihood =  167.85557
BFGS stepping has contracted, resetting BFGS Hessian (1)
Iteration 21:  log likelihood =  167.85559
Iteration 22:  log likelihood =  167.85559  (backed up)
Iteration 23:  log likelihood =   167.8556  (backed up)
Iteration 24:  log likelihood =  167.85561  (backed up)
Iteration 25:  log likelihood =  167.85565  (backed up)
Iteration 26:  log likelihood =  167.85566  (backed up)
Iteration 27:  log likelihood =  167.85566  (backed up)
BFGS stepping has contracted, resetting BFGS Hessian (2)
Iteration 28:  log likelihood =  167.85566
Iteration 29:  log likelihood =  167.85566  (backed up)
(switching optimization to BHHH)
Iteration 30:  log likelihood =  167.85566  (backed up)
Iteration 31:  log likelihood =  167.85566
Iteration 32:  log likelihood =  167.85566

ARCH family regression -- AR disturbances

Sample: 2002q1 thru 2023q4                      Number of obs     =         88
                                                Wald chi2(2)      =     144.88
Log likelihood = 167.8557                       Prob > chi2       =     0.0000

------------------------------------------------------------------------------
             |                 OPG
          rr | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
rr           |
          fp |   .2679431   .0516706     5.19   0.000     .1666707    .3692155
       _cons |  -.0562139   .0151725    -3.70   0.000    -.0859513   -.0264764
-------------+----------------------------------------------------------------
ARMA         |
          ar |
          L1.|   .7946622   .0680483    11.68   0.000       .66129    .9280344
-------------+----------------------------------------------------------------
ARCH         |
        arch |
          L1.|   .0040606   .0240182     0.17   0.866    -.0430143    .0511355
             |
       garch |
          L1.|   1.014533   .0616946    16.44   0.000     .8936138    1.135452
             |
       _cons |  -.0000384   .0000343    -1.12   0.263    -.0001056    .0000288
------------------------------------------------------------------------------
```

Appendix 3. Uninterpreted-able



Appendix 2. RR FP GARCH Multicollinearity, Autocorrelation, Heteroskedasticity

```
. regress rr fp
```

Source	SS	df	MS	Number of obs	=	88
				F(1, 86)	=	26.64
Model	.093686912	1	.093686912	Prob > F	=	0.0000
Residual	.302421043	86	.003516524	R-squared	=	0.2365
				Adj R-squared	=	0.2276
Total	.396107955	87	.004552965	Root MSE	=	.0593

rr	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
fp	.3156048	.061145	5.16	0.000	.1940525	.437157
_cons	-.0863226	.0167925	-5.14	0.000	-.119705	-.0529402

```
. vif
```

Variable	VIF	1/VIF
fp	1.00	1.000000
Mean VIF	1.00	

```
. predict residuals_auto_check, residuals

. wntestq residuals_auto_check, lags(12)

Portmanteau test for white noise
---------------------------------------
 Portmanteau (Q) statistic =    21.6199
 Prob > chi2(12)           =     0.0420


. wntestq sq_resid_hetero_check , lags(12)

Portmanteau test for white noise
---------------------------------------
 Portmanteau (Q) statistic =     8.3525
 Prob > chi2(12)           =     0.7570
```

Appendix 4. Spike-Smoothing Details

```
. gen spike90 = sigma2_Volatility_Fin > r(p90)

. gen sigma2_avg4 = (L2.sigma2_Volatility_Fin + L1.sigma2_Volatility_Fin + F1.sigma2_Volatility_Fin + F2.sig
> ma2_Volatility_Fin )/4
(4 missing values generated)

. gen spike4x = sigma2_Volatility_Fin > 2 * sigma2_avg4

. gen spike_flag = spike90 | spike4x

. list quarter tq sigma2_Volatility_Fin if spike_flag == 1, clean

      quarter       tq   sigm~Fin
  6.        2   2003q2   .0057857
 17.        1   2006q1    .005466
 25.        1   2008q1   .0036576
 37.        1   2011q1    .007419
 46.        2   2013q2   .0067992
 75.        3   2020q3   .0081734
```

Criteria:

(1) exceeds the 90th percentile of the entire volatility distribution

(2) surpassed twice the average of surrounding volatility values (±2 quarters).

Appendix 5. RR GARCH Model

```
. arch rr, arch(1) garch(2) ar(1) ma(2)

(setting optimization to BHHH)
Iteration 0:   log likelihood =  136.98249
Iteration 1:   log likelihood =  148.12991
Iteration 2:   log likelihood =  150.48939
Iteration 3:   log likelihood =  152.11935
Iteration 4:   log likelihood =  152.61067
(switching optimization to BFGS)
Iteration 5:   log likelihood =  153.04025
Iteration 6:   log likelihood =  153.65255
Iteration 7:   log likelihood =  153.73492  (backed up)
Iteration 8:   log likelihood =  154.15647
Iteration 9:   log likelihood =  154.19267
Iteration 10:  log likelihood =  154.26159
Iteration 11:  log likelihood =  154.28406
Iteration 12:  log likelihood =  154.28924
Iteration 13:  log likelihood =  154.29017
Iteration 14:  log likelihood =  154.29078
(switching optimization to BHHH)
Iteration 15:  log likelihood =  154.29087
Iteration 16:  log likelihood =  154.29088  (backed up)
Iteration 17:  log likelihood =  154.29088
Iteration 18:  log likelihood =  154.29088
Iteration 19:  log likelihood =  154.29088  (backed up)
(switching optimization to BFGS)
Iteration 20:  log likelihood =  154.29088
Iteration 21:  log likelihood =  154.29091
Iteration 22:  log likelihood =  154.29091
Iteration 23:  log likelihood =  154.29092
Iteration 24:  log likelihood =  154.29092

ARCH family regression -- ARMA disturbances

Sample: 2002q1 thru 2023q4                      Number of obs     =         88
                                                Wald chi2(2)      =     101.29
Log likelihood = 154.2909                       Prob > chi2       =     0.0000
```

rr	Coefficient	OPG std. err.	z	P>|z|	[95% conf.	interval]
rr						
_cons	-.0134204	.014047	-0.96	0.339	-.040952	.0141113
ARMA						
ar						
L1.	.7916258	.0815175	9.71	0.000	.6318544	.9513972
ma						
L2.	.1252472	.0952588	1.31	0.189	-.0614566	.311951
ARCH						
arch						
L1.	.467537	.241944	1.93	0.053	-.0066646	.9417385
garch						
L2.	-.2006551	.1555122	-1.29	0.197	-.5054535	.1041433
_cons	.0017096	.000477	3.58	0.000	.0007748	.0026444

Appendix 6. Stationarity Test RR FP

```
. dfuller fp

Dickey-Fuller test for unit root           Number of obs  = 87
Variable: fp                               Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test          ———————— critical value ————————
              statistic              1%           5%          10%
—————————————————————————————————————————————————————————————————
 Z(t)            -2.976          -3.528       -2.900       -2.585
—————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0372.

. dfuller rr

Dickey-Fuller test for unit root           Number of obs  = 87
Variable: rr                               Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test          ———————— critical value ————————
              statistic              1%           5%          10%
—————————————————————————————————————————————————————————————————
 Z(t)            -3.509          -3.528       -2.900       -2.585
—————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0078.

.
```

```
. dfuller rr, trend

Dickey-Fuller test for unit root           Number of obs  = 87
Variable: rr                               Number of lags =  0

H0: Random walk with or without drift

                                       Dickey-Fuller
                   Test          ———————— critical value ————————
              statistic              1%           5%          10%
—————————————————————————————————————————————————————————————————
 Z(t)            -4.415          -4.069       -3.463       -3.158
—————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0021.

. dfuller fp trend
variable trend not found
r(111);

. dfuller fp, trend

Dickey-Fuller test for unit root           Number of obs  = 87
Variable: fp                               Number of lags =  0

H0: Random walk with or without drift

                                       Dickey-Fuller
                   Test          ———————— critical value ————————
              statistic              1%           5%          10%
—————————————————————————————————————————————————————————————————
 Z(t)            -3.033          -4.069       -3.463       -3.158
—————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.1231.

.
```

Appendix 7. Unified VAR Model Autocorrelation

```
. varlmar
```

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	122.3183	25	0.00000
2	46.5340	25	0.00556

H0: no autocorrelation at lag order

Appendix 8. Debt VAR Model and Investment VAR Autocorrelation

```
. varlmar
```

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	12.8634	16	0.68272
2	22.2386	16	0.13565

H0: no autocorrelation at lag order

```
. //Debt-Model
```

```
. varlmar
```

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	20.3859	16	0.20334
2	19.3694	16	0.24997

H0: no autocorrelation at lag order

```
. //Investment Model
```

Appendix 9. VAR Model Stationarity Test

```
. pperron r

Phillips–Perron test for unit root        Number of obs   = 87
Variable: r                               Newey–West lags =  3

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(rho)         -14.595      -19.566      -13.596      -10.922
 Z(t)            -3.883       -3.528       -2.900       -2.585
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0022.

. pperron i

Phillips–Perron test for unit root        Number of obs   = 87
Variable: i                               Newey–West lags =  3

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(rho)         -29.083      -19.566      -13.596      -10.922
 Z(t)            -4.496       -3.528       -2.900       -2.585
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0002.

. pperron sigma2

Phillips–Perron test for unit root        Number of obs   = 87
Variable: sigma2                          Newey–West lags =  3

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(rho)         -74.021      -19.566      -13.596      -10.922
 Z(t)            -9.080       -3.528       -2.900       -2.585
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0000.

. pperron b

Phillips–Perron test for unit root        Number of obs   = 87
Variable: b                               Newey–West lags =  3

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(rho)          -0.227      -19.566      -13.596      -10.922
 Z(t)            -0.374       -3.528       -2.900       -2.585
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.9144.

. pperron D_b

Phillips–Perron test for unit root        Number of obs   = 86
Variable: D_b                             Newey–West lags =  3

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(rho)         -70.273      -19.548      -13.588      -10.916
 Z(t)            -7.447       -3.530       -2.901       -2.586
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0000.

. pperron y

Phillips–Perron test for unit root        Number of obs   = 87
Variable: y                               Newey–West lags =  3

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(rho)          -0.426      -19.566      -13.596      -10.922
 Z(t)            -1.584       -3.528       -2.900       -2.585
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.4917.

. pperron D_y

Phillips–Perron test for unit root        Number of obs   = 86
Variable: D_y                             Newey–West lags =  3

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(rho)         -79.202      -19.548      -13.588      -10.916
 Z(t)            -9.082       -3.530       -2.901       -2.586
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0000.

.
```

```
. dfuller r

Dickey–Fuller test for unit root          Number of obs  = 87
Variable: r                               Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(t)            -3.995       -3.528       -2.900       -2.585
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0014.

. dfuller i

Dickey–Fuller test for unit root          Number of obs  = 87
Variable: i                               Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(t)            -4.844       -3.528       -2.900       -2.585
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0000.

. dfuller sigma2

Dickey–Fuller test for unit root          Number of obs  = 87
Variable: sigma2                          Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(t)            -9.026       -3.528       -2.900       -2.585
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0000.

. dfuller b

Dickey–Fuller test for unit root          Number of obs  = 87
Variable: b                               Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(t)            -0.335       -3.528       -2.900       -2.585
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.9203.

. dfuller D_b

Dickey–Fuller test for unit root          Number of obs  = 86
Variable: D_b                             Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(t)            -7.403       -3.530       -2.901       -2.586
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0000.

. dfuller y

Dickey–Fuller test for unit root          Number of obs  = 87
Variable: y                               Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(t)            -1.453       -3.528       -2.900       -2.585
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.5564.

. dfuller D_y

Dickey–Fuller test for unit root          Number of obs  = 86
Variable: D_y                             Number of lags =  0

H0: Random walk without drift, d = 0

                                       Dickey–Fuller
                   Test         ———————— critical value ————————
              statistic           1%           5%          10%
————————————————————————————————————————————————————————————————
 Z(t)            -9.072       -3.530       -2.901       -2.586
————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0000.
```

Appendix 10. VAR Model Heteroskedasticity

```
. regress e_Dy2 L.e_Dy2
```

Source	SS	df	MS	Number of obs	=	85
				F(1, 83)	=	0.65
Model	3.5554e-07	1	3.5554e-07	Prob > F	=	0.4226
Residual	.000045439	83	5.4746e-07	R-squared	=	0.0078
				Adj R-squared	=	-0.0042
Total	.000045795	84	5.4518e-07	Root MSE	=	.00074

e_Dy2	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
e_Dy2						
L1.	.0881167	.1093426	0.81	0.423	-.1293612	.3055947
_cons	.0000935	.000081	1.15	0.252	-.0000677	.0002547

```
.
. estat bgodfrey, lags(1)

Breusch-Godfrey LM test for autocorrelation
```

lags(*p*)	chi2	df	Prob > chi2
1	0.016	1	0.9007

H0: no serial correlation

```
. regress e_o2_2 L.e_o2_2
```

Source	SS	df	MS	Number of obs	=	85
				F(1, 83)	=	0.30
Model	6.2856e-12	1	6.2856e-12	Prob > F	=	0.5846
Residual	1.7322e-09	83	2.0870e-11	R-squared	=	0.0036
				Adj R-squared	=	-0.0084
Total	1.7385e-09	84	2.0696e-11	Root MSE	=	4.6e-06

e_o2_2	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
e_o2_2						
L1.	-.0601575	.1096156	-0.55	0.585	-.2781784	.1578634
_cons	1.55e-06	5.22e-07	2.98	0.004	5.16e-07	2.59e-06

```
.
. estat bgodfrey, lags(1)

Breusch-Godfrey LM test for autocorrelation
```

lags(*p*)	chi2	df	Prob > chi2
1	0.056	1	0.8122

H0: no serial correlation

```
. regress e_r2 L.e_r2
```

Source	SS	df	MS	Number of obs	=	85
				F(1, 83)	=	3.49
Model	8.4047e-08	1	8.4047e-08	Prob > F	=	0.0653
Residual	1.9989e-06	83	2.4083e-08	R-squared	=	0.0403
				Adj R-squared	=	0.0288
Total	2.0830e-06	84	2.4797e-08	Root MSE	=	.00016

e_r2	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
e_r2						
L1.	.2010945	.1076456	1.87	0.065	-.0130083	.4151973
_cons	.0000544	.0000184	2.95	0.004	.0000178	.000091

```
.
. estat bgodfrey, lags(1)

Breusch-Godfrey LM test for autocorrelation
```

lags(*p*)	chi2	df	Prob > chi2
1	0.000	1	0.9854

H0: no serial correlation

```
. regress e_i2 L.e_i2
```

Source	SS	df	MS	Number of obs	=	85
				F(1, 83)	=	8.12
Model	33.595666	1	33.595666	Prob > F	=	0.0055
Residual	343.420008	83	4.13759045	R-squared	=	0.0891
				Adj R-squared	=	0.0781
Total	377.015674	84	4.48828183	Root MSE	=	2.0341

e_i2	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
e_i2						
L1.	.2984782	.1047478	2.85	0.006	.0901391	.5068173
_cons	.4803645	.2319596	2.07	0.041	.0190062	.9417228

```
.
. estat bgodfrey, lags(1)

Breusch-Godfrey LM test for autocorrelation
```

lags(*p*)	chi2	df	Prob > chi2
1	0.648	1	0.4209

H0: no serial correlation

```
.
```