The Effectiveness of Monetary Policy and Financial Stability: Critical Perspective from South Mediterranean Countries

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Abstract:

This paper examines the relationship between the effectiveness of monetary policy and financial stability for south Mediterranean economies. The study employs annual panel data ranging from 2000-2022 for a set of variables (Z-Score, money market interest rate, GDP growth, consumer price index and real effective exchange rate). Cointegration analysis suggests no long-term relationships among the variables, leading to the use of a Vector Autoregressive (VAR) model to capture short-term dynamics. Results indicate that changes in interest rates have a negative impact on financial stability, affecting borrowing costs, debt servicing and asset valuations, However, GDP growth indirectly influences financial stability. Fluctuations in consumer prices can impact financial stability through inflationary pressures and monetary policy measures. While, changes in the real effective exchange rate affect export competitiveness, external debt burden, and overall macroeconomic stability. The study suggests that by understanding the short-term interdependencies and the effects of external factors, policymakers and financial institutions can make

informed decisions to promote and maintain stability in the financial system.

Keywords: Monetary Policy, Financial Stability, SVAR, Granger Causality

1. Introduction:

There is an extensive argument about the association between monetary policy and financial stability. However, there is no clear certainty on how one affects the other, and whether there are trade-offs or synergies between them (Schwart, 1995; Bernanke and Gertler, 1999; Herrero and Del Rio, 2003). The global financial crisis followed by protracted economic recovery, in addition to prolonged uncertainty of financial instability, have provoked reluctance regarding the role of monetary policy on both price stability and financial stability goals (Reinhart and Rogoff, 2009; Bordo and Siklos 2015). Ajello (2020) argued that with a stable financial sector, price stability cannot be ensured due to the noticeable trade-off between inflation and financial stability.

Financial stability has been a crucial concern for central banks because of its potential for an adverse impact on price stability (Bean et al., 2010; Blanchard et al., 2010; Mishkin, 2010; Goodhart, 2000; Leeper and Nason, 2014; Smets, 2014, Dreschler et al., 2019). Further, it causes a significant reduction in economic growth, which leads to more unemployment and

welfare loss as claimed by Altavilla and Ciccarelli (2009) and Cardarelli et al. (2011). Moreover, Juselius et al. (2017) pointed out that monetary policy has a long-lasting impact on output and real interest rates throughout the financial cycle.

There are debatable and opposite schools of thought in the literature explaining the role of monetary policy in financial stability. The 'conventional wisdom hypothesis' states that "monetary policy focusing on price stability mitigates financial market imbalances and achieves financial stability[1]" (Schwartz, 1995, P. 21). So forth, monetary policy can affect the determinants of financial imbalances such as credit, liquidity, risk- taking through better information sharing and strong coordination with financial sectors (Riksbank, 2013). One such instance is inflation targeting monetary policy, it is argued that an inflation target, which stimulates price stability, leads to better financial stability up to a certain level (Svensson, 1997; Bordo et al., 2002; Holub and Hurn, 2008; Woodford, 2012; Svensson, 2015). In an inflation targeting regime, price stability enhances the financial market efficiency by ensuring a smooth flow of funds and risk diversification across markets. On the contrary,

[1] At a micro level, low inflation, which is a proxy for price stability, leads to a reduction in uncertainty and consequently increases investment, which leads to financial stability. At a macro level, price stability increases the value of collateral and reduces financial vulnerability. Therefore, monetary policy can achieve financial market stability without harming price stability.

the ‘new environment hypothesis’ proposed by Borio and Lowe (2002) and Borio et al. (2003), posits that price stability might not guarantee financial stability. They juxtaposed that financial instability can be observed even when price stability is achieved and that monetary policies should be designed in consideration of both financial stability and price stability. Therefore, monetary policies with high credibility can ensure price stability and improve the expectations of economic actors. As mentioned by Hellwig (1995), Issing (2003) and Granville and Mallick (2009). It is therefore assumed by Blot et al. (2015) that expectations cause the formation of bubbles in debt asset prices and the accumulation of systemic risks, monetary policy designs that do not provide expectations channels cannot prevent but rather deepen financial instabilities.

However, the 2008 financial crisis brought up serious uncertainty about the role of monetary policy in ensuring financial stability. Various studies advocated that tools of monetary policy may not always be sufficient condition to reach considerable levels of financial stability, alternatively, they may direct the market to more financial instability (Forbes and Warnock, 2011; Fratzscher, 2011; Frankel and Saravelos, 2012; Chen et al., 2015; Melecky and Podpiera, 2015). The focus on low inflation and low interest rates may encourage more leverage

in the financial market (White 2006)[2]. Therefore, if price stability is accompanied by greater financial market fragility, then inflation targeting policy, which is fully focused on the objective of price stability may encounter a serious problem. Witch means inflation target systems are more subject to financial instability than systems that do not follow the mandate of price stability as the prime goal of monetary policy (Caruana, 2011; Acharya and Naqvi, 2012; Sethi and Acharya, 2019).

Moreover, since inflation spiked in 2021, the volatility of interest rates has increased greatly. These economic developments have stimulated concerns about the effects of interest rates on the stability of the financial system. In particular, policy-makers have expressed interest in financial stability, pointing to recent increases in interest rates as potential threats (ECB, 2021a; IMF, 2022).

The relationship between the effectiveness of monetary policy and financial stability is essential as it impacts macroeconomic stability, involves feedback loops, addresses systemic risks and entails policy trade-offs. For these reasons, this topic requires further consideration, as it might maneuvere central banks' arrangements and policy responses to enhance

[2] A persistent low interest rate regime has leveraged the investors' portfolio with the aim of higher returns, which has caused a boom in the financial market and later a financial crisis.

monetary and financial stability. The organization of this paper is as follows: following the introduction, section 2 highlights the related literature. Section 3 describes data and methodology used in the analysis. Section 4 presents the main outcome and discussion of the findings. Section 5 is the conclusion.

2. Review of Literature:

Interest in the analysis of the monetary policy transmission mechanism has increased in the last decade. There are various studies examining the importance of monetary policy in maintaining financial stability. An early attempt was made by Schwartz (1995), which states that monetary policy committed to price stability is likely to achieve financial stability. Before the crisis, economists reached a wide consensus regarding the justification of the frame of the central bank and its main role in price stability. Price stability is the main aim of monetary policy and it is independent of financial stability (Goodhart, 2006). The concern of the central bank about financial stability remains a centre of debate for economists and policymakers, which led to 'financial domination' (Frappa and Mésonnier, 2010). The monetary policy tightening arranged by major central banks has led to a sharp negative impact on the financial institutions that were not well structured to cope with shocks (Whelan, 2023).

Literature has pointed out the dilemma of monetary policy and financial stability from several viewpoints. Geraats (2010)

argued that whether price and financial stability are complementary or contradictory, depends on the type of economic shocks. Jonsson and Moran (2014) claimed that a trade-off between monetary policy and financial stability may arise if supply shocks drive economic fluctuations. While Kim and Mehrotra (2015) suggested that there may have been a short-term policy trade-off for central banks with both financial and price stability objectives. As mentioned by several studies, the pre-crisis conventional view accepted the policy rate is an ineffective instrument to contain asset price movements and that central banks should act against the adverse consequences of a bubble unwinding (Bernanke and Gertler 2001; Greenspan, 2002; Bean, 2004; Mishkin, 2011). The opposite view held the asymmetric nature of the costs of policy errors and advocated the merits of the 'pre-emptive' policy, which conducted because of financial imbalances accumulation, aiming to prevent the potential adverse consequences in the aftermath of a crisis (Goodhart, 1995; Kent and Lowe, 1997; Shiratsuka, 1999; Cecchetti et al., 2000; Borio and Lowe, 2002; Bordo and Jeanne, 2002; White 2006; Kokores, 2015).

Many studies pointed out that there was limited focus on the financial imbalances that resulted in a near breakdown of the global financial system (Grauwe, 2007; Leijonhufvud, 2008; Giavazzi and Giovannini, 2010; Cairo and Sim, 2020). An implicit assumption is that "the low and predictable inflation delivered by inflation

targeting would promote financial robustness" (Kuttner, 2013, P. 10). The global financial crisis casts doubt on such optimism. Barrett, et al. (2017) concluded that when a central bank addresses financial stability as a main and systematic component of its decision making process, namely as an explicit monetary policy objective, then policy yields better results in terms of anchoring inflation expectations to the central bank's inflation target and enhancing financial sector profitability when conducted under commitment to a rule.

The risks to financial stability inherent in the financial system and the perceived trade-offs are substantial. Borio and Lowe remarked that "perceived trade-offs are themselves to a significant degree a function of what we think we know about the workings of the economy and the role of policy, … [this] determines views about the consequences of actions and of failures to act by the central bank, and such views change over time, in the light of evolving circumstances" (Borio and Lowe, 2002, p. 26). The recent severe financial crisis and the consequent recession are stark examples of such a shift in attitude (Cardarelli, 2011). The literature in favor of monetary policy under risks to financial stability puts forward the conclusion that the monetary authorities should exercise their policy with more flexibility and over longer policy horizons (Hellwig, 1995; Kent and Lowe, 1997; Farooq-Akram et al., 2007; Barrett et al. 2016).

In another contrasting view about the effect of interest rates

on the health of financial intermediaries. Traditionally, focuses were given on the maturity mismatch between the assets and liabilities of banks as the key measure of their exposure to interest rate risk (Kaufman, 1984; Gertler and Karadi, 2011). More recently, a different view, which emphasizes the exposure of banks' interest margins to interest-rate risk, has asserted itself. A large literature documents the association between interest rates and the stability of the financial system (Driscoll and Judson, 2013; Yankov, 2014; Borio et al., 2017; Drechsler et al., 2017; Claessens et al., 2018; Drechsler et al., 2021; Akinci et al., 2022).

The induction of macroprudential policies can enhance the trade-offs for monetary policy and surge the chance for maneuvere. Maintaining financial stability can help ensure a well-functioning financial system and an effective transmission process which makes achieving price stability more efficient (Bernanke, 2013; Bianchi and Mendoza, 2018; Adrian et al., 2019, Ampudia et al., 2020; Araujo et al., 2020)[34]. Mester (2017) supports that the macroprudential tools are reliable since they can be more targeted to the markets and institutions where the risks are emerging[5]. However, in Gali (2014) model, increasing

[3] By managing the financial cycle and increasing the resilience of the financial sector.

[4] For example, changes in policy interest rates or non-standard monetary policies may affect risk-taking behavior ex-ante and the tightness of credit constraints ex-post.

[5] The impact may depend on the underlying nature of the financial imbalance.

interest rates to combat a bubble can even expand it. Consequently, monetary policy is apt to be a narrow instrument depending upon the extent and span of the financial shock. Stein (2013) mentioned that one benefit of adopting monetary policy is that "it gets in all the cracks," meaning that a change in interest rates would affect all financial institutions and markets, whether regulated or not. Anand et al. (2015) in a situation in which the macroprudential tools proved to be inadequate and risks to financial stability remained to expand, monetary policy should be implemented as a counterpart.

There is mounting evidence about monetary policy response to the global financial crisis and how this may have affected the stability of the banking system. Unconventional monetary policy measures were arranged to avoid the risk of deflation (Hau and Lai, 2016; Di Maggio and Kacperczyk, 2017). These measures involved trade-offs, and the adverse spillovers on banks' intermediation capacity and risk-taking require close monitoring. These measures involved trade-offs, and the adverse spillovers on banks' intermediation capacity and risk-taking require close monitoring (ECB, 2021b). On the other hand, as concluded by Boyarchenko et al. (2022) it is difficult to empirically separate changes in monetary policy from other business cycle effects. The limited evidence does not necessarily rule out a link between monetary policy induced financial

vulnerabilities and the real economy; it can also mean that it is empirically difficult to identify a causal role of monetary policy.

3. Data and Methodology

3.1Data:

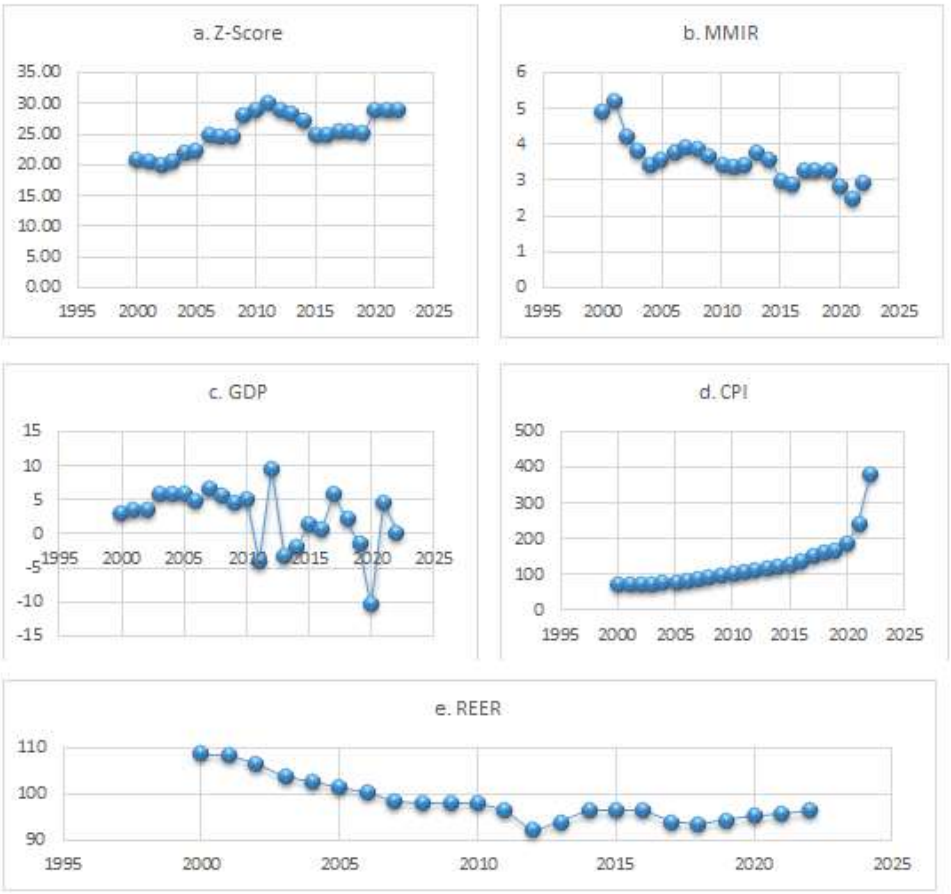
The main aim of this study is to investigate the nexus between monetary policy and financial stability, consequently examine how the selected financial variables respond against the interest rate shocks. This study is focusing on the South Mediterranean countries, including Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Syria and Tunisia. The rationale behind the selection of these countries stems from several reasons. These countries typically share similar economic characteristics, including similar economic structures, levels of development, and challenges. South Mediterranean countries often adopt a mix of monetary policy frameworks, such as inflation targeting, exchange rate targeting or monetary aggregates targeting. This variety of policy frameworks can provide valuable insights into the impact of different monetary policy strategies on financial stability. Furthermore, assigned countries have experienced significant financial instability, including currency crises, banking sector vulnerabilities and episodes of excessive credit growth. As a result, studying the relationship between monetary policy and financial stability in these countries can shed light on the effectiveness of policy measures in mitigating systemic risks and

promoting stability. The study employs annual data, ranging from 2000-2022. The chosen timeframe encompasses several significant events and economic developments that have had a substantial impact on studied countries. This includes the global financial crisis of 2007-2008, the debt crisis, various monetary policy measures implemented by central banks and other regional economic and financial challenges. Additionally, the majority of the selected countries underwent substantial economic reforms during the early 2000s, which influenced their monetary policy frameworks and financial systems. These reforms aimed to improve economic stability, enhance financial intermediation, and align monetary policies with global best practices. It is important to note that this duration enables a comprehensive evaluation to assess the short-term and long-term responses of the economy and financial system to various monetary policy actions. Data description and sources are presented at table 1, while data trends are displayed at figure 1(a-e).

Table 1: Variables Description and Sources

Abbreviation	Description	Source
	Dependent Variable	
Z-score	Bank Z-score	Global Financial Development Database-World Bank
	Independent Variables	
MMIR	Money market interest rate (%)	International Monetary Fund, International Financial Statistics and data files using World Bank data on the GDP deflator
GDP	GDP growth (annual %)	World Bank national accounts data, and OECD National Accounts data files
CPI	Consumer price index (2010 = 100)	International Monetary Fund, International Financial Statistics and data files
REER	Real effective exchange rate index (2010 = 100)	International Monetary Fund, International Financial Statistics

Figure 1: Plots of Data Series (2000-2022)



Source: Author's Preparation

To provide a foundational framework for further analysis, and identify patterns, trends and outliers, some descriptive measures are conducted (see table 2). It is remarked that the Z-score values range from 8.41 to 24.75, indicating variation in the standardized values. The mean Z-score of 16.79 represents the

average deviation from the mean in terms of standard deviations. The negative skewness (-0.226) suggests a slightly left-skewed distribution, indicating the presence of lower extreme values. Whereas, the interest rate values range from 0.47 to 7.12, indicating a wide range of borrowing costs or returns on investment. It is noted that the mean GDP is 2.92, this suggests the overall economic performance during the observed period. The median GDP is 3.20, which is slightly higher than the mean. This indicates a relatively symmetric distribution of GDP values. The minimum GDP is -5.1, suggesting a negative GDP value during the observed period, which could indicate an economic contraction. The kurtosis value of 7.83 indicates a highly peaked distribution with heavy tails, suggesting the presence of outliers or extreme values. Moreover, the CPI values show a range from 70.43 to 181.61, indicating a significant variation in price levels. Whilst, the REER values range from 86.80 to 123.20, indicating fluctuations in the strength of the country's currency.

Table 2: Descriptive statistics

	Z-SCORE	MMIR	REER	GDP	CPI
Mean	16.7987	3.555495	101.1228	2.926087	112.1612
Median	18.98	3.475000	100.2757	3.200002	104.5242
Maximum	24.75	7.120000	123.201	7.2	181.6199
Minimum	8.41	0.470000	86.80366	-5.1	70.43813
Std. Dev.	6.058119	1.204268	8.418537	2.304781	33.24271
Skewness	-0.226211	0.316758	1.061542	-1.554091	0.485087
Kurtosis	1.399602	2.925358	4.191634	7.836385	2.037015
Jarque-Bera	2.650712	3.085764	5.680502	31.67427	1.790718
Probability	0.265708	0.213764	0.058411	0	0.408461
Sum	386.37	647.1000	2325.824	67.3	2579.707
Sum Sq. Dev.	807.4179	262.4971	1559.179	116.8643	24311.71
Observations	182	182	182	182	182

Source: Author's Preparation

3.2Methodology

To assess the effect of monetary policy on the financial stability in Egypt, the Vector Autoregressive (VAR) approach is applied. The choice of the VAR for widely used in empirical studies dealing with the transmission mechanism of monetary policy. VAR models, as introduced by Sims (1980), consist of a system of dynamic linear equations, where all variables in this

system are considered as endogenous variables. Therefore, the reduced form of the system gives one equation for each variable, which states that variable as a function of its own lagged values and all lagged values of other variables in the system. There are several advantages of using the VAR methodology: 1) the model allows for the analysis of the dynamic interdependencies among multiple variables simultaneously. 2) Monetary policy and financial stability are subject to endogeneity and feedback effects, changes in monetary policy can impact financial stability, while financial stability conditions can, in turn, influence monetary policy decisions. The VAR model can account for these feedback effects and provide insights into the simultaneous interactions between these variables. 3) The VAR model allows for the examination of the dynamic relationships and adjustments between variables over time. It captures the lagged effects, short-term dynamics, and long-run equilibrium relationships among the variables included in the model. 4) VAR models enable researchers to conduct impulse response analysis, which provides information on the dynamic effects of a shock to one variable on all the variables in the system. However, The VAR modeling of the dynamic behavior of economic variables is not perceived as a technique based on the economic theory. This criticism may be justified by the reduced form of VAR model. Thus, the structural form (SVAR) is based an underlying a theoretical framework and centered on short and long term. In this case, the shocks affecting

the system are structural, this means that they reflect the particularities of the economic structures of the studied countries. For those reasons, this empirical study is based on a SVAR.

The SVAR has become a popular tool in recent years in the analysis of the mechanism and economic and monetary transmission fluctuations. In this study SVAR model is used to capture the impact of monetary policy shocks on the financial stability, trying to investigate the relationship between monetary policy and financial stability. The VAR modeling of the dynamic behavior of economic variables is not perceived as a technique based on the economic theory. This criticism may be justified by the reduced form of VAR model. However, the structural form is based an underlying a theoretical framework and centered on short and long term. In this case, the shocks affecting the system are structural, this means that they reflect the particularities of the economic structures of the studied countries. This study is empirically based on a SVAR. As per Hamilton (2022) VAR model been represented as:

$$Y_t = A_0 + A_1 Y_{t-1} + \cdots + A_p Y_{t-p} + U_t \quad (1)$$

With $y_t = (y_{tt}, \dots, y_{kt})$ vector of endogenous variables; A_0 is the vector of parameters $Kx1$; $A_1 \dots A_p$ are matrices of dimension parameters KxK and U_t is orthogonal vector with the following characteristics:

$$U_t \sim N(0, S) et\ E(U_t, U_s) = 0 \text{ for all } t \neq s.$$

The VAR model can be rewritten as follows:

$$A\left(I_k - A_1L + A_2L^2 - \cdots A_pL^p\right)Y_t = A\varepsilon_t = Be_t \quad (2)$$

Where L is the lag operator, ε_t is the vector of innovation with $\varepsilon_t \sim (0, S)\ et\ E(\varepsilon_t, \varepsilon_s) = 0$ for all $t \neq s$, $U_t = Be_t$. The matrices A and B represent a short-term system. Long-term analysis of this system requires the VAR model or $y_t$to fluctuate around its mean and matrices A and B are not singular. Therefore, by $\bar{A}\left(I_k - A_1L + A_2L^2 - \cdots A_pL^p\right)$, its inverse is obtained as $\bar{A}^{-1}$. By pre-multiplying the equation (2) by the inverse matrix, a long-term system is obtained as presented in equation (3).

$$Y_t = \bar{A}^{-1}Be_t = Ce_t \quad (3)$$

Then $C = \bar{A} - 1\ B$ is the long-term matrix response to shocks. Since the goal of the empirical analysis is to evaluate the response of the financial variables to the monetary policy shock, the methodology of the analysis of the impulse response is explained by the monetary policy shock. The correlation of the error term may indicate that a shock of a variable is likely by a shock of another variable. Therefore, it is assumed that the structural shocks are orthogonal, which means that the covariance matrix of the VAR residuals transmits information on the coefficients of the simultaneous relationships between endogenous variables. The relationship between the reduced form of disturbances U_t and structural shocks ε_t is as follows: $U_t = B^*\varepsilon_t$. Where B is the triangular matrix obtained from a Cholesky decomposition of the covariance matrix $\sum u$, as $BB' = \sum u$. ε_{it} represents the shock of monetary policy.

To investigate the impact of monetary policy on financial stability, selected variables can be categorized as; financial stability (dependent variable) measured by bank Z-score[6]; and monetary policy indicator, mainly the short run interest rate. A common measure of stability at the level of individual institutions is the Z-score. It explicitly compares buffers (capitalization and returns) with risk (volatility of returns) to measure a bank's solvency risk. The popularity of the Z-score stems from the fact that it has a clear (negative) relationship to the probability of a financial institution's insolvency, that is, the probability that the value of its assets becomes lower than the value of its debt. A higher Z-score therefore implies a lower probability of insolvency. Studies that used the Z -score for measuring the bank stability include; Boyd and Runkle (1993), Beck et al. (2007), Čihák (2007), Demirgüç-Kunt et al. (2008), Laeven and Levine (2009), Čihák and Hesse (2010), Baselga-Pascual et al. (2015), Chiaramonte et al. (2016), Altuntas and Rauch (2017), Bongini et al. (2018), Rubio-Misas (2020), Moreno et al. (2022), Kishwar et al. (2023) and others. However, several studies have created a composite index to measure financial stability (please see: Brave and Butters, 2011; Jakubík

[6] The Z-score is defined as $z \equiv (k+\mu)/\sigma$, where k is equity capital as percent of assets, μ is return as percent of assets, and σ is standard deviation of return on assets as a proxy for return volatility. Z-score captures the probability of default of a country's commercial banking system. Z-score compares the buffer of a country's commercial banking system (capitalization and returns) with the volatility of those returns.

and Slačík, 2013; Karanovic and Karanovic, 2015; Imanov et al., 2017; Vîntu and Negotei, 2018; Xuyan and Shuai, 2018; Babar et al., 2019; Zelka, 2022)

On the other hand, the effectiveness of the monetary policy depends on various channels of transmission. The existing literature has already identified various channels of monetary transmission. These channels consist of short- and long-term interest rate channels, credit channel, exchange-rate channel, asset channel, and balance-sheet channel. The main monetary policy transmission channel (specifically developing countries) stresses on short-term interest rate pass-through[7] (Cottarelli and Kourelis (1994); Angeloni et al., 2003; Chmielewski, 2004; Rasche and Williams, 2007; Basci et al., 2008; Betancourt et al., 2008; Egert and MacDonald, 2009; Ornek, 2009; Mishra and Montiel, 2012; Seth and Kalyanaraman, 2017; Rashid et al., 2020; Sena et al., 2021; Sethy and Goyari, 2022; Ramedoust et al., 2023)[8]. Thus, this study aims to test short-term interest rate pass-through.

[7] Most of developing countries often face economic vulnerabilities such as high inflation, exchange rate volatility, and external shocks. Interest rate shocks can provide an understanding of how changes in monetary policy affect these vulnerabilities and their potential spill-over effects on financial stability. Besides, interest rate policy is one of the instruments used in macroprudential policy, which aims to safeguard the stability of the financial system.

[8] This channel basically works as; if central bank is interested in inducing economic stimulus in response to weakening economic conditions, it purchases financial assets to inject additional liquidity into the banking system. This additional liquidity reduces the overnight interbank rates. The ability to borrow at lower overnight rates encourages the banks to purchase additional short-term government papers, leading to further cascade of reductions in the short-term risk-free interest rates.

Moreover, to capture the influence of other factors, which can influence financial stability in the presence of monetary policy, a set of control variables are introduced in the regression model. This is done to avoid misspecification problems arising from omitted variables in the regression. These variables include measures of real economic activity, which are real GDP and the price level, furthermore, the stability of the exchange rate is crucial for the development of foreign investment, indicated by real effective exchange rate. The estimated model takes the following form:

$$Z - score_{it} = \beta IR_{it} + \delta Z - score_{it-1}\, \gamma X_{it} + \varphi_i + \nu_{it} \quad (4)$$

Where, $Z - score_{it}$ stands for a financial stability in i^{th} country for t period, $Z - score_{it-1}$ is one year lag of $Z - score$. IR_{it} is the money market interest rate, which is used as a proxy for monetary policy. While, X_{it} is the control variable set.

4. Results and Interpretations of the Findings

4.1 Unit Root Test

Initially, to examine the presence of a unit root in a time series analysis, this study employs Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP), which are widely used unit root tests. These measures consider different specifications, such as intercept, time trend and first differencing. Based on ADF and PP test results, as highlighted in table 3 and table 4 respectively, it is concluded that all variables (Z-Score, MMIR, GDP, CPI, REER) are stationary at *I*(1), since the test statistics have absolute values

greater than the critical values at 5% significance level and the corresponding p-values are less than 0.05, indicating a strong rejection of the unit root hypothesis. Both the ADF and PP test results provide robust evidence that the variables are stationary at first difference. This implies that these variables have well-behaved patterns and do not exhibit a stochastic trend.

Table 3: Augmented Dicky Fuller (ADF) test results

Variables	At Level				At 1st Difference			
	Intercept		Intercept + Time Trend		Intercept		Intercept + Time Trend	
	t-Statistics	Prob.*	t-Statistics	Prob.*	t-Statistics	Prob.*	t-Statistics	Prob.*
Z-score	-0.771	0.807	-2.326	0.403	-3.251	0.031*	-3.164	0.011*
MMIR	-4.260	0.003*	-4.015	0.023*	-5.538	0.000*	-6.390	0.001*
GDP	-3.290	0.028*	-4.295	0.013*	-7.355	0.000*	-7.145	0.000*
CPI	3.635	1.000	-1.471	0.801	-5.667	0.004*	-5.328	0.001*
REER	-2.129	0.235	-2.543	0.306	-4.863	0.000*	-5.112	0.002*

****5% significance level.**

Source: Author's computation using Eviews version 12.

Table 4: Phillips-Perron (PP) test results

Variables	At Level				At 1st Difference			
	Intercept		Intercept + Time Trend		Intercept		Intercept + Time Trend	
	t-Statistics	Prob.*	t-Statistics	Prob.*	t-Statistics	Prob.*	t-Statistics	Prob.*
Z-SCORE	-0.821	0.792	-1.880	0.630	-3.274	0.029*	-3.189	0.011*
MMIR	-4.255	0.003*	-4.004	0.024*	-7.856	0.000*	-8.728	0.001*
GDP	-3.256	0.030*	-4.270	0.014*	-7.856	0.000*	-7.624	0.000*
CPI	5.387	1.000	1.249	0.999	-5.108	0.008*	-5.251	0.001*
REER	-2.270	0.189	-2.321	0.406	-4.864	0.000*	-5.090	0.002*

****5% significance level.**

Source: Author's computation using Eviews version 12.

4.2 Johansen Cointegration Test

This study utilizes the Johansen cointegration test to examine the presence of cointegration among a set of time series variables. Cointegration implies a long-run relationship between the variables, indicating that they move together in the long term. The results of the Johansen cointegration test as provided in table 5 indicate that there is no evidence of cointegration among studied variables. The test suggests that the null hypothesis of no cointegration cannot be rejected, as both Trace and the Maximum Eigenvalue values are lower than the critical values at 5% significance level, implying that the variables in question do not exhibit a long-term relationship. In such cases, it is appropriate to consider using VAR model. VAR models are suitable when cointegration is not present because they capture short-term dynamics and allow for the analysis of the interdependencies among variables over time. By employing a VAR model, one can explore the dynamic interactions and responses between the variables of interest, even in the absence of cointegration.

Table 5: Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Included observations: 182 after adjustments
Trend assumption: Linear deterministic trend
Series: ZSCORE MMIR GDP CPI REER
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Prob.**	Max-Eigen Statistic	Prob.**
None *	0.838741	0.838741	0.2085	69.81889	0.2628
At most 1 *	0.692401	0.692401	0.5058	47.85613	0.6109
At most 2 *	0.546063	0.546063	0.1059	29.79707	0.2874
At most 3	0.457319	0.457319	0.4058	15.49471	0.5441
At most 4	0.108582	0.108582	0.1567	3.841466	0.1203

Trace test indicates no cointegration at the 0.05 level
Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

****5% significance level.**

Source: Author's computation using Eviews version 12.

4.3Lag Length Criteria

The results of the lag length test, as shown in the table 6, provide information about different lag orders and their corresponding evaluation criteria. The lag length test helps determine the appropriate number of lagged variables to include in the VAR model. In this case, three lag orders (0, 1, and 2) were evaluated. The evaluation criteria used include the log-likelihood (LogL), the likelihood ratio test statistic (LR), the final prediction error (FPE), the Akaike information criterion (AIC),

the Schwarz information criterion (SC), and the Hannan-Quinn information criterion (HQ). Based on these results, the lag length test suggests that a VAR model with lag order 2 is the most appropriate choice. This model captures the short-term dynamics and interdependencies among the included variables, namely Z-SCORE, MMIR GDP, CPI, and REER.

Table 6: Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: ZSCORE MMIR GDP CPI REER
Exogenous variables: C
Sample: 2000 2022
Included observations: 182

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-319.4202	NA	18040651	30.89716	31.14586	31.14586
1	-225.7605	133.7996*	28298.11*	24.35815	25.85032*	25.85032*
2	-196.8544	27.52962	32029.40	23.98614*	26.72179	26.72179

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

Source: Author's computation using Eviews version 12.

4.4Granger Causality Test

In order to investigate the relationships between the financial stability and monetary policy, the Granger causality test is implemented. As indicated by Enders (2004), the Granger causality test is a test to determine the direction of causality of a variable to another variable. Table 7 denotes the directions of causality between the Z-score and MMIR. Results show that the

null hypotheses of MMIR does not Granger Cause Z-SCORE and Z-SCORE does not Granger Cause MMIR are rejected at the 5% significance level. This result gives evidence that the relationship between monetary policy and financial stability in the sample countries does exists.

Table 7: Granger Causality Test Result

Pairwise Granger Causality Tests Sample: 2000 2022 Lags: 2			
Null Hypothesis:	**Obs.**	**F-Statistic**	**Prob.**
MMIR does not Granger Cause Z-score	184	7.18915	0.0059*
Z-score does not Granger Cause MMIR	184	5.58599	0.0026*

***5% significance level.**

Source: Author's computation using Eviews version 12.

4.5Dialogistic Tests

In order to assess the validity and the reliability of the VAR model, diagnostic tests are crucial in examining the assumptions and potential aspects associated with the model. These tests including the LM (Lagrange Multiplier) test and the heteroscedasticity test. The LM test helps evaluate the presence of autocorrelation in the residuals, which is essential for ensuring that the model adequately captures the dynamic relationships among the variables. The heteroscedasticity test, on the other hand, examines whether the variance of the residuals is constant across observations, as the presence of heteroscedasticity could lead to biased and inefficient estimation results. However, the

test results indicated insignificance at 5% level (p-values are higher than 0.05), suggesting that there is no evidence of significant autocorrelation or heteroscedasticity in the VAR model (see table 8 and table 9). This implies that the model's assumptions hold reasonably well and that the estimated coefficients can be interpreted with confidence.

Table 8: Autocorrelation Test Result

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	3.86008	Prob. F(2,16)	0.1756
Obs*R-squared	5.88479	Prob. Chi Square(2)	0.4431

Source: Author's computation using Eviews version 12.

Table 9: Hetroskedasticity Test Result

Hetroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.483649	Prob. F(3,19)	0.2509
Obs*R-squared	4.365359	Prob. Chi-Square(3)	0.2246
Scaled explained SS	2.758854	Prob. Chi-Square(3)	0.4303

Source: Author's computation using Eviews version 12.

4.6. VAR Estimates

As previously explained, this paper employs SVAR system consisting of five endogenous variables, including Z-score, MMIR, GDP, CPI and REER, estimated with the lag length of 2. Therefore, VAR model can be structured as follows:

$$Z-score = C(1,1)^{*}Z-score(-1) + C(1,2)^{*}Z-score(-2) + C(1,3)^{*}MMIR(-1) + C(1,4)^{*}MMIR(-2) + C(1,5)^{*}GDP(-1) + C(1,6)^{*}GDP(-2) + C(1,7)^{*}CPI(-1) + C(1,8)^{*}CPI(-2) + C(1,9)^{*}REER(-1) + C(1,10)^{*}REER(-2) + C(1,11)$$

$$MMIR = C(2,1)^{*}Z - score(-1) + C(2,2)^{*}Z - score(-2) + C(2,3)^{*}MMIR(-1) + C(2,4)^{*}MMIR(-2) + C(2,5)^{*}GDP(-1) + C(2,6)^{*}GDP(-2) + C(2,7)^{*}CPI(-1) + C(2,8)^{*}CPI(-2) + C(2,9)^{*}REER(-1) + C(2,10)^{*}REER(-2) + C(2,11)$$

$$GDP = C(3,1)^{*}Z - score(-1) + C(3,2)^{*}Z - score(-2) + C(3,3)^{*}MMIR(-1) + C(3,4)^{*}MMIR(-2) + C(3,5)^{*}GDP(-1) + C(3,6)^{*}GDP(-2) + C(3,7)^{*}CPI(-1) + C(3,8)^{*}CPI(-2) + C(3,9)^{*}REER(-1) + C(3,10)^{*}REER(-2) + C(3,11)$$

$$CPI = C(4,1)^{*}Z - score(-1) + C(4,2)^{*}Z - score(-2) + C(4,3)^{*}MMIR(-1) + C(4,4)^{*}MMIR(-2) + C(4,5)^{*}GDP(-1) + C(4,6)^{*}GDP(-2) + C(4,7)^{*}CPI(-1) + C(4,8)^{*}CPI(-2) + C(4,9)^{*}REER(-1) + C(4,10)^{*}REER(-2) + C(4,11)$$

$$REER = C(5,1)^{*}Z - score(-1) + C(5,2)^{*}Z - score(-2) + C(5,3)^{*}MMIR(-1) + C(5,4)^{*}MMIR(-2) + C(5,5)^{*}GDP(-1) + C(5,6)^{*}GDP(-2) + C(5,7)^{*}CPI(-1) + C(5,8)^{*}CPI(-2) + C(5,9)^{*}REER(-1) + C(5,10)^{*}REER(-2) + C(5,11)$$

The interpretation of the results is based on the Impulse Response Functions (IRF) and the Variance Decomposition (VD). In both the IRF and VD analyses, the values provide insights into the dynamic relationships and contributions of different variables to the overall system. The IRF measures the response of each variable to a one-unit shock in another variable while holding all other variables constant. The IRF uses one standard deviation positive innovation and the bands given by ±2 standard errors of all variables against the financial stability

indicator based on the Cholesky decomposition. On the other hand, the VD measures the proportion of the forecast error variance of each variable that can be attributed to shocks in itself and other variables. Figure 2 and table 9 respectively provide a breakdown of IRF and VD for each variable (Z-SCORE, MMIR, GDP, CPI, REER) at different periods (1-10).

Results show that the Z-score has an initial value of 100.00 in Period 1, indicating the baseline level. In Period 2, a shock in MMIR leads to a response of 3.68 units in the Z-score. This suggests that an increase in MMIR has a negative and significant impact on Z-score. From Period 3 to 10, the IRF values for Z-score remain increasing, indicating sustained responses to shocks in MMIR. After 10 periods, shocks to MMIR seem to explain about 12% of the variations in financial stability. As claimed by various studies interest rate shocks can affect financial stability negatively in several ways: an increase in interest rates raises the cost of borrowing for firms and households. If a firm has a large amount of debt or relies heavily on borrowing, higher interest rates can increase its debt servicing costs. This can lead to financial distress and a deterioration in the z-score. It can also impact the valuation of financial assets. For example, rising interest rates can lead to a decline in bond prices, which affects the value of bond holdings. Furthermore, when interest rates rise, borrowers with variable-rate loans may find it more difficult to meet their debt obligations. This can lead to an increase in loan defaults and non-performing loans,

negatively impacting the z-scores of both borrowers and lenders (Granville and Mallick, 2009; Albulescu, 2013; Cocriş and Nucu, 2013; Valencia, 2014; Prasad, 2016; Tong, 2017; Tobal and Menna, 2020; Akinci et al. (2021); Elsayed et al., 2021). It is stated by IMF (2023a), that several countries in the region have made significant progress in terms of financial adjustment and reform, while others lag. Despite these differences, countries in the region may be thought of as confronting policy challenges ensuring supportive monetary policy tools.

The response function of the Z-score to GDP is relatively low in periods 1 to 3, however, the response becomes positive in the fourth period and remains positive for the subsequent periods, recording an increase of approximately 5.30% in the Z-score in period 10. The relationship between GDP and Z-score as a measure of financial stability is indirect, and their correlation depends on various factors[9]. This result is aligned with Fang et al. (2014), Cesa-Bianchi and Rebucci (2017), Muharam (2019) and Abbas et al. (2022), who observed that GDP growth is influenced by various macroeconomic factors such as consumer spending, investment, government expenditure, and exports. When the GDP of a country is growing steadily, it generally indicates a favorable

[9] It's important to note that GDP is a lagging indicator, meaning it reflects past economic performance. Changes in GDP may only be observed after a significant time lag. In contrast, z-scores are more immediate measures of financial stability, providing a snapshot of a company's financial health at a given point in time. Therefore, the relationship between GDP and z-score may not be concurrent or directly correlated.

economic environment, higher business profitability, and increased consumer demand. In such cases, companies are more likely to have better financial health, leading to higher Z-scores. Nevertheless, it is claimed by Negro et al. (2019) that certain industries may be more sensitive to economic fluctuations than others. For example, during an economic downturn, sectors like manufacturing, construction and retail may experience reduced demand and profitability, which can negatively impact their Z-scores. However, industries like healthcare, utilities, or essential services may be relatively less affected.

On the contrary, in the second period, a shock in consumer prices leads to a decrease of approximately 0.71% in Z-score. The response rises over time but generally remains negative. The standard error associated with the estimated response ranges from 0.58 to 3.31. Excessive inflation erodes the purchasing power of money, reduces consumer confidence, and can lead to economic instability. Conversely, low and stable inflation is generally associated with greater financial stability. Moreover, fluctuations in CPI can indirectly influence financial stability. When CPI rises rapidly, it can lead to higher interest rates as central banks may tighten monetary policy to curb inflationary pressures. As highlighted by IMF (2023b), increased interest rates can affect borrowing costs, investment decisions and asset valuations, potentially impacting the stability of financial markets and institutions. CPI can have implications for wealth and income

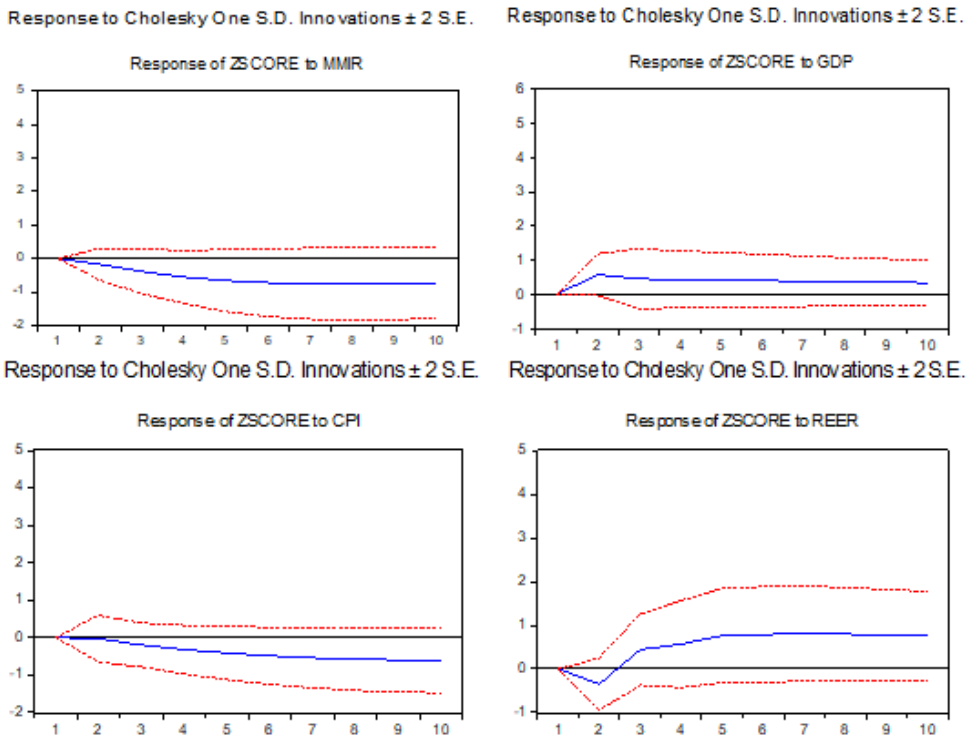
distribution, which are crucial factors in financial stability[10]. Concerning the AMF report (2023), It is noteworthy that central banks of countries under study have a dual mandate or an explicit inflation target, which often includes maintaining price stability. Central banks use various monetary policy tools, such as interest rate adjustments to influence inflation. By achieving price stability, central banks aim to promote financial stability by reducing the likelihood of disruptive economic imbalances and financial crises. Maintaining price stability is a crucial objective of monetary policy and is closely linked to financial stability.

The response of the Z-score to REER fluctuates over time, the standard error associated with the estimated response ranges from 0.68476 to 1.71019. It's important to note that the response of the Z-score to REER shocks is complex and can be influenced by various other factors, such as the overall health of the financial system, monetary policy measures, fiscal stability, and external shocks. Ali (2022) revealed that higher currency values imply a relatively stronger currency, which can reduce the competitiveness of a country's exports. If a significant portion of an economy's stability relies on export-oriented industries, a

[10] Inflation affects different economic agents and households differently. For example, if prices rise faster than wages, it can reduce the purchasing power of consumers, particularly those with fixed or lower incomes. This can lead to economic disparities, social unrest, and potential risks to financial stability.

decline in export competitiveness due to a higher REER may negatively impact financial stability, potentially leading to lower profitability and increased risk for firms in those sectors. This could result in lower Z-scores for firms operating in export-oriented industries. Another parallel dimension investigated by Belghitar et al. (2016) and Agénor et al. (2020) is that changes in the REER can affect the value of external debt denominated in foreign currencies. If a country has a high level of external debt, a significant appreciation in the REER could increase the burden of servicing that debt. This may put pressure on the financial stability of both the government and private sector, potentially leading to higher default risks. However, according to Ghosh et al. (2015), Magud et al. (2016) and Levieuge et al. (2021) significant capital outflows triggered by higher exchange rates may pose challenges to financial stability, particularly if they lead to liquidity shortages or increased borrowing costs. These factors can affect the stability of financial institutions and firms that rely on capital inflows for their operations or funding. Large and volatile fluctuations in exchange rates can create uncertainty in the economy, impacting investment decisions, asset valuations, and overall macroeconomic stability. In such cases, the financial stability of firms and financial institutions may be influenced by the general economic conditions resulting from exchange rate movements.

Figure 2: The impulse responses of Z-score to (MMIR, GDP, CPI, REER)



Source: Author's computation using Eviews version 12.

Table 10: Variance Decomposition of Z-score

Variance Decomposition of Z-SCORE:						
Period	**S.E.**	**Z-SCORE**	**MMIR**	**GDP**	**CPI**	**REER**
1	1.560378	100.0000	0.000000	0.000000	0.000000	0.000000
2	2.449664	90.16137	3.685356	0.016736	0.712412	5.424122
3	3.173472	83.96590	8.197468	1.452001	1.756826	4.627808
4	3.492385	81.35357	8.723182	2.018629	2.362362	5.542254
5	3.680415	80.26884	8.909705	3.590659	2.145399	5.085400
6	3.761477	79.45443	9.310181	3.821788	2.055744	5.357855
7	3.784813	78.75370	9.719097	4.022645	2.032921	5.471636
8	3.806824	77.85418	9.608541	4.732749	2.260559	5.543973
9	3.864497	74.55312	10.729679	5.366691	3.506874	5.843632
10	3.926687	71.21605	12.00316	5.309633	5.178763	6.292388

Source: Author's computation using Eviews version 12.

5. Conclusion:

This paper aims to investigate the intricate dynamics between monetary policy and financial stability in the south Mediterranean countries namely: Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Syria and Tunisia throughout the period from 2000 to 2022. Through a comprehensive analysis of various econometric techniques, this study explored the dynamics and interdependencies among key variables. Thus Z-Score is employed as a measure of financial stability and monetary policy as reflected in interest rate adjustments. The analysis also underscores the importance of macroeconomic factors, such as GDP growth and consumer prices, in shaping

financial stability. The study further highlights the significance of external factors, particularly real effective exchange rate fluctuations, in influencing financial stability, export-oriented industries, external debt burdens, capital flows, and macroeconomic uncertainty all contribute to the complex relationship between REER and financial stability.

The initial analysis employs unit root tests, namely Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP), which confirmed that all variables were stationary at *I*(1), indicating the absence of a stochastic trend. The Johansen cointegration test revealed no evidence of a long-term relationship among the variables, suggesting the suitability of a VAR model for capturing short-term dynamics. The lag length test determined that a VAR model with a lag order of 2 was the most appropriate choice. Diagnostic tests, including the LM test and heteroscedasticity test, affirmed the validity and reliability of the VAR model. Moreover, Impulse Response Functions (IRF) and Variance Decomposition (VD) analyses provide insights into the dynamic relationships and contributions of the variables over time.

Results show that the response of Z-Score to interest rate shocks exhibited a sustained negative impact, emphasizing the adverse effects of higher interest rates on financial stability in studied countries. Higher interest rates can negatively impact financial stability by increasing borrowing costs, inducing financial distress, and affecting asset valuations. The relationship

between Z-Score and GDP was indirect, influenced by various macroeconomic factors. On the other hand, positive responses of Z-Score to GDP shocks indicate the favorable economic environment associated with higher business profitability. Conversely, shocks to consumer prices resulted in a negative impact on Z-Score, reflecting the destabilizing effects of excessive inflation, excessive inflation erodes financial stability, contrariwise, low and stable inflation contributes to greater financial stability. Additionally, the response of Z-Score to real effective exchange rate shocks fluctuated over time, influenced by factors such as export competitiveness, external debt burden, capital flows and macroeconomic uncertainty. Fluctuations in exchange rates exerted both direct and indirect effects on financial stability, highlighting the vulnerability of firms and financial institutions to external shocks.

Overall, this paper contributes to the understanding of the complex linkage between monetary policy and financial stability. The findings emphasize the need for policymakers to carefully consider the potential impact of monetary policy decisions on financial stability, taking into account the interconnectedness of various macroeconomic factors. By promoting a stable and resilient financial system, policymakers can mitigate the risks associated with economic imbalances and foster sustainable economic growth. Policymakers should also maintain flexibility in adjusting interest rates and implementing other monetary

measures. This flexibility allows them to respond effectively to changing economic conditions and mitigate potential risks to financial stability. In addition to monetary policy, policymakers should employ macroprudential measures to enhance financial stability. These measures include setting and enforcing prudent lending standards, capital adequacy requirements and liquidity regulations. By adopting a comprehensive approach that combines both monetary and macroprudential policies, authorities can address systemic risks, prevent excessive credit growth and promote the resilience of the financial system.

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