

AMERICAN UNIVERSITY OF BEIRUT

MONETARY POLICY AND HOUSING AFFORDABILITY IN
EMERGING MARKETS: A CROSS-COUNTRY ANALYSIS

by
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A thesis
submitted in partial fulfillment of the requirements
for the degree of Master of Arts
to the Department of Economics
of the Faculty of Arts and Sciences
at the American University of Beirut

Beirut, Lebanon
April 2025

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ACKNOWLEDGEMENTS

I would like to extend my sincere thanks to my supervisor for her guidance and support throughout my research. I also thank my family and friends for their unwavering support and patience. Last but definitely not least, I am grateful to those institutions and data providers whose resources made this research possible.

ABSTRACT

OF THE THESIS OF

Ali Kadah El Habbal

for

Master of Arts

Major: Economics

Title: Monetary Policy and Housing Affordability in Emerging Markets: A Cross-Country Analysis

Housing affordability is becoming an increasingly crucial socio-economic issue in many developing nations through its entrenchment in macroeconomic instability, rapid urbanization, and lack of access to financial resources. This study investigates how monetary policy affects housing affordability in four key emerging economies-Brazil, Turkey, South Africa, and Indonesia. In conducting this, it uses Structural Vector Autoregression (SVAR) to analyze dynamic interactions between interest rates, inflation, real growth in GDP, exchange rates, and housing affordability using quarterly data on the period from 2000 to 2023. The study adopts recursive Cholesky decomposition for identification of structural shocks and tracing monetary transmission mechanisms. Findings will show how dissimilar institutional settings, such as mortgage market depth and urban growth rates, shape the money effectiveness. This comparative approach would provide both theoretical and policy insight highlighting the nuanced role that monetary policy plays in tackling housing affordability issues in varied economic contexts.

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ABBREVIATIONS

- **IRF** – Impulse Response Function
- **GDP** – Gross Domestic Product
- **CPI** – Consumer Price Index
- **SVAR** – Structural Vector Autoregression
- **FGTS** – Fundo de Garantia do Tempo de Serviço (Severance Indemnity Fund for Employees, Brazil)
- **SBPE** – Sistema Brasileiro de Poupança e Empréstimo (Brazilian Savings and Loan System)
- **LTV** – Loan-to-Value Ratio
- **ESG** – Environmental, Social, and Governance
- **DTI** – Debt-to-Income Ratio
- **IMF** – International Monetary Fund
- **FAVAR** – Factor-Augmented Vector Autoregression
- **DSGE** – Dynamic Stochastic General Equilibrium
- **BIS** – Bank for International Settlements

CHAPTER I

INTRODUCTION

Housing affordability is a sharp issue for the majority of emerging economies, driven by factors such as rapid urbanization, economic uncertainty, and monetary policy. Central banks play a central role in influencing the housing market through interest rate control and inflation management. The impact of monetary policy on housing affordability varies across economies, necessitating an in-depth exploration. This chapter provides the background, problem discussion, research aims, research questions, research approach, and significance of the study, which is a foundation for understanding the intricate relationship between monetary policy and housing affordability in emerging markets.

A. General Background

Affordability of housing has been rising as a problem in emerging economies, with the rate of urbanization and shifting economic conditions contributing to financial pressures on prospective homebuyers. Demand for housing continues to outpace supply in most regions, with house prices soaring and further financial pressure on low- and middle-income groups (World Bank, 2022). As economic instability affects income security and labor markets, affordability in home acquisition is doubtful for the majority of households. Brazil, South Africa, and Indonesia are examples of how diverse macroeconomic conditions influence housing markets, capturing prevailing trends that can be applied to emerging economies globally.

Urban expansion is among the major drivers of the housing affordability crisis, as it increases the demand for residential properties while squeezing available infrastructure and housing supply chains. In Indonesia, for instance, the urban population has grown at

4.1% annually, significantly increasing demand for housing and placing pressure on price stabilization efforts (World Bank, 2022). In South Africa, affordability is also challenged by an average 5.7 price-to-income ratio, which is above the commonly accepted threshold of 3 for affordable housing (Numbeo, 2023). This difference accounts for the increasingly large gap between home prices and household incomes, a common trend in emerging economies.

Monetary policy is one of the most important channels through which central banks and governments affect housing affordability. Through interest rate adjustments and inflation control, central banks can influence borrowing costs, impacting the accessibility and stability of the real estate market. The transmission of monetary policy varies across economies depending on financial infrastructure, credit availability, and institutional settings. In developing economies, mortgage penetration is lower than in developed economies, and the role of interest rate policies in housing affordability management is limited. The International Monetary Fund (2021) notes that mortgage penetration in Indonesia and Brazil is below 20% of GDP, whereas in advanced economies such as the United States, mortgage financing is 50% to 70% of GDP. This deviation accentuates the importance of structural economic differences when analyzing the effectiveness of monetary policy interventions in the housing sector.

The second is a complicated influence, one disproportionately affecting the affordability of housing in developing economies. Brazil has, however, maintained a more prudent monetary policy stance that has anchored housing prices after an 8% per annum increase during 2010-2015 (BIS, 2022). These case studies determine how different policy approaches yield different outcomes, capturing the subtlety of housing affordability in emerging economies.

Structural determinants such as financial affordability, employment security, and government regulations also shape the dynamics of housing affordability. In countries where mortgage markets are underdeveloped, cash purchase is involved in a high volume of transactions, and housing markets are less sensitive to changes in interest rates. Government policies, such as subsidies and tax incentives for housing development, also shape affordability significantly, but their effectiveness depends on economic conditions and institutional capacity. The interplay between these factors underscores the requirement for a composite approach in investigating the impact of monetary policy on housing affordability in emerging markets.

In summary, housing affordability issues in emerging economies are intricate, propelled by rapid urbanization, inflationary pressures, and monetary policy transmission channels. It is such an appreciation of these interactions that is key to formulating policy responses that are effective in addressing both short-term market instability and longer-term structural constraints. This thesis aims to contribute to this debate through an examination of the interaction between monetary policy and housing affordability in Brazil, South Africa, and Indonesia, with a view to gaining insight into potential policy solutions in a range of economic contexts.

B. Problem Discussion

Despite extensive research on monetary policy and housing markets, its specific impact on housing affordability in emerging economies remains insufficiently explored. Unlike advanced economies, where monetary policy adjustments typically lead to direct changes in mortgage rates and housing demand, the effects in emerging markets are often more complex and moderated by structural economic factors. The relationship between

interest rates, inflation, and affordability varies significantly due to differences in mortgage penetration, financial market development, and household borrowing behaviors (Tunc & Gunes, 2023).

Emerging markets frequently experience high inflation, which erodes purchasing power and complicates affordability issues. South Africa's inflationary pressures and stagnant income growth have worsened housing affordability, exacerbating social inequality and limiting homeownership opportunities (World Bank, 2022).

Another challenge is the underdeveloped mortgage financing sector in many emerging economies. In Brazil and Indonesia, mortgage penetration remains below 20% of GDP, meaning that a substantial portion of home purchases rely on cash transactions rather than borrowing (IMF, 2021). This limits the effectiveness of monetary policy tools, as interest rate adjustments have a weaker influence on housing affordability than in economies where mortgages are more widely used. Additionally, stringent lending requirements and financial instability further restrict access to affordable financing, intensifying the housing affordability crisis (BIS, 2022).

Also, urbanization and demographic change continue to impact housing demand and affordability. Indonesia and South Africa's rapid urban growth has pushed urban city property prices above wage growth, creating an increasing affordability gap (World Bank, 2022). Without targeted policy actions, the pressures are likely to persist, and low- and middle-income families might struggle to achieve homeownership.

The complexities of the relationships between monetary policy, inflation, financial access, and urbanization create the imperative of developing a deeper understanding of how determinants affect housing affordability in emerging economies. This paper attempts to do so by providing empirical insights into the effects of monetary policy in

Brazil, South Africa, and Indonesia, deepening the broader housing economics and responsiveness of policy debate.

C. Research Aims

This study will investigate the intersection of monetary policy and housing affordability in emerging economies, with an emphasis on Brazil, South Africa, and Indonesia. The study specifically seeks to:

- Analyze how key monetary policy instruments, such as interest rates and inflation targeting policies, influence housing affordability in emerging economies.
- Refer to structural factors that enable the monetary policy transmission to housing affordability.
- Develop a comparative framework for describing cross-country differences in the potency of monetary policy.

D. Research Questions

To provide a structured approach to this investigation, the following research questions have been formulated:

1. How do interest rates, inflation rates, and other monetary policy instruments impact housing affordability in emerging markets?
2. What structural factors influence the transmission of monetary policy to housing affordability in Brazil, South Africa, and Indonesia?

E. Research Approach

This study takes a comparative approach in the analysis of the monetary policy's role in Brazil, South Africa, and Indonesia towards housing affordability. A SVAR model will be used to investigate how the most significant macroeconomic variables, such as interest rates, inflation, exchange rates, and real GDP growth, relate to each other. This makes it possible to identify both the short-run and long-run monetary policy effects on the housing sector. Data from real estate reports, central banks, and international financial institutions will be collected for analysis to offer a strong empirical foundation.

F. Significance of Study

This research has far-reaching implications for policymakers, banking institutions, and housing market players. By providing the elasticity of housing affordability to monetary policy shocks, this work provides inputs that can inform central bank policy orientations to maintain stable and affordable housing markets. This work also contributes to the broader literature in monetary policy and housing economics, especially in the developing markets' context. Understanding how variables such as mortgage access and inflation will influence affordability will enable policymakers to design better regulatory frameworks that balance housing concerns without exacerbating financial instability. This study will also serve as a platform for further examination in the dynamics of monetary policy and housing affordability in developing economies.

G. Conclusion

This chapter has outlined the key concerns of housing affordability in emerging economies, with particular focus on the roles played by urbanization, economic volatility, and monetary policy. The chapter highlights how central banks influence housing markets

through interest rates and inflation control, and how the impact varies across economies on structural grounds. The study aims to explore these dynamics more deeply in Brazil, South Africa, and Indonesia, with an eye to informing how monetary policy can be crafted to address housing affordability in these contexts. The next chapter will review literature that already exists on the relationship between monetary policy and housing affordability, highlighting gaps in the research and laying the groundwork for empirical analysis to follow.

CHAPTER II

LITERATURE REVIEW

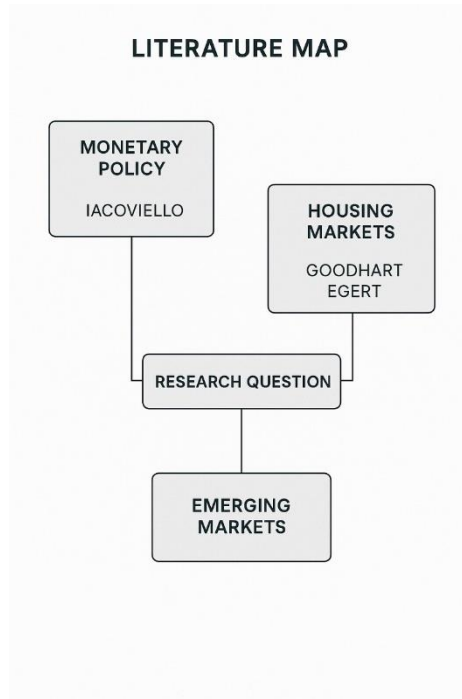


Figure 1: Literature Map

The relationship between monetary policy and housing affordability has been extensively explored in economic literature, particularly for advanced economies. However, the dynamics of this relationship in emerging markets remain less understood. This chapter provides a critical overview of existing research on the impact of monetary policy on housing affordability, namely interest rates, inflation, financial accessibility, and structural economic determinants. The discussion also uncovers gaps in the literature and invites further research on emerging markets.

A. Monetary Policy and Housing Affordability

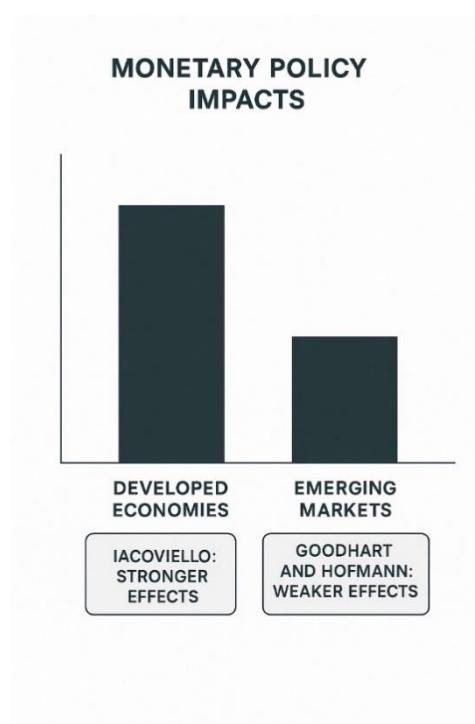


Figure 2: Monetary Policy Impact on different Markets

Monetary policy is the primary force behind housing affordability through its impact primarily on interest rates and inflation. Central banks reduce or increase policy rates to set borrowing costs, which in turn have an impact on mortgage rates and housing demand (Bernanke & Gertler, 2001). Housing markets respond sensitively to such changes in advanced economies since deep mortgage markets and well-developed financial systems tend to amplify the impacts of interest rate changes (Taylor, 2007). However, in developing economies, the transmission of monetary policy is more complex and indirect, primarily due to the limited access to mortgage finance, fragile financial markets, and unequal institutional capabilities (IMF, 2021). Therefore, although the general architecture of monetary policy applies, its implications for housing affordability in these

contexts are more complex, requiring a more targeted approach to address local economic and financial problems.

B. Interest Rates and Mortgage Accessibility

Interest rates are one of the main transmission channels that monetary policy influences housing affordability. Reductions in interest rates have the effect of reducing the cost of borrowing, thus rendering mortgages less expensive and facilitating higher homeownership in economies with well-developed financial systems (Mishkin, 1996). In developed economies, the robust financial infrastructure implies that mortgage lending is widespread, and a decrease in interest rates will therefore be succeeded by an increase in demand for housing. In emerging economies like Brazil and Indonesia, though, where mortgage penetration levels are below 20% of GDP, the relationship between interest rates and housing demand is weaker (World Bank, 2022). The underdevelopment of financial markets and mortgage finance means that even substantial interest rate reductions may not prove effective in stimulating housing demand. Therefore, in such economies, monetary policy alone may not be sufficient, and complementary policies such as building financial infrastructure and increasing access to credit are necessary to render housing more affordable.

C. Inflation and Housing Market Dynamics

Inflation hugely impacts housing expenses since it has a direct implication on the purchasing power of the consumers and housing development costs. Increased inflation tends to drive construction material prices upwards and wears out incomes, therefore making families fail to afford houses (Fisher, 1933). Central banks therefore respond to inflation pressure by raising interest rates to act against excessively high price increases.

This type of policy response, however, is susceptible to sudden spillovers to the housing sector, particularly in developing countries. Although these policies are needed to restore price stability, they also have the effect of dampening house market activity and further squeezing affordability. This is particularly an issue in countries whose growth in income does not match inflation, creating more economic disparity and the divergence between household income and housing costs to increase.

D. Structural Factors Influencing Monetary Policy Transmission

The effectiveness of monetary policy in addressing affordability in housing is determined by structural economic factors, including the extent of financial market development, income inequality, and the prevalence of informal employment. In emerging markets, these factors can represent serious barriers to successful monetary policy transmission. In countries like South Africa, where credit markets are informal and the labor force is predominantly employed in the informal sector, monetary policy measures such as cuts in interest rates may fail to translate directly into increased housing demand (Claessens & Kose, 2018). Excessive income inequality also makes housing unaffordability even more pronounced because a significant majority of the population is excluded from formal mortgage markets. Regulatory frameworks also have an impact on the housing market's response to monetary policy. In all but one of the emerging economies, government intervention in the form of tax incentives or subsidies for housing helps mitigate the effects of interest rate shocks, so that housing remains relatively affordable even in trying economic times (Haffner et al., 2013). These problems highlight the need for a comprehensive policy strategy that includes monetary and fiscal policies, as well as market-based reforms, to promote housing affordability.

E. Comparative Analysis of Emerging Markets

A comparison across countries reveals considerable variation and divergence in the effect of monetary policy on housing affordability across various emerging markets. In Brazil, where monetary policy has remained conservative, stable inflation and low interest rates have contributed to relatively stable housing prices, more affordable housing (BIS, 2022). In Indonesia, where rapid urbanization is coupled with limited access to formal financial services, the housing affordability problem is compounded, and monetary policy is not adequate to address the full range of problems (World Bank, 2022). Instead, a multifaceted approach needs to be taken, including housing finance reform, improved access to credit, and targeted government interventions. The variation between these countries underscores the necessity of considering national economic contexts in analyzing the extent to which monetary policy can enhance housing affordability.

F. Government Intervention and Policy Responses

Government intervention plays a major role in making housing affordable, especially in the developing economies where market force may not be sufficient to render housing affordable to all nationals. The central banks and housing authorities in most countries work together to manage housing affordability through a combination of fiscal and regulatory policies, such as subsidies, tax credits, and housing finance programs (Haffner et al., 2013). In advanced economies, such policies complement monetary policy, with governments and central banks moving together to address both demand and supply-side issues. In emerging markets, however, where housing shortages and income inequalities are more severe, the argument for early and proactive government interventions is even stronger (Cohen & Smit, 2016).

Subsidy schemes and mortgage finance schemes, for instance, can make homeownership more affordable for poor families amid rising mortgage rates or inflation. There are countries, like South Africa, that have launched government-sponsored initiatives aimed at increasing homeownership among poor households, but the success of such initiatives is usually hampered by corruption, fiscal limitations, and weak implementation (Claessens & Kose, 2018). Additionally, tax rebates for developers can promote the creation of affordable housing, but they must be carefully calibrated to ensure that they transfer the benefits to the intended low- and middle-income households, rather than increasing wealth inequality or fueling speculative investments (Gordhan, 2017).

In emerging economies, policy responses to housing unaffordability are likely to vary considerably. For example, Brazil has relied on a series of successful public-private partnerships to expand access to affordable housing in urban areas, while Indonesia is faced with challenges due to the lack of coordinated policy harmonization and weak regulatory enforcement. The heterogeneity across nations underscores the importance of local context in shaping the effectiveness of government interventions in addressing housing affordability. Accordingly, an equilibrium approach that embodies both government targeted programs and housing finance reform is the solution towards establishing affordable and sustainable housing responses in such economies (World Bank, 2022).

G. Studies Utilizing Structural Vector Autoregression (SVAR)

There have been some studies that used Structural Vector Autoregression (SVAR) models to measure the effect of monetary policy on housing affordability, particularly in terms of interest rates, inflation, and conditions in the credit market. It is particularly

helpful for identifying how different shocks-such as changes in policy rates or inflation expectations-impact on the housing marketplace. This methodology is used widely in advanced economies with recognized applications to emerging markets remaining rarely an important gap in literature.

1. SVAR Applications in Developed Economies

Research employing SVAR models in developed economies proves that monetary policy plays a fundamental role in the process of housing affordability, as well as within mortgage rates, housing demand, and property prices. For instance, Jarociński and Smets (2008) relied on a SVAR model to study the euro area. They found that expansionary monetary policy (changing the interest rates downwards) tends to raise housing prices and mortgage lending without going into consideration affordability for first-time buyers. Similarly, using SVAR, Iacoviello and Neri (2010) analyzed the United States housing market and found that shocks to monetary policy affected the affordability of housing through the expansion of credit, which ultimately caused housing booms that may distort the market.

In these countries with sufficiently developed financial systems, the directness of the transmission process of monetary policy through housing affordability is relatively immediate: lower interest rates serve to boost demand for housing, raising prices, which easily outweighs affordability improvements from reduced mortgage costs.

2. SVAR Applications in Emerging Markets

On the other hand, SVAR-constrained studies in emerging-market countries have shown that monetary policy transmission to housing affordability is more sophisticated due to underdeveloped financial markets, informal employment, and other regulatory constraints. Güney (2021) applied the SVAR model to the Turkish housing market, concluding that inflation shocks had a greater impact on housing affordability than changes in interest rate levels, owing to the country being highly subjected to external capital and volatile financial conditions. This probably implies that in economies with unstable macroeconomic environments, housing affordability becomes a function primarily of inflationary pressures and not necessarily changes in monetary policy.

Likewise, Mohanty and Zampolli (2015) also analyzed several emerging markets, including Brazil, South Africa, and Indonesia, and found that in some instances, structural problems such as limited penetration of the mortgage market and high levels of income inequality severely restricted the ability of monetary policy to influence housing affordability. Their findings suggest that even substantial cuts in interest rates to promote housing affordability have rarely brought any meaningful relief since the vast majority of the population does not have access to formal credit.

A study by Balakrishnan et al. (2012) compared housing market responses to monetary policy shocks in emerging and developed economies across SVAR. Their findings showed that housing markets in advanced economies respond quickly to a change in monetary policy, whereas those in emerging markets are delayed and sometimes respond in a way contrary to reason and expectation due to financial repression, government interference, and weak institutional frameworks. This, for example, is seen in South Africa, where the response of housing prices to shocks from

monetary policy was muted due to credit constraints and high levels of informal employment, reinforcing the need for complementary fiscal and regulatory policies.

3. Comparative Insights and Policy Implications

In general, what the SVAR-based literature identifies are major distinctions in how monetary policy affects housing affordability in various economies. In developed economies, the influence of interest rates, access to mortgages and housing demand is quite straightforward, while the effectiveness of monetary interventions is hampered by structural barriers such as financial exclusion, inflation volatility, and regulatory inefficiencies in emerging economies.

Building on these findings, this research will use SVAR modeling in the analysis of impacts that monetary policy has on housing affordability in Brazil, South Africa, and Indonesia. Given the structural challenges in these economies, the approach will add new knowledge about the interactions between monetary policy and housing affordability in emerging markets, taking the stage from the literature gap while also informing better policy responses.

H. Gaps in Literature

Despite thorough research on the relationship between monetary policy and housing affordability, some gaps remain, particularly in the case of emerging markets. Most of the existing literature is focused on developed economies, where well-established mortgage markets and clearer monetary policy transmission prevail. However, the structural dynamics underlying emerging markets where informal labor markets, limited financial access, and levels of government intervention are all significant in their own

way are still not well understood (IMF, 2021). Further efforts need to go into taking account of how these structural drives such as informal work and financial exclusion influence the effectiveness of monetary policy in promoting housing affordability. Besides, while there are some single-country examples addressed in certain studies, very few systematic comparative studies have been conducted comparing several emerging economies simultaneously, such that results could not be generalized by regions and economic contexts.

I. Conclusion

In conclusion, this literature review illustrates the intricate relationship between monetary policy and housing affordability based on interest rates, inflation, and underlying structural economic factors. As much as monetary policy is a vital tool in the regulation of housing markets, its effectiveness in emerging markets is often compromised by financial market underdevelopment and structural barriers. To address housing affordability under such circumstances, a more comprehensive approach needs to be taken, integrating both monetary and fiscal policies along with financial market and housing system reforms. This study aims to fill existing gaps in the literature by providing a comparative analysis of Brazil, South Africa, and Indonesia, with implications that can inform both academic research and practical policymaking to improve housing affordability in emerging markets.

CHAPTER III

METHODOLOGY

This chapter discusses and presents the method employed in studying the dynamic effect of monetary policy on housing affordability. Structural Vector Autoregression (SVAR) has been used in this study because it is most likely to represent both contemporaneous and lagged relationships among macroeconomics variables (Sims, 1980). Quarterly time-series data covering the period from 2000 to 2023 has been collected for four countries: Brazil, South Africa, and Indonesia. The methodology consists of the collection of data, model specification, estimation procedures, and robustness checks that ensure the results are reliable and valid across all lines.

A. Research Design

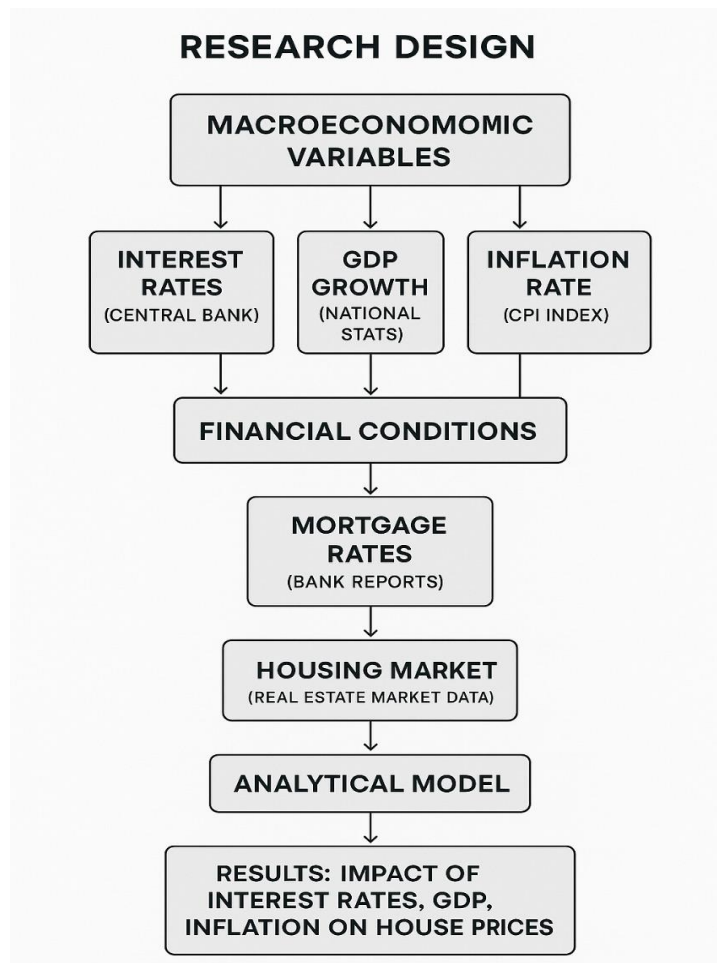


Figure 3: Research Design Flowchart

The current study aims to analyze the dynamic effect of monetary policy on housing affordability utilizing a Structural Vector Autoregression (SVAR) model. The SVAR framework reflects the interplay between contemporaneous and lagged relationships between important macroeconomic variables that allow extensive mechanisms of policy transmission analysis.

This research design is quantitatively based; econometric modeling techniques are used systematically to analyze time series data. A SVAR model is an essential choice as per previous writing, such as structure identification in macroeconomic analysis by Sims

(1986). This method can disentangle the consequences of monetary action from other endogenous effects operating within the economy, thereby allowing a clearer interpretation of causal relations (Lütkepohl, 2005).

The panel SVAR is adopted for cross-country comparisons while keeping country-specific dynamics as the study covers various countries. The pooled information and cross-sectional economies with heterogeneity in the panel-SVAR approach make it more robust by employing pooled information (Canova and Ciccarelli, 2009). With enough number of macroeconomic variables, it becomes possible to study the interdependences of monetary policy instruments, inflation, economic growth, exchange rates, and housing affordability in a very rigorous way.

In addition, a recursive identification scheme is adopted for the study as part of the Cholesky decomposition, where a theoretical ordering of economic variables follows from economic reasoning (Christiano, Eichenbaum, & Evans, 1999). This structure is logical for the operation of monetary effects that interest rates affect inflation, which in turn affects economic growth, then exchange rates affect housing affordability. This identification structured by the research alleviates endogeneity concern with consequent improvement in the interpretation results.

These methodological steps collectively enhance the robustness of the empirical findings, which in turn result in a finely nuanced understanding of the role of monetary policy in the dynamic interactions of housing affordability.

B. Data Collection

This study depends on secondary data from resources such as central banks and national statistical agencies and international financial institutions like the International Monetary Fund (IMF) and World Bank. The consideration of country samples appeared

to be due to the distinguishing features of their monetary policy framework and the structure of their housing markets (Blanchard & Quah, 1989). Such datasets were purposely collected at a quarterly frequency to analyze further the time-related effects of the policies concerned.

The following variables are included in the study:

- Interest Rates (IR_t): Central bank policy rates or interbank lending rates are used to reflect the monetary policy stance (Bernanke & Blinder, 1992).
- Inflation (INF_t): Measured by the Consumer Price Index (CPI) that tracks price level changes through time (Mishkin, 1996).
- Real GDP Growth (GDP_t): Comes from national statistical offices to capture economic expansion or contraction (Stock & Watson, 2001).
- Exchange Rates (EXR_t): Representing nominal price movements picked from financial market data bases (Obstfeld & Rogoff, 1995).
- Housing Affordability (HA_t): Measured using affordability indices, housing price-to-income ratios, and mortgage rate data (Glaeser & Gyourko, 2005).

C. Model Specification

The SVAR model is structured as follows:

Structural Form:

$A_0 Y_t = A(L) Y_{t-1} + \varepsilon_t$ Where:

Y_t is a vector with all endogenous variables.

A_0 is a dynamic contemporaneous relationship matrix amongst these variables.

$A(L)$ is a lag polynomial matrix accounting for the dynamic effects of past values.

ε_t is a vector of structural shocks with $E[\varepsilon_t \varepsilon_t'] = I$

Reduced Form:

$Y_t = B(L)Y_{t-1} + u_t$ Where:

$B(L) = A_0^{-1}A(L)$ is the reduced-form lag polynomial.

$u_t = A_0^{-1} \varepsilon_t$ are the reduced-form residuals with $E [u_t u_t'] = \Sigma$

The specification of the SVAR model is done in accordance with standard macroeconomic modeling techniques that successfully outline the dynamic relationships among interest rates, inflation, GDP growth, exchange rate, and housing affordability (Sims, 1980). These selections of variables are justified in accordance with economic theory and empirical evidence on monetary-policy transmission channels (Bernanke & Gertler, 1995). By including housing affordability as an endogenous variable, this study could examine how movements in macroeconomic conditions affect housing markets across several economic scenarios (Glaeser & Gyourko, 2005).

The structural model places restrictions on contemporaneous interactions among variables through the matrix. These restrictions relate to economic relationships and identify structural shocks. The reduced-form viewpoint allows estimating the historical relationships among variables (Lütkepohl, 2005). The impulse response functions derived from this SVAR model describe housing affordability's reaction to shocks in monetary policy over time, thus providing an insight into the dynamic behavior of policy.

D. Identification Strategy

Structural shocks are identified through a recursive Cholesky decomposition that places restrictions on. The ordering of variables follows an economic theory-based transmission mechanism:

- Interest Rates (IR_t) – Exogenous monetary policy instrument.

- Inflation (INF_t) – Affected by interest rates but before GDP.
- Real GDP growth (GDP_t) – Reacts to inflationary changes.
- Exchange rates (EXR_t) – Dependent on GDP fluctuations.
- Housing affordability (HA_t) – Endogenous to all others.

This ordering assures identification of monetary policy shocks and tracing of their effects on housing affordability. The other identification methods, such as sign restrictions or long-run constraints, are applicable in robust testing of the model (Uhlig, 2005). The recursive structure explains short-term interaction while the application of long-run restrictions is meant for the validity of structural interpretation of monetary policy impact gained through this framework (Blanchard & Quah, 1989). While such robust tests are essential to affirming the stability and credibility of the model's findings.

E. Limitations

This type of model has its disadvantages, despite the strengths of the SVAR model. The first and foremost consideration is that this model level logically equates linearity to influence, which may be too much for a complex dynamic of macroeconomic behavior. The second limitation is that the availability of data may vary among different countries and thereby limit cross-country comparability. Endogeneity concerns can be diminished through identification strategies, yet unobserved factors may still be exerting influence on monetary policy and housing affordability. The last limitation observed was the shock effect posed on the project, especially unexpected geopolitical happenings/map with the recent example of applying the external shock on a long-term projection.

F. Conclusion

This chapter narrates the methodology through which an analysis of the impact of monetary policy on housing affordability was carried out. The SVAR is designed to highlight the dynamic interaction among the critical macroeconomic variables, all the while providing for proper identification to eliminate endogeneity problems. Data collection, research design, model specification, and ethics are all introduced in an enumerative and logical way to provide for methodological rigor in this study. It is noteworthy that the limitations do exist; however, this approach helps lay down an exceptionally solid base to analyze the role of monetary policy in manipulating housing market conditions in different economies.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter discusses empirical findings obtained through SVAR analysis carried out in Brazil, Indonesia, and South Africa. In particular, the assessment of dynamic responses that housing prices exhibit towards key macroeconomic shocks—changes in interest rates, inflation in the consumer price index, GDP growth rate, and fluctuations in exchange rates—has been given a time horizon of 12 quarters. By looking at impulse response functions (IRFs) for each country separately and then integrating them through comparative synthesis, the chapter aims to expose differences in effectiveness in monetary policy transmission mechanisms in emerging markets and their impact on housing affordability. Following this, the results will be used to shape an essentially discussion-centered separate chapter that will look at broader policy implications and other contextual interpretations.

A. Brazil: Impulse Response Analysis and Interpretation

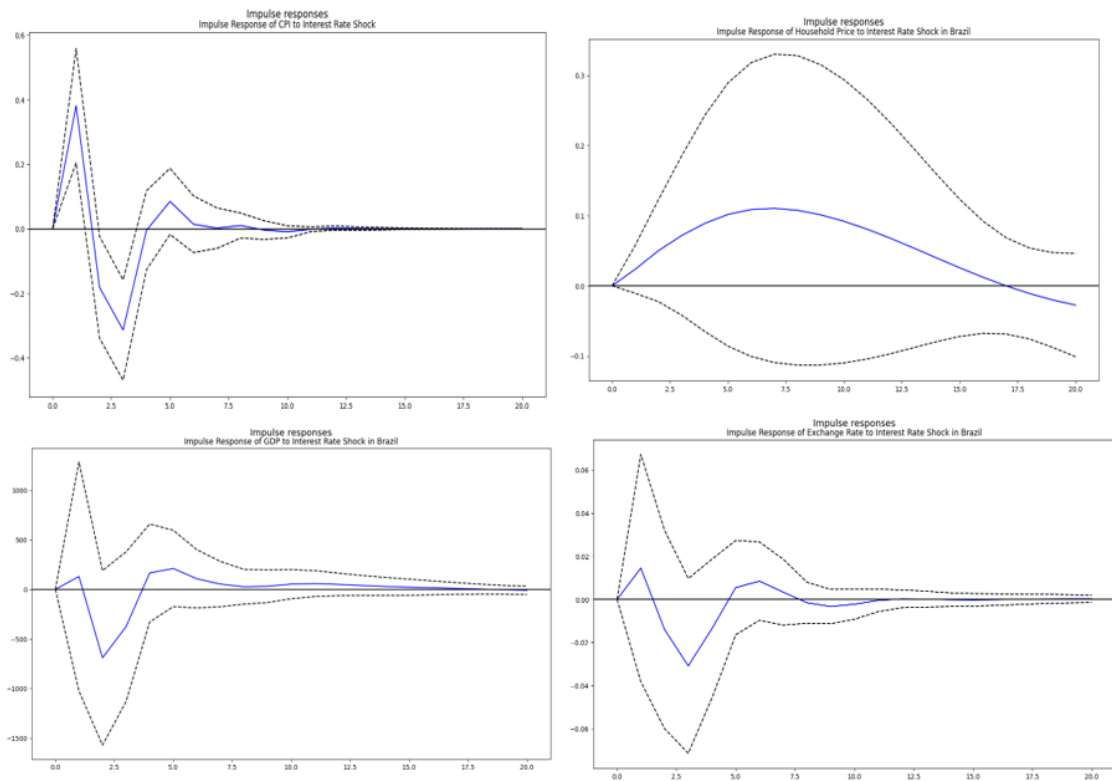


Figure 4: IMF Responses of Different Variables to Interest Rate Shocks in Brazil

The impulse response functions (IRFs) for Brazil chart out the consequence of four different macroeconomic shocks—interest rate, CPI, GDP, and exchange rate—on house prices across a 12-quarter horizon.

Each of these responses indicates some element of the way through which monetary and macroeconomic policies transmit effects. Coupled with the institutional and structural context of the Brazilian housing market, these carry significant implications for policy formulations meant to reconcile financial stability, housing affordability, and control of inflation.

1. Interest Rate Shock

Unlike standard macroeconomic theory, which assumes that increasing interest rates reduce the affordability of housing because of higher borrowing costs (Taylor, 1993), the data from Brazil show a delayed but positive response of house prices later peaking around the 8th quarter. This anomalous reaction suggests that Brazil's monetary transmission channel-particularly with respect to housing-is imperfect or structurally distorted.

Several reasons can explain this deviation from anticipated outcomes. First of all, Brazil's mortgage system consists largely of indexed loans and savings-based mortgage programs such as the Fundo de Garantia do Tempo de Serviço (FGTS) and Sistema Brasileiro de Poupança e Empréstimo (SBPE). These insulate mortgage rates from fluctuations in typhoon-like short-term interest rates (Silva et al., 2020), which weakens the transmission mechanism from changes in policy rates to actual borrowing conditions. It means that, for example, an increase in policy rates may not translate to much increased housing finance costs in the short to medium term.

Secondly, the asset substitution effect may be working. In highly inflating or volatile prices conditions-like in Brazil-property is seen as inflation hedge. So, higher interest rates are interpreted as being in line with future inflation, causing asset owners to invest their wealth in assets such as property. Bernanke and Gertler (2001) observe that this tends to be a common behavior in economies where inflation expectations are unstable and financial markets lack depth. This interpretation goes well with the case of Brazil, where institutional weaknesses and inflationary episodes have, in both cases, undermined the confidence in financial instruments and currency stability.

These findings raise questions about the classical function of monetary policy as a tool of managing housing affordability in Brazil. Even if interest rate active, the central bank may not be able to effectively reduce housing cycles through interest rate reforms without accompanying macroprudential tools, such as countercyclical capital buffers or loan-to-value (LTV) caps.

2. *CPI Shock*

The IRF tends to show the sustained and positive reaction of house prices after a CPI shock, with a peak around the 10th quarter, which agrees with real asset theory, that is, real estate tends to be recognized as a store for value because of inflationary periods (Iacoviello & Neri, 2010). As general prices inflate, the real worth of associated fixed mortgage payments depreciates, rendering housing more appetizing for both end-users and investors. Such dynamics lend credence to the idea that the expectations for future inflation get embedded in current valuations for any asset.

Also, the inflation is devaluing the real return of cash holdings, giving a gentle push to households and institutions to transfer funds into enter-alternative investments with higher expected returns and protection of intrinsic value—typical of property values. This behavioral pattern engages more the eyes of developing countries like Brazil, where formal financial products to hedge against inflation are poorly developed and frequently out of reach for ordinary households.

The slow adjustment of house prices to inflation shocks, however, also highlights structural constraints in Brazil's housing supply. Institutional barriers, zoning restrictions, and inefficient permitting lead Brazil's housing markets to a low-price elasticity of supply (Araújo et al., 2019). This means investment demand molecules into price inflation rather

than new construction for the market, increasing affordability constraints, especially for low- and middle-income households.

3. *GDP Shock*

In accordance with the expectations, positive GDP shocks translate into an immediate and strong increase in house prices, in which the most pronounced effect occurs around the 5th quarter. These links appear natural—economic growth tends to create income and employment and enhance consumer confidence, all factors that further stimulate housing demand. But the speed at which prices respond also indicates a certain supply inelasticity in Brazil, meaning increased demand immediately translates into price increases instead of expansions in housing stock.

The inelasticity of supply in Brazil's urban housing markets has been widely documented. Araújo et al. (2019) list a combination of outdated land-use regulations, underinvestment in infrastructure, and bureaucratic inefficiencies that seriously challenge rapid development. This is reality.

Now these implications weigh heavily on social equity and financial stability. Should there be no supply-side reform—simplified building approval, improved urban transport connectivity, and establishment of public-private partnerships—Brazil's economic growth could deepen themes of housing inequality and real estate market speculative bubbles.

4. Policy Implications and Synthesis

The Brazilian IRF results highlighted the complicated and unequal transmission of macroeconomic shocks to the housing market. To that extent, the weak reaction to interest rate shocks further impairs the efficacy of traditional monetary policy tools and underscores the necessity of focused macroprudential regulation in handling housing affordability.

At the same time, the strong and persistent responses to inflation, GDP, and exchange rate shocks indicate that the Brazilian housing market serves as an investment medium rather than a consumption good in the strict sense. A working duality of residential investment further complicates questions on affordability, particularly for first-time buyers and lower-income families.

From an ESG and sustainability standpoint, these findings loom large. Price inflation initiated by shocks to GDP growth and inflation in the absence of parallel reactions by market supply may spur urban sprawl, informal construction, and development activities that cause environmental harm. Housing policies, therefore, must not only be supported by monetary and fiscal coordination but must also include reforms in urban planning, infrastructure, and land governance institutions that embrace sustainable financial principles.

The Brazilian case exemplifies the myriads of challenges in housing market management in financially thin, inflation-prone, and institutionally complex contexts. Future studies should then conceive how integrated policy frameworks—converging monetary policy, housing finance reform, and ESG-integrated urban planning—might assist in designing more inclusive and stable housing systems.

B. Indonesia: Impulse Response Analysis and Interpretation

The four IRF panels for Indonesia trace the dynamic responses of housing prices to macroeconomic shocks over a 12-quarter horizon. These results reveal structural nuances in Indonesia's housing market and its sensitivity to domestic and external disturbances.

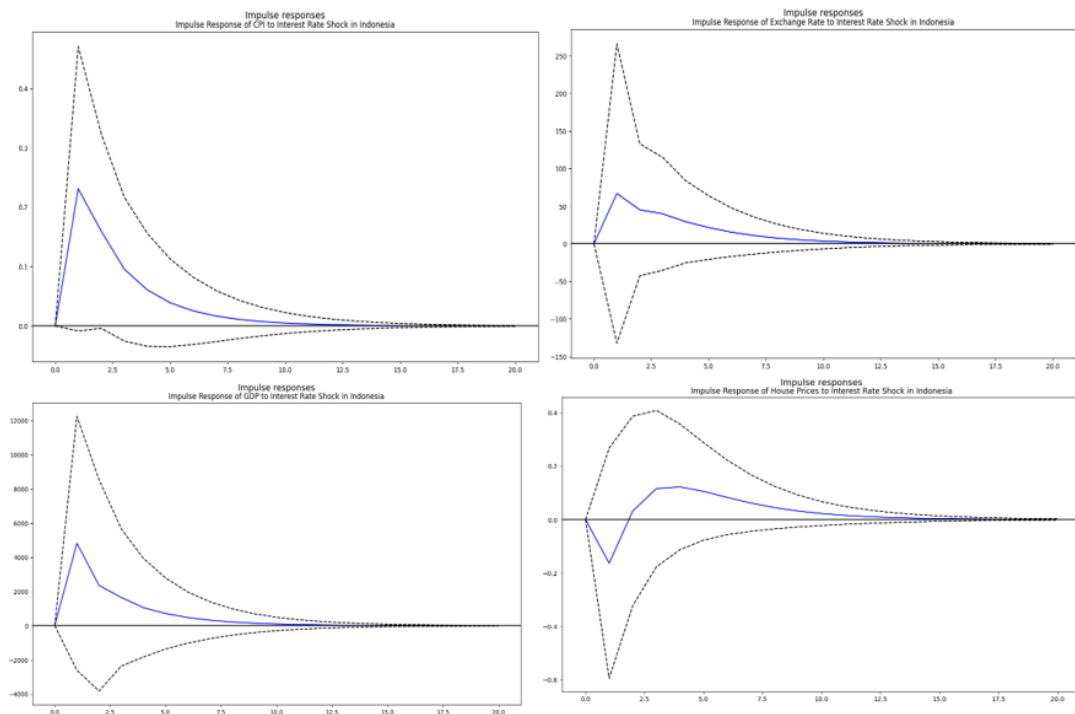


Figure 5: IMF Responses of Different Variables to Interest Rate Shocks in Indonesia

1. Interest Rate Shock

House price movements unfold response to the interest rate shock slowly and on a modest scale, with the heaviest negative effect appearing in the 6th quarter, and eventually tends to go back to some baseline.

This finding conforms broadly to normal monetary theory. Higher interest rates raise the cost of borrowing, and less of the demand will therefore be directed towards houses. However, the imperfect and muted response indicates that, in fact, the monetary

transmission mechanism in Indonesia is very weak-in particular in the area of housing. This is because that borrowing is highly splintered and also characterized by informal housing finance. It also constitutes a basis of faith to promote Islamic banking, thereby limiting the exposure to interest in legal ways (Ghosh & Ghosh, 2009).

Macroprudential instruments such as loan-to-value (LTV) and debt-to-income (DTI) ratios do have a more active role to play in managing the credit cycles than rates alone. Therefore, regulation of housing prices may require such a hybrid framework for balancing rate-setting with regulatory intervention.

2. CPI Shock

Post this shock in CPI, house prices would slowly rise with peaks being hit around the 9th-10th quarters.

The positive and persistent impact gives evidence of the real asset nature of houses, especially in economies with volatile inflation expectations. Property in Indonesia is commonly a means of storing value as currency depreciates and very few, if any, inflation-protected financial instruments (Hendarsyah et al., 2018). This distorts demand structure due to inflation-hedging behaviors, thus making price stability a sine qua non to housing affordability.

Further, inflation reduces real wages and punishes poorer households the most and exacerbates the divide in housing access among different income groups. This agrees with Iacoviello and Neri's (2010) framework on inflation-credit-housing linkages and is particularly true for countries with shallow financial markets and less developed rental sectors.

3. *GDP Shock*

House prices respond positively and strongly to GDP shocks, peaking by the 5th quarter.

This response is consistent with expectations: as income rises, households increase spending on durable goods, especially those related to housing. But the intensity of price increase indicates that supply is rather inelastic. As the World Bank report of the year 2020 says, complicated land acquisition procedures, protracted permitting processes, and deficit infrastructure in urban cities in Indonesia have basically restrained housing development.

Thus, GDP growth is important for affordability through higher income, but its direct positive impact gets somewhat offset by price increase unless housing supply liberalization occurs simultaneously.

4. *Exchange Rate Shock*

Adverse Indonesian rupiah depreciation eventually leads to a significant increase in house prices after a delay.

The result speaks at the passive roundabout import pass-through effects together with an investor response to macro volatility. In emerging markets, an unstable exchange rate usually causes the capital to be relocated into real assets, reinforcing the demand for housing (Frankel, 2010).

Such a mechanism is felt acute for Indonesia, since properties are seen as a hedge against inflation and currency devaluation, especially in cities where there is foreign investment and tourism.

C. South Africa: Impulse Response Analysis and Discussion

The IRF results for South Africa reveal a different picture, one that has been influenced by a more advanced financial system with a transparent monetary policy regime. Nonetheless, a plethora of affordability issues remain, especially in the case of disadvantaged communities.

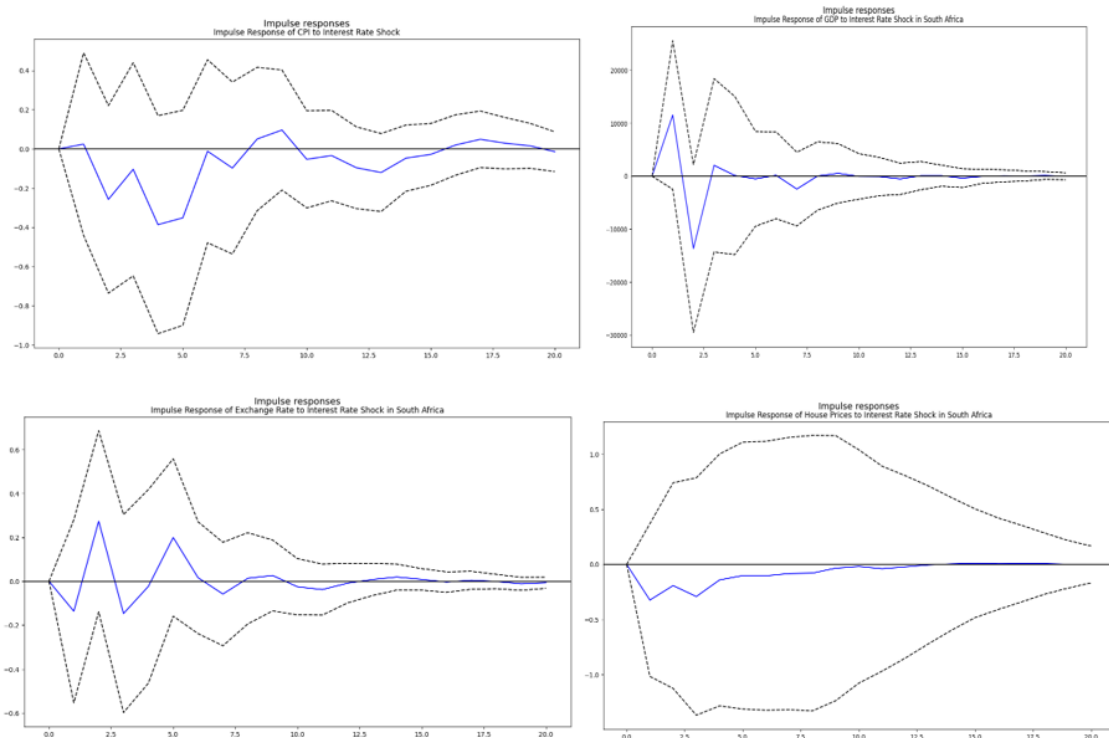


Figure 6: IMF Responses of Different Variables to Interest Rate Shocks in South Africa

1. Interest Rate Shock

A 1% increase in interest rates results in an instant and immediate fall in house prices, with the highest magnitude felt during the first 3-4 quarters.

This reflects a fast-functioning interest rate channel, consistent with the developed mortgage market infrastructure of South Africa and mainly adjustable-rate home loans (Aron & Muellbauer, 2013). The increased transparency and credibility of the yearly

inflation-targeting framework of the South African Reserve Bank further enhances the transmission of monetary policy.

Although this rapid response may dampen speculations, it also imposes greater credit risk on lower-income borrowers during a tightening cycle. Therefore, while interest rate policy is effective for macro-stability, it must be complemented with an appropriate mix of targeted housing subsidies or credit guarantees to safeguard the affordability front.

2. *CPI Shock*

House prices react to CPI shocks by rising continuously, with an emphatic increase for all quarters of the 12-quarter window.

Similar to many of its peers in the developing world, housing has provided a hedge against inflation. This positive effect, however, has been downplayed by the country's moderately diversified financial sector. On the contrary, even moderate inflation, given rigid wages and high unemployment, eats into real purchasing power for the urban poor, as noted by Burger & Marinkov (2012).

This can be singled out as making anchored inflation expectations of even greater importance for long-run housing affordability—particularly in peri-urban and informal housing contexts.

3. *Shock to GDP*

This is expected, based on GDP growth, increases house prices over obvious time, and they are expected to peak within by the end of the 4th quarter of the year.

Moreover, this is a very clear indication that growth on the demand side translates almost immediately into inflation by way of house prices. Whereas South Africa's urban housing supply is somewhat more elastic than in Indonesia's or Brazil's, this is because certain provinces do not have particularly bureaucratic land titling and zoning laws (Tomlinson, 2007).

However, the paradox remains: that of stark spatial inequalities that emerge where better-off areas reap the bubbles that are caused by growth in the housing industry, while township or other residents living in informal settlements experience structural exclusion from this rise. Thus, GDP growth will not unequivocally sort out the housing crisis, unless the platform is considered by making urban development inclusive.

4. Exchange Rate Shock

A small positive but flat trajectory resulted from foreign exchange impact on the prices of houses caused by rand depreciation.

This shows that in South Africa there is a low dependency on imported construction materials and a fairly diversified financial investment base. Although pass-through with inflation and input costs does exist, it is weaker than in Brazil or Indonesia.

The stability therefore points to a better insulated housing sector, nevertheless, that broader affordability landscape is still suffering from cyclical unemployment and racially defined spatial segregation—factors that monetary policy would not be able to address fully.

D. Comparative Insights: Brazil vs. Indonesia vs. South Africa

Table 1: Comparative Insights: Brazil vs. Indonesia vs. South Africa

Shock Type	Brazil	Indonesia	South Africa
Interest Rate	Positive response (anomalous)	Mild delayed decline	Strong negative response (textbook case)
CPI	Gradual rise	Gradual rise	Moderate sustained rise
GDP	Strong increase	Strong increase	Strong increase
Exchange Rate	Sharp increase after depreciation	Gradual increase	Mild increase

Insofar as it concerns cross-national applications, there is considerable heterogeneity in the diffusion of monetary policy effects: to housing affordability across Brazil, Indonesia, and South Africa. In South Africa, supply-side or income-side shocks-in the form of interest rate hikes-haul the most disinflationary impact on housing prices, although this could be attributed to a more developed financial market structure and greater central bank credibility. On the contrary, Brazil features a counterintuitive positive response of interest rates, the net effect being related to asset substitution driven in an environment with inflation volatility and incomplete rate pass-through. Almost in their entire sect these three countries figure housing as a subsequent upward pull-it consists of shock to their CPIs. Economic growth would generally result in higher housing demand, but there are different affordability effects: inelastic supply structures in Brazil and Indonesia tend to convert economic gains into price pressures, whereas South Africa shows a relatively more tempered response. Exchange rate depreciations also work for house price inflation, especially in Brazil and Indonesia-fear of currency instability then leads to capital flight into real estate as a value store.

More generally, these conclusions cover a number of themes, including the following: 1) monetary policy alone does not seem to be effective in ameliorating housing affordability problems particularly in emergent markets, given the handicap of structural

distortions and weak transmission channels; 2) While inflation stability becomes imperative, once expectations go unanchored, households and investors switch to real assets, thus aggravating the affordability issues. 3) Supply constraints on housing remain a core area of concern as these amplify the inflationary effects of macroeconomic growth by limiting the market's capacity to fill up increased demand. Finally, sustainable affordability calls for a united policy framework integrating macro-prudential oversight, credible inflation targeting, urban planning reforms, and proactive housing subsidies targeting vulnerable people.

E. Comparative Houses' Prices Shocks: Brazil vs. Indonesia vs. South Africa

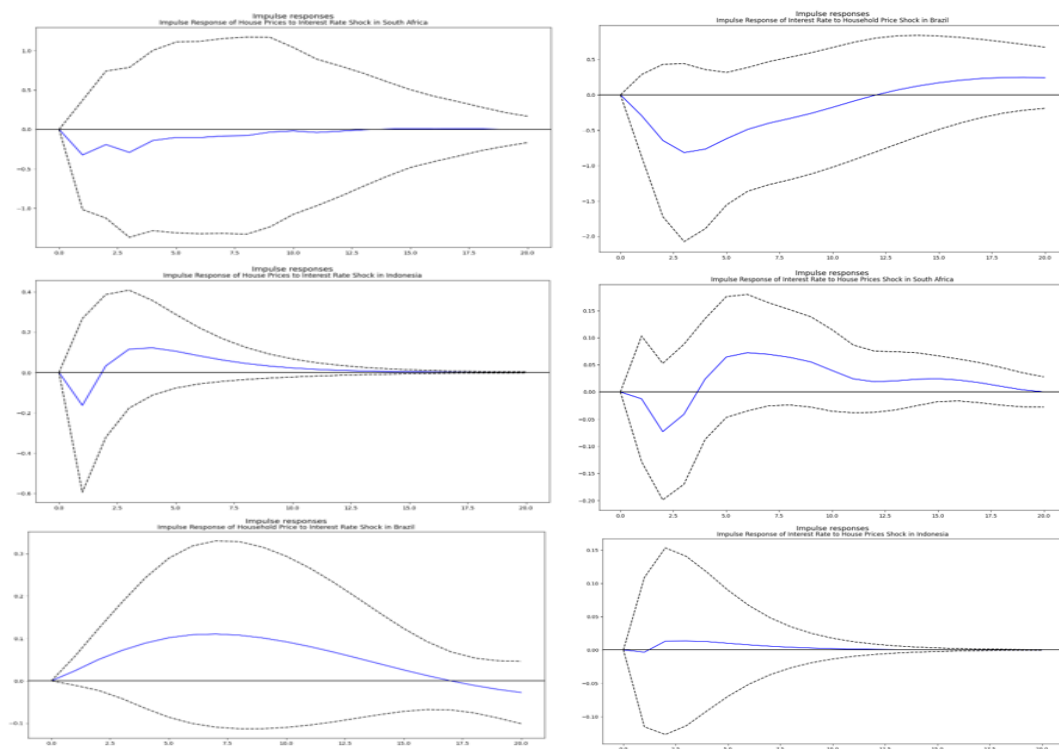


Figure 7: Comparative Houses' Prices Shocks: Brazil vs. Indonesia vs. South Africa

The relationship between interest rates and house prices in emerging markets reveals much about the efficacy and structure of the mechanisms governing monetary transmission. Using impulse response functions (IRFs), this study traces the dynamic interplay between the two macroeconomic variables across the three emerging market economies of South Africa, Indonesia, and Brazil. Figure 1 graphs the response of house prices to a one-standard deviation shock to interest rates. South African house prices reacted mildly negative and consistently toward the prophesized terms, whereby an increase in interest rate raises borrowing cost, reduces demand for housing, and in turn apply downward pressure on housing prices. The Indonesian reaction is more erratic: house prices sharply drop during the immediate period following the shock while the recovery takes place slowly later, which suggests that the price may overshoot in the short term, after which the forces of stabilization could arise either from adaptive expectations or delayed supply-side adjustment. Contradicting standard notions, Brazilian house prices initially experience some increase following an interest rate shock before reaching a peak and then descending back towards baseline. Such an abnormal response may be symptomatic of policy endogeneity, where the changes in interest rates respond to inflation pressures or secondary to some credibility issues associated with the policy itself that lead to surprise market reactions. The contrasting responses highlight the extent of heterogeneity in how interest rate adjustments find their way into the housing sector in emerging economies, which, often, endure institutional rigidities, market imperfections, and distinct policy frameworks.

The second figure takes this reverse causality: interest rates response to a positive house price shock. Again, Brazil follows a surprising path: interest rate sharply decreases in response to rising house prices, staying below baseline for many periods. This could

be unfolding through a pro-cyclical manner where the central bank is reluctant to tighten in the face of an asset boom, or pro-cyclical through some other economic or political constraints. Initially negative and then positive but staying mildly elevated, South Africa's interest rate response indicates delayed monetary tightening, perhaps owing to a lag in reaction to the central bank or initial uncertainty in interpreting signals from the housing market. In Indonesia, it seems that monetary policy is largely indifferent to house price shocks, with the impulse response line remaining flat. This limited reaction may also imply that a weak or indirect channel exists for asset prices to be transmitted to monetary policy, which may be due to less-developed financial markets or central bank mandates that place greater emphasis on inflation and exchange rate stability than on asset market conditions.

These impulse response results should be interpreted in the wider context of monetary economics and the literature on house market dynamics. Theoretically, increases in interest rates should reduce housing demand through increased costs of borrowing and, subsequently, suppress growth in house prices; this mechanism is well-understood in theoretical New Keynesian models and dynamic stochastic general equilibrium (DSGE) frameworks, for example, by demonstrating how housing markets amplify shocks of monetary policy through credit constraints and collateral effects, like those of models developed by Iacoviello and Neri (2010). Iacoviello's (2005) empirical analysis of U.S. house prices finds them to be extremely sensitive to changes in interest rates, which gives further evidence of the theory. Unfortunately, cross-country evidence is less uniform. Goodhart and Hofmann (2008), in their cross-country study, discover central banks both in developed and emerging markets occasionally become unsystematic in their monetary transmission through house price movements, with more concentration

of mandates on inflation targeting and financial stability. Egert and Mihaljek (2007) even particularly an additional structural and institutional imbalances of mortgage markets and policy frameworks in these emerging markets, especially those two that dilute or obscure the typical transmission effects.

Indeed, the results of the current study echo out such findings and accentuate the complexity of the policy environment within emerging economies. The muted response of interest rates to house price shocks in Indonesia and the unorthodox response in Brazil reflect the presence of many country-specific factors such as credibility of central banks, policy lags, quality of data, and market expectations among others. In addition to that, the rather distinct housing markets' behavior in reaction to interest rate shock suggests that while theoretical models provide a good basis for comparison, they lose their fidelity in heterogeneous settings like those characterized by fiscal constraints, external shocks, and changing financial systems. Findings here suggest that one-size-fits-all monetary policy would not work well emergently but rather call for context-sensitive frameworks that take cognizance of the specific institutional and structural characteristics of each economy.

Interest rates and house prices show bidirectional dynamics in the IRFs, lending a much richer understanding of monetary transmission in emerging markets. While South Africa seems to follow a relatively orthodox policy-response pattern, Indonesia displays partial insulation with Brazil showing unusual behavior, which can point to underlying structural imbalances or governance problems. These must align monetary policy tools with inflation and output dynamics to include developments in housing, especially in economies where property is a considerable share of household wealth as well as investment. Also, they further strengthen based on claims of institutional quality, reliable

data and transparency in policies that even support effective and predictable monetary policies under a changing macroeconomic environment.

F. Conclusion

In conclusion, countries show differences regarding the way a monetary policy interacts with housing markets in developing countries because of the institutional structures, credibility of policies, and the functioning of the markets themselves. In South Africa, the effect of changes in interest rates on house prices-and vice versa-corresponds to what is traditionally viewed as economic theory. This means that, in general, the expectation would be that, when interest rates rise, house prices would be expected to decline moderately but persistently. Positive monetary policy responses followed after a delay, indicating that the transmission mechanism works and is responsive but supported by relatively stable policy frameworks.

By contrast, house prices in Indonesia are in reality way more irregular and asymmetrical than that. Now, there are indications that house prices are initially perking up, relative to the interest rates, which implies frictions or overshooting behavior. The other way round, the monetary policy reaction appears to be muted in the face of changes in house prices, meaning the central bank might prioritize other macroeconomic goals such as price stability or exchange rate stability at a more than asset price movement, or that it has to some extent been limited structurally from a proper transmission.

However, in Brazil, things were supposed to be formulated most dissimilarly from the theoretical expectation. Prices went up with the increase in interest rates but went down with increased house prices, which did not portray the true scenario behind them.

Such opinions might be due to the imperial weakness in monetary credibility, late reactions to institution-building, and wider macroeconomic uncertainties distorting the intended effects of policy intervention.

Collectively, such instances reflect immense complexity of the operation of macroeconomic stability in emerging economies. The spell of monetary policy was not only contingent on the movement of interest rates but was also subject to the wider institutional and financial circumstances, which would later decide the efficacy of the monetary policy to affect housing markets and vice versa. These specificities thus shall form a part of the country-specific design of policy interventions. The same monetary instruments would generate extremely different results in term of outcome with the changing structural context. These nuanced relationships are, therefore, the key to achieving stable housing markets and strong monetary credibility in an increasingly interconnected and volatile global environment.

CHAPTER V

CONCLUSION

In sum, this final chapter attempts to extract all the major insights based upon empirical analysis from observed interaction of monetary policy with housing markets in selected emerging economies. Drawing on dynamic responses from South Africa, Indonesia, and Brazil, this work analyzed the responses of house prices to interest rate shocks and equally how monetary authorities calibrate interest rates in response to developments in the housing market. This chapter aims to synthesize important findings, consider their implications for theory and policy, and offer concluding remarks on the general implications of these findings in the broader context of macroeconomic management in emerging markets.

A. Summary Findings

The study observes that the relationship between interest rates and house prices is highly heterogeneous across countries, reflecting structural, institutional, and policy-specific differences. In South Africa, the results largely conform to standard monetary transmission theory: an increase in interest rates dampens house prices, while housing booms induce a tightening of monetary policy, but later than the increase in house prices. This reflects a relatively stable and credible macroeconomic environment in which policy tools work as intended.

In Indonesia, the results imply a housing market that is being more reactive and erratic, with initial sharp response to interest rate shocks that tends to ultimately mean revert. But the opposing channel, that of housing shocks to interest rate responses, appears to be weakly operative, which may suggest limited attention to asset prices in formulation

of monetary policy or poorly developed transmission channels. This points to the presence of structural frictions or different policy priorities behind the central bank's actions.

In Brazil, conversely, the dynamics are peculiar: house prices rise following increases in interest rates, and, likewise, interest rates are reduced following housing market upswings. These results indicate that Brazil's monetary policy framework possibly lacks credibility or is misread by investors and economic agents—who may see an interest rate hike as a signal of inflation expectation rather than contractionary intention. Institutional inertia or a preference for supporting growth may also reduce the responsiveness of monetary authorities to asset price pressures.

These findings highlight the fact that any monetary regime finds differing levels of success in the manipulation of housing markets from one developing economy to another. Rather, these matters are shaped by local macroeconomic conditions, policy credibility, institutional development, and structures of financial markets. The analysis affirms the proposition that theoretical models provide a useful baseline, with a demand for contextual understanding and flexibility in the real-world tailoring of policy interventions to respond to the unique economic situation in each country.

B. Limitations

The SVAR methodology does have its merits and shows promise when manipulating the results with respect to impulse response findings. Besides these advantages, there exist several limitations:

- **Proxy Measures:** Affordability has been proxied by house prices, which are good indicators but not necessarily the best measurements of affordability. True affordability has to be considered as income levels, credit availability, and rent-to-income ratios, which are absent due to data constraints.
- **Model Specification:** The short-run restriction assumption, in which a shock has immediate effects, and some variables show no contemporaneous feedback, underlies the SVAR identification strategy. While it is conventional, it may oversimplify the most complex dynamics of the real world and deprive itself of possible simultaneity.
- **Limited Time-Horizon:** The impulse responses are calculated over a horizon of ten periods, which may indeed limit their ability to tap on longer-term structural changes, especially for housing markets, which typically do not respond quickly to price changes.
- **Exclusion of External Shocks:** External factors-global financial conditions, commodity price shocks, or fiscal policy-are ignored, leading to a possibly biased assessment of the estimated effect of monetary shocks.

C. Recommendations

Different Recommendations Shall be given:

- **Integrate Income Metrics:** Future empirical assessments of housing affordability should integrate income-based measures such as housing cost-to-income ratio or median income-to-median price ratio for a more comprehensive analysis.

- **Broaden Model Scope:** Policymakers ought to consider making use of augmented SVAR or Factor-Augmented VAR (FAVAR) models to register other latent factors that also influence both housing and monetary transmission.
- **Monetary Policy Coordination:** Since tightening of monetary policy will significantly depress GDP and household prices, monetary authorities should coordinate with fiscal authorities to ensure that complementary policies (e.g., housing subsidies or affordable loan programs) offset potential negative repercussions on affordability.
- **Macroprudential Tools:** In conjunction with interest rate changes, targeted macroprudential measures (such as loan-to-value limits or mortgage stress testing) would more effectively influence housing affordability without broader contractionary spillovers.
- **Granger Causality Test Implementation:** To assess causal relationships, Granger Test on monetary policy shocks could be applied (like policy interest rate changes and quantitative easing) against housing affordability metric (like housing price index, cost-to-income ratio). The test can thus give empirical credibility to either of these positions, based on whether past values of monetary policy variables aid in predicting future movement in housing affordability, or the other way around. The implication of these findings would then enable policymakers to distinguish whether some specific policy action was proactive or reactive regarding influencing said trends in affordability, and thus identifying the lag structure through which housing markets would propagate these monetary interventions. Tests conducted over rolling windows or subsample periods would enable detecting structural breaks or evolving causal patterns over time.

D. Future Research

While this research provides new insights concerning evolving interest-rate and housing-price relationships in emerging economies, many more avenues remain for future inquiries. Such a widening-off scope and depth of analysis could unravel some of the broader mechanisms forming these interactions in light of recent changes in macroeconomic conditions, financial innovations, and demographic pressures. The following sketch of future directions presents some ideas on how, in time, future research could build on findings given in this study:

- **Cross-Country Comparative Analysis:** Future applications of this SVAR methodology may allow for comparative study across economies, whereby differences in institutions (e.g., mortgage systems, property taxation) qualify the housing response to monetary policy.
- **Disaggregate Housing Markets:** Regional or city-level housing markets could be analyzed to observe different impacts of monetary tightening in highly residential urban areas in contrast to rural areas.
- **Crisis Context-Based Monetary Policy:** Further, it may be to study how effectiveness diverges during downturns or crises (such as COVID-19) when interest rates are often close to the lower zero-bound, and unconventional monetary tools are utilized.
- **Distributional Impacts:** Future work should aim at analyzing the effects of interest rate changes on different income groups, renters vs. owners, or first-time homebuyers. This would create a more social footprint for research that ties monetary policy to housing inequality.

- **Dynamic Interaction with Credit Markets:** Integrating bank lending behavior, credit availability, and levels of household debt into a larger DSGE or Bayesian VAR framework would give a better perspective on how monetary transmission impacts affordability.
- **Granger Causality Extensions:** Incorporating Granger causality analysis across different subsamples (e.g., pre-crisis vs. post-crisis periods or developed vs. emerging markets) can help identify structural shifts in causality between interest rates and housing prices over time.

E. Conclusion

This chapter analyses the complex and multifaceted interplay among interest rates and housing prices within emerging markets, where the context-specific dynamics arguably play an important role in determining most monetary transmission mechanisms. While typically useful in cases such as South Africa, this has less appeal for countries like Indonesia and Brazil, suggesting just how far the generalization stretches in a one-size-fits-all monetary policy. On the other hand, although the SVAR methodology provides strong analytic tools, the constraints of simplified assumptions and limited data indicate the need for more nuanced frameworks. Policy recommendations indicate the need to include income-based affordability measures, expanded model specifications, and improved coordination of monetary and fiscal instruments. The future of research will involve unpacking factors such as institutional, regional, or socio-economic ones, thereby enriching the policy dialogue on housing-affordability and monetary effectiveness in a rapidly changing global landscape.

APPENDIX

SVAR MODULE DATA

Table 2: Required Data for SVAR Module in Brazil

	Brazil (2000 - 2023)				
	CPI	Interest Rate (%)	GDP	Household Prices	Exchange Rate
Q1 2000	1.501095	18.85	192382.703125	28.5500	1.7749
Q2 2000	0.694787	18.04	194950.703125	28.6128	1.8024
Q3 2000	2.737228	16.56	197628.703125	28.6728	1.8157
Q4 2000	1.140549	16.19	199873.406250	28.7327	1.9309
Q1 2001	1.510747	15.39	200321.406250	28.8298	2.0192
Q2 2001	1.440039	17.28	199598.203125	29.0211	2.2883
Q3 2001	2.389699	19.06	198735.203125	29.3466	2.5540
Q4 2001	1.952676	19.05	197772.703125	29.8662	2.5508
Q1 2002	1.638334	18.72	202820.906250	30.6399	2.3830
Q2 2002	1.607189	18.10	203522.703125	31.6734	2.5041
Q3 2002	2.228887	17.89	206073.203125	32.8753	3.1348
Q4 2002	4.803863	23.03	208095.093750	34.0973	3.6719
Q1 2003	6.219476	26.32	207426.500000	35.2336	3.4966
Q2 2003	2.684371	26.09	205691.500000	36.2385	2.9831
Q3 2003	0.79153	21.02	207419.296875	37.1264	2.9363
Q4 2003	1.328185	16.91	209566.500000	37.9287	2.9011
Q1 2004	1.793661	16.19	212686.093750	38.6853	2.8981
Q2 2004	1.4702	15.80	218409.406250	39.4447	3.0465
Q3 2004	2.137139	16.09	221127.203125	40.2669	2.9772
Q4 2004	1.646374	17.50	222927.203125	41.2062	2.7849
Q1 2005	1.991859	18.97	224823.000000	42.3111	2.6642
Q2 2005	1.80176	19.75	227267.703125	43.6130	2.4821
Q3 2005	0.631056	19.61	225916.906250	45.1233	2.3420
Q4 2005	1.534234	18.24	229055.796875	46.8334	2.2485
Q1 2006	1.436587	16.74	232271.406250	48.7463	2.1927
Q2 2006	0.630222	15.18	233279.500000	50.8818	2.1824
Q3 2006	0.186382	14.17	237182.093750	53.2686	2.1705
Q4 2006	0.855814	13.19	240128.000000	55.9323	2.1496
Q1 2007	1.285565	12.74	244259.500000	58.8844	2.1066
Q2 2007	0.925743	12.03	248569.203125	62.0934	1.9820
Q3 2007	0.896089	11.22	251137.296875	65.5280	1.9152
Q4 2007	1.080874	11.18	254783.703125	69.2024	1.7836
Q1 2008	1.655358	11.18	258192.296875	73.1794	1.7363
Q2 2008	1.818636	12.09	263462.593750	77.5104	1.6542
Q3 2008	1.565746	13.39	267422.312500	82.2041	1.6686

Q4 2008	1.053862	13.66	257445.906250	87.1917	2.2823
Q1 2009	1.224794	11.70	254018.203125	92.3279	2.3157
Q2 2009	1.234865	9.54	258494.906250	97.4869	2.0767
Q3 2009	0.818164	8.65	264582.500000	102.5916	1.8656
Q4 2009	0.889612	8.65	271220.312500	107.5936	1.7385
Q1 2010	1.838051	8.65	277055.500000	112.4642	1.8031
Q2 2010	1.468748	9.94	280525.406250	117.1293	1.7917
Q3 2010	0.32976	10.66	283002.812500	121.3890	1.7486
Q4 2010	1.838362	10.66	286891.812500	125.1062	1.6974
Q1 2011	2.34175	11.62	291074.406250	128.3980	1.6661
Q2 2011	1.936686	12.10	293668.000000	131.5156	1.5941
Q3 2011	0.842327	11.91	293174.812500	134.6076	1.6361
Q4 2011	1.426993	10.90	295959.500000	137.7139	1.7986
Q1 2012	1.442744	9.82	291804.000000	140.8230	1.7657
Q2 2012	1.200517	8.39	296813.187500	143.8892	1.9605
Q3 2012	1.070745	7.39	301991.500000	146.8527	2.0281
Q4 2012	1.78129	7.16	302192.500000	149.7106	2.0578
Q1 2013	2.157773	7.15	303653.687500	152.7426	1.9951
Q2 2013	1.402414	7.90	308015.906250	154.9895	2.0703
Q3 2013	0.604148	8.90	309299.312500	156.4712	2.2856
Q4 2013	1.559028	9.90	309887.312500	157.2306	2.2771
Q1 2014	2.124724	10.65	312180.593750	157.2906	2.3634
Q2 2014	1.964029	10.90	308096.687500	156.7567	2.2293
Q3 2014	0.788221	10.90	307788.687500	155.8460	2.2769
Q4 2014	1.491117	11.58	309134.000000	154.7554	2.5480
Q1 2015	3.219993	12.58	306621.812500	153.5962	2.8643
Q2 2015	2.774191	13.58	299666.906250	152.4485	3.0700
Q3 2015	1.727688	14.15	294974.593750	151.3493	3.5491
Q4 2015	2.26515	14.15	292113.593750	150.3786	3.8473
Q1 2016	3.017026	14.15	288139.906250	149.5935	3.9060
Q2 2016	1.843615	14.15	288991.093750	149.0396	3.5090
Q3 2016	1.337939	14.15	287533.812500	148.7427	3.2466
Q4 2016	0.68145	13.65	287274.000000	148.7142	3.2921
Q1 2017	0.946327	12.15	290028.812500	148.9426	3.1411
Q2 2017	0.547028	10.15	292338.500000	149.3765	3.2129
Q3 2017	0.369895	8.35	293301.500000	150.0189	3.1599
Q4 2017	0.926378	7.00	295030.312500	150.9125	3.2501
Q1 2018	0.922503	6.58	296392.812500	152.1402	3.2471
Q2 2018	1.077813	6.40	296321.906250	153.7847	3.6038
Q3 2018	1.404525	6.40	299008.812500	155.8831	3.9547
Q4 2018	0.649867	6.40	298387.812500	158.4240	3.8102
Q1 2019	0.88944	6.40	299244.187500	161.4446	3.7669
Q2 2019	1.306717	6.40	301024.593750	164.9106	3.9149
Q3 2019	0.300288	5.71	300914.593750	168.7249	3.9733

Q4 2019	0.836184	4.59	303385.500000	172.5934	4.1143
Q1 2020	1.338006	3.95	296690.093750	176.1622	4.4615
Q2 2020	0.347215	2.58	270496.500000	179.1856	5.3816
Q3 2020	0.781638	1.90	291806.687500	181.5410	5.3807
Q4 2020	2.431924	1.90	302607.593750	183.1769	5.4061
Q1 2021	2.343977	2.23	305580.312500	184.1362	5.4719
Q2 2021	1.95719	3.76	303685.687500	184.7300	5.2941
Q3 2021	2.579839	5.44	304042.906250	185.3496	5.2296
Q4 2021	3.222384	8.76	307573.000000	186.2889	5.5878
Q1 2022	2.580508	11.15	310197.812500	187.7135	5.2349
Q2 2022	3.036513	12.88	313814.312500	189.6835	4.9213
Q3 2022	0.417887	13.65	316917.187500	192.2273	5.2507
Q4 2022	0.756657	13.65	318206.000000	195.2507	5.2552
Q1 2023	1.889189	13.65	322586.812500	198.5939	5.1939
Q2 2023	1.494222	13.65	325169.187500	202.0941	4.9522
Q3 2023	0.383775	12.98	325808.000000	205.6372	4.8801
Q4 2023	0.866153	11.88	326297.593750	209.1574	4.9512

Table 3: Required Data for SVAR Module in Indonesia

	Indonesia (2000 - 2023)				
	CPI	Interest Rate (%)	GDP	Household Prices	Exchange Rate
Q1 2000	32.42037	11.2133	1012908.5000	-	7590
Q2 2000	32.74737	11.2733	1007085.1250	-	8735
Q3 2000	33.47842	13.5600	1031621.8125	-	8780
Q4 2000	34.43233	14.1400	1061287.2500	-	9595
Q1 2001	35.44663	15.0367	1053724.5000	-	10400
Q2 2001	36.40054	16.3567	1064503.0000	-	11440
Q3 2001	37.75018	17.4700	1064723.7500	-	9675
Q4 2001	38.78531	17.6000	1079803.5000	-	10400
Q1 2002	40.60357	16.8500	1092967.3750	139.3968	9655
Q2 2002	41.02012	15.7433	1107016.7500	140.2587	8730
Q3 2002	41.66786	14.1667	1121225.6250	139.9494	9015
Q4 2002	42.74882	13.0300	1133346.8750	137.5584	8940
Q1 2003	43.77146	12.1100	1148138.2500	137.5344	8908
Q2 2003	43.97974	10.3433	1161156.6250	139.1240	8285
Q3 2003	44.32547	8.8900	1173320.7500	140.0263	8389
Q4 2003	45.18357	8.4267	1184885.0000	138.1515	8465
Q1 2004	45.88963	7.6600	1198807.2500	137.0134	8587
Q2 2004	46.78731	7.3300	1213143.8750	136.0705	9415
Q3 2004	47.29967	7.3733	1227905.7500	135.8428	9170
Q4 2004	48.03280	7.4167	1262459.8750	134.3467	9290

Q1 2005	49.44492	7.4300	1272698.7500	132.0823	9480
Q2 2005	50.37175	7.9667	1287273.7500	131.0152	9713
Q3 2005	51.27151	9.0833	1301458.2500	129.5311	10310
Q4 2005	56.57423	12.0000	1319954.1250	119.6483	9830
Q1 2006	57.80307	12.7500	1337393.6250	119.9825	9075
Q2 2006	58.18630	12.5833	1354469.2500	119.6010	9300
Q3 2006	58.89652	11.7500	1376301.8750	118.8713	9235
Q4 2006	59.99831	10.2500	1398245.3750	117.3973	9020
Q1 2007	61.47916	9.2500	1420985.8750	114.8509	9118
Q2 2007	61.69160	8.7500	1444669.5000	115.2280	9054
Q3 2007	62.72882	8.2500	1467445.7500	113.6946	9137
Q4 2007	64.03263	8.1667	1480154.0000	111.9200	9419
Q1 2008	66.17996	8.0000	1513322.8750	109.0932	9217
Q2 2008	67.99197	8.2500	1535377.7500	106.5868	9225
Q3 2008	70.18929	9.0000	1555748.2500	102.8170	9378
Q4 2008	71.13071	9.4167	1558398.0000	101.9431	10950
Q1 2009	71.24525	8.2500	1579535.2500	102.2484	11575
Q2 2009	71.22859	7.2500	1599868.7500	102.9899	10225
Q3 2009	72.13043	6.5833	1624617.3750	102.1505	9681
Q4 2009	72.97187	6.5000	1648588.5000	101.6649	9400
Q1 2010	73.85080	6.5000	1675340.1250	101.1526	9115
Q2 2010	74.34233	6.5000	1703291.7500	101.5211	9083
Q3 2010	76.56673	6.5000	1728932.7500	99.0352	8924
Q4 2010	77.58104	6.5000	1756568.5000	98.3973	8991
Q1 2011	78.89526	6.6667	1782103.3750	98.9325	8709
Q2 2011	78.72240	6.7500	1807988.2500	100.2263	8597
Q3 2011	80.14076	6.7500	1835379.0000	98.9294	8823
Q4 2011	80.77600	6.1667	1862164.6250	99.2897	9068
Q1 2012	81.83405	5.8333	1890231.2500	98.8626	9180
Q2 2012	82.26102	5.7500	1918494.7500	99.5703	9480
Q3 2012	83.73562	5.7500	1945631.1250	99.1251	9588
Q4 2012	84.33546	5.7500	1972726.2500	102.0747	9670
Q1 2013	85.70163	5.7500	2000098.1250	105.0269	9719
Q2 2013	86.56249	5.8333	2025736.7500	106.2543	9929
Q3 2013	90.32704	6.9167	2052275.2500	104.1581	11613
Q4 2013	90.87512	7.4167	2078387.8750	105.3673	12189
Q1 2014	92.35326	7.5000	2103052.7500	105.1854	11404
Q2 2014	92.69926	7.5000	2129143.7500	106.5637	11969
Q3 2014	94.25768	7.5000	2153970.5000	106.3295	12212
Q4 2014	96.75999	7.5833	2178699.5000	105.1779	12440
Q1 2015	98.39591	7.5833	2205433.5000	104.9153	13084
Q2 2015	99.24847	7.5000	2231060.5000	105.4536	13332
Q3 2015	100.93980	7.5000	2258599.0000	104.7136	14657
Q4 2015	101.41590	7.5000	2287424.0000	104.9789	13795

Q1 2016	102.66150	7.0000	2315005.7500	104.7312	13276
Q2 2016	102.68360	6.6667	2344363.5000	105.3797	13180
Q3 2016	103.99290	5.5833	2373256.2500	104.4301	12998
Q4 2016	104.76520	4.7500	2401987.7500	104.0400	13436
Q1 2017	106.40390	4.7500	2432127.0000	103.7015	13321
Q2 2017	107.09040	4.7500	2462375.5000	104.2506	13319
Q3 2017	107.95120	4.5000	2493307.7500	103.9382	13492
Q4 2017	108.43010	4.2500	2525118.0000	104.0476	13548
Q1 2018	109.89160	4.2500	2557357.7500	104.1168	13756
Q2 2018	110.57530	4.7500	2589577.0000	104.0773	14404
Q3 2018	111.28670	5.5000	2622797.5000	103.7329	14929
Q4 2018	111.87080	5.9167	2656119.5000	103.5621	14481
Q1 2019	112.77590	6.0000	2689235.7500	103.1088	14244
Q2 2019	114.05200	6.0000	2722677.0000	102.1774	14141
Q3 2019	115.07070	5.5000	2754043.5000	101.5732	14174
Q4 2019	115.17030	5.0000	2783199.0000	101.8454	13901
Q1 2020	116.06970	4.7500	2766517.5000	101.3679	16367
Q2 2020	116.46190	4.4167	2576608.5000	101.3277	14302
Q3 2020	116.45080	4.0000	2660288.5000	101.5166	14918
Q4 2020	116.86150	3.8333	2719584.5000	101.4023	14105
Q1 2021	117.73110	3.5833	2748568.5000	100.8933	14572
Q2 2021	118.18260	3.5000	2760994.5000	100.8077	14496
Q3 2021	118.27880	3.5000	2767809.5000	100.9689	14307
Q4 2021	118.91890	3.5000	2842687.2500	100.8287	14269
Q1 2022	120.42870	3.5000	2876287.5000	100.1885	14349
Q2 2022	122.66370	3.5000	2910040.5000	98.7306	14848
Q3 2022	124.42140	3.8333	2943294.5000	97.8429	15247
Q4 2022	125.51300	5.1667	2980625.2500	97.4461	15731
Q1 2023	126.73780	5.7500	3016956.7500	96.9761	15062
Q2 2023	127.50750	5.7500	3056265.5000	96.7740	15026
Q3 2023	127.99600	5.7500	3094713.5000	96.9029	15526
Q4 2023	128.87660	6.0000	3133457.7500	96.4337	15416

Table 4: Required Data for SVAR Module in South Africa

	South Africa (2000 - 2023)				
	CPI	Interest Rate (%)	GDP	Household Prices	Exchange Rate
Q1 2000	2.789548	9.92846153846154	696879.8750	56.8612	6.29869126262626
Q2 2000	4.927842	10.12951655011660	703291.1250	55.1598	6.85445145573381
Q3 2000	6.598806	10.18129230769230	710256.3750	53.0921	6.99716254689755
Q4 2000	7.013259	10.20280885780890	716300.3750	52.0144	7.59514831649831
Q1 2001	7.420131	10.14498931623930	720702.1875	51.7566	7.82498910533910

Q2 2001	6.407246	10.2358643356643 0	724303.5000	52.0612	8.03474276094276
Q3 2001	4.774448	9.38068376068376	726228.3750	53.5547	8.37820183413078
Q4 2001	4.303880	8.94355526652628	731815.3750	55.2154	10.1974168935734 0
Q1 2002	5.768631	9.59423076923077	739763.0000	55.1730	11.5336856618820 0
Q2 2002	7.832208	11.0648183760684 0	749149.5000	54.9214	10.4599806220096 0
Q3 2002	10.71723 0	11.6366975308642 0	757628.6250	55.0861	10.4374164803313 0
Q4 2002	13.56937 0	12.3493249101945 0	763932.0000	55.6828	9.66197057971013
Q1 2003	11.40299 0	12.5682995726496 0	768781.1875	57.2377	8.34548166666667
Q2 2003	8.284878	12.1675622445188 0	772535.6875	59.6370	7.76736665831245
Q3 2003	4.384736	10.1863316239316 0	776728.1250	63.2938	7.42342374051070
Q4 2003	-0.728545	7.74130246913580	781209.3125	69.1859	6.74077340579710
Q1 2004	-1.761435	7.60888888888889	793035.1250	74.4365	6.78048906926407
Q2 2004	-1.719961	7.77131515151515	804117.3750	79.2104	6.59425608465608
Q3 2004	-0.882401	7.48506666666667	817265.6875	84.3495	6.38070252525253
Q4 2004	1.650220	7.26702991452991	825993.5000	90.6077	6.06119920634921
Q1 2005	1.933485	7.23671666666667	834390.5000	96.6460	6.00237523809524
Q2 2005	1.860981	6.81946666666667	849364.1250	100.4208	6.41429793650794
Q3 2005	2.395897	6.73074358974359	860946.1875	103.7278	6.50960418470418
Q4 2005	2.059879	6.83320000000000	866709.0000	107.9251	6.53161833333333
Q1 2006	2.046772	6.64661111111111	881938.5000	111.0045	6.15435587301587
Q2 2006	2.540835	6.85525081585082	894464.1875	113.2757	6.45500980816569
Q3 2006	3.762170	7.57180000000000	906818.1250	114.5250	7.15242081529582
Q4 2006	4.604133	8.28163879598662	919357.8125	117.1931	7.31747910685806
Q1 2007	5.139408	8.54735042735043	934285.1250	120.0777	7.23613736652237
Q2 2007	6.013766	8.59726153846154	941942.1250	122.6142	7.10472075517076
Q3 2007	6.282339	9.15635683760684	952981.1250	123.3962	7.11322559808613
Q4 2007	7.232645	10.1538141541765 0	966485.6250	121.4059	6.76958227199532
Q1 2008	8.803958	10.3251820512821 0	970544.8750	116.0920	7.53804536720589
Q2 2008	9.737199	10.76279444444444 0	982394.1250	110.3597	7.78006460317460
Q3 2008	11.10908 0	11.2921925925926 0	984741.3750	104.7780	7.78494478951001
Q4 2008	9.943172	10.8492382716049 0	979135.8125	103.8669	9.94816818840579
Q1 2009	8.874802	9.49523504273504	963904.8750	102.1190	9.97330045454547
Q2 2009	8.179012	7.72840000000000	960596.6875	99.5849	8.45038646464647
Q3 2009	6.268657	7.16248888888889	962824.3750	98.2343	7.77802776209298
Q4 2009	5.769231	7.00907839506173	969246.1250	99.3723	7.46788154840329
Q1 2010	5.312955	7.04538034188034	980554.6250	100.2780	7.49513243616287

Q2 2010	4.136947	6.57045217391304	988785.5000	100.0049	7.53982106782107
Q3 2010	3.441011	6.32525925925926	997588.1250	99.4554	7.29924242424242
Q4 2010	3.426574	5.73516025641026	1006873.5000	100.2652	6.88642257983563
Q1 2011	3.731859	5.52442307692308	1016789.1875	99.7298	6.99320079365079
Q2 2011	4.657534	5.46013260869565	1022479.8125	98.5301	6.77926190476190
Q3 2011	5.363204	5.48923076923077	1026710.6250	98.1617	7.13923749921576
Q4 2011	6.220419	5.47722222222222	1033734.1875	98.2698	8.08460101010101
Q1 2012	6.129247	5.50581538461538	1039593.8125	98.3836	7.74555844155844
Q2 2012	5.955497	5.56884615384615	1048271.6875	97.6300	8.11993857832988
Q3 2012	5.219072	5.12231837606838	1052533.5000	97.4944	8.25952687747036
Q4 2012	5.665182	4.95176534951897	1057553.5000	97.4371	8.68454520358868
Q1 2013	5.963591	5.04719017094017	1065760.2500	97.7172	8.94937684610076
Q2 2013	5.558987	5.09110228539576	1073512.5000	98.0430	9.49248889249640
Q3 2013	6.246173	5.09122777777778	1078605.7500	98.3638	9.98694814291988
Q4 2013	5.361446	5.08342788719600	1084412.5000	99.4130	10.16209312535290
Q1 2014	5.746446	5.50482777777778	1082916.7500	99.6331	10.85548329537610
Q2 2014	6.612054	5.75346313131313	1087190.7500	99.4481	10.54490880230880
Q3 2014	6.397695	6.01173333333333	1092415.5000	99.2461	10.76576371321910
Q4 2014	5.774728	5.92234224369297	1100595.2500	100.1837	11.21855971014490
Q1 2015	4.257703	5.89601953601954	1108545.3750	101.5742	11.74289863636360
Q2 2015	4.500549	5.76004306418219	1099186.3750	100.9271	12.08808870851370
Q3 2015	4.496208	6.14552179487180	1104137.3750	100.5525	13.00598408620360
Q4 2015	4.810811	6.40722692307692	1108923.3750	101.9799	14.22189214348450
Q1 2016	6.555615	6.94388803418803	1111572.2500	100.9652	15.82574195997240
Q2 2016	6.512605	7.17733333333333	1112641.7500	99.7221	15.00163228715730
Q3 2016	6.480042	7.31315897435897	1112506.2500	99.4996	14.06730366867430
Q4 2016	6.859206	7.47793803418803	1113450.7500	99.3391	13.91853950216450
Q1 2017	6.505295	7.31912222222222	1118707.7500	98.4989	13.22408498682480
Q2 2017	5.226824	7.39597902097902	1124808.1250	98.7780	13.19639406126480

Q3 2017	4.527750	7.19889328063241	1126876.625 0	98.9116	13.1854643547274 0
Q4 2017	4.536680	7.41345760233918	1131309.250 0	98.9382	13.6172828282828 0
Q1 2018	3.929924	7.16730303030303	1137294.250 0	98.3998	11.9638017127800 0
Q2 2018	4.311153	7.00638072453862	1134466.250 0	97.8033	12.6643135955831 0
Q3 2018	4.890545	7.11200956937799	1148418.125 0	97.3279	14.0784121113307 0
Q4 2018	4.893814	7.33607890499195	1151604.875 0	97.3833	14.2838866098877 0
Q1 2019	4.145786	7.26766666666667	1141546.375 0	97.5202	14.0251328761215 0
Q2 2019	4.402516	7.12755764411028	1146708.625 0	96.1354	14.3832275263505 0
Q3 2019	4.174067	6.96217563837129	1147913.875 0	95.4617	14.6824882301274 0
Q4 2019	3.697183	6.97962732919255	1147498.250 0	95.7377	14.6979300034506 0
Q1 2020	4.330709	6.42749230769231	1147036.750 0	94.5074	15.3771920388669 0
Q2 2020	2.366609	4.45248695652174	953846.1875	95.0363	17.9438378210678 0
Q3 2020	3.069054	3.69490864197531	1085060.875 0	95.2250	16.9117768322981 0
Q4 2020	3.183362	3.60758580246914	1114960.500 0	96.6574	15.6127410116695 0
Q1 2021	3.102725	3.79880000000000	1121623.250 0	97.4873	14.9546129382333 0
Q2 2021	4.960067	3.71253132832080	1137721.750 0	97.6422	14.1223603535353 0
Q3 2021	4.921422	3.81168831168831	1118356.250 0	97.1134	14.6291136363636 0
Q4 2021	5.471000	3.81222222222222	1136314.250 0	97.1332	15.4262019151139 0
Q1 2022	5.815372	3.68944733044733	1151125.125 0	96.9176	15.2200685093168 0
Q2 2022	6.688025	4.62833333333333	1140330.750 0	95.7224	15.5911920274170 0
Q3 2022	7.922743	5.63388167388167	1162541.125 0	93.9390	17.0417225782671 0
Q4 2022	7.683307	6.30333014354067	1146303.125 0	93.6304	17.6116878787879 0
Q1 2023	7.302075	6.71395598845599	1153529.250 0	92.9149	17.7602843873518 0
Q2 2023	6.418919	8.08257321110262	1161487.500 0	91.6078	18.6588639031620 0
Q3 2023	5.003652	8.44313059163059	1156701.125 0	90.2691	18.6397865769496 0
Q4 2023	5.650127	8.50422558922559	1160714.750 0	89.5363	18.7423389249639 0

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