THREE ESSAYS ON MONETARY POLICY:

EXPECTATIONS, COMMUNICATION AND TRANSPARENCY

By

WYTONE YOHANE JOMBO

Dissertation

Submitted to
KDI School of Public Policy and Management
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY
IN PUBLIC POLICY

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The committee in charge:

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ABSTRACT

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The conduct of monetary policy has greatly evolved in the past two decades, particularly because monetary authorities have become more transparent and are communicating monetary policy issues to the public more than before. Most central banks have reformed into either de jure or de facto inflation targeting frameworks, with intensified efforts to influence inflation expectations. The discussion in this dissertation is three-pronged. Chapter 1 explores the behavioral aspect of economic agents in forming inflation expectations by utilizing threshold models and time-varying Granger causality techniques in the context of lag-augmented vector autoregressive models to establish the extent to which inflation expectations may have a non-linear relationship with their predictors and whether inflation expectations can be adequately predicted. Chapter 2 discusses monetary policy communication, precisely by utilizing the text mining algorithms to extract the levels of readability, complexity, and sentiment contained in the monetary policy statements and further test how these indicators are related to financial market variables' volatilities. Finally, chapter 3 attempts to understand how monetary policy transparency may affect the stability of the banking system. I find that economic agents might not revise their inflation expectations until the inflation target is missed beyond some threshold. I further find that credibility of the central bank, changes in the policy rate and missing of the inflation target by the central bank may provide insights on how economic agents would form their expectations about inflation in the future. I also find that small misses of inflation target do not trigger the revision of inflation expectations by the economic agents. There is evidence suggesting that the readability and complexity of monetary policy statements may affect exchange rate volatility in developing countries, and the tone of a central bank's statements regarding overall macroeconomic conditions matters for financial market volatility. Finally, I find evidence to suggest that banking industry stability could be influenced by how transparent a central bank is, particularly on issues related to explicit announcement of policy rules, provision of a comprehensive account of monetary policy deliberations, and disclosure of how each decision was reached.

Dedicated to:
My dear wife Rose and
our children Prince,
Ayanda, Tadala and
Nthanda

ACKNOWLEDGEMENTS

A Ph.D. journey can never be routinized, and any such attempts have ended in futility. Wretchedly, so. My own voyage had its own oddities and hurdles. I certainly fought many battles. I had some wins and some losses. But look, if you are reading this now, please join me as I celebrate that I won the war. So, who do I thank for this victory? Many. I sincerely thank my wife, Rose, for her sacrifices in allowing me to travel to read for this qualification, considering the tough and depressing circumstances at that time. I thank the family for remembering me in their prayers for my good health and academic success. Your prayers and encouragement kept me going and strong. I am incredibly grateful to my employers—the Reserve Bank of Malawi—for granting me study leave to pursue this program. With utmost humility, I am grateful to my academic advisor, Professor Sohn Wook, who made sure I was on the right academic radar all the time. Surely, I am profoundly indebted to the four members of the dissertation committee—Professor Dongchul Cho, Professor Jinsoo Lee, Professor Hyeon-Wook Kim, and Professor Man Cho—who provided constructive comments to this work. However, all errors are mine.

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1.0 CHAPTER ONE: TWO DECADES OF TARGETING INFLATION IN SOUTH AFRICA: WHAT ARE THE DYNAMICS OF INFLATION EXPECTATIONS?

ABSTRACT

This study is set out to answer three key questions. Whether there exists a threshold of target-miss beyond which economic agents become responsive in form of expectations revision; whether inflation expectations can be predicted by the level of current and past credibility of a central bank and how the causal link between inflation expectations and its determinants is affected by economic shocks such as global financial crisis. Using time-series data for South Africa from 2000 to 2020, the study invokes a threshold regression model to establish that economic agents revise their inflation expectations when the central bank misses the target by more than 1.5 percentage points. The lag-augmented VAR (LA-VAR) suggests that the central bank's credibility, target-miss, and policy rate adjustments have predictive power on inflation expectations. Finally, the novel time-varying Granger causality analysis suggests that the relationship between inflation expectations and their determinants is unstable around periods of economic downturns.

Keywords: Monetary policy, Inflation expectations, Threshold analysis, Time-varying Granger causality

1.1 Introduction

Good central banks have clearly defined policy objectives. Objectives may include, but are not limited to, achieving price stability, financial stability, and enhancing economic growth. In recent times, most central banks have considered price stability a primary objective. This notwithstanding, the other objectives are usually pursued as secondary objectives. It is common, particularly in emerging economies, for central banks to pursue multiple objectives. For instance, they may state price stability as a primary objective, but their monetary policy decision-making processes are riddled with other objectives such as economic growth. Central banks frequently employ monetary policy strategies to achieve their stated goals. Since the 1990s, discussions in the literature have often been about inflation targeting as a candidate for a monetary policy framework. First introduced in New Zealand in 1990, more than 70 countries have now adopted the inflation targeting (IT) framework in their conduct of monetary policy. The inflation targeting regime utilizes people's inflation expectations as a nominal anchor (Gürkaynak et al., 2007). The inflation-targeting central banks try to align short-term interest rates with an interest rate called the policy rate or central bank rate set by the Monetary Policy Committee (MPC) of the central bank. If the short-term interest rate is aligned with the policy rate, the money market liquidity conditions are believed to be optimal and non-inflationary, such that the resultant inflation will equal or approach the inflation target.

In recent years, central banks have intensified monetary policy communication in a bid to influence people's inflation expectations and control future inflation. Central banks attempt to convince the public that, in a specified future, inflation will be on target or at least reasonably close to the target. If inflation is exactly on target or close to the target, economic agents start believing the central bank announcements about the target and that the price-building mechanism is benchmarked around the target. Indeed, if the central bank fails to steer actual inflation close to the target, agents tend to disregard the announced inflation target and work

out inflation expectations based on their own understanding of current and future economic developments.

There is merit for central banks to care about inflation expectations. When Ang *et al*. (2007) compared the performance of four out-of-sample forecasting methods of U.S. inflation, inflation expectations surveys emerged to outperform the rest. These findings are well collaborated by Gil-Alana et al. (2012) and Grothe and Meyler (2015) who also find survey-based expectations to be superior to standard time series forecasting models. These findings suggest that if economic agents expect inflation to rise by some degree and if such expectations are not anchored to the desired inflation target, prices would rise by this magnitude, ceteris paribus. Therefore, most central banks are today investing in monetary policy communication to influence the public into believing that central banks can use their monetary policy instruments to align future inflation with the target. However, the credibility of a central bank is put into question if it does not deliver inflation aligned with the target. Economic agents are likely to raise inflation expectations away from the target if the target is not achieved.

While it is well known that actual inflation rarely matches the target, there should be some reasonable miss beyond which the economic agents will raise their inflation expectations away from the announced target. Unfortunately, this tolerable deviation is not known to policymakers. Specifically, MPC does not know how much inflation target-miss is consequential to inflation expectations. If they can have an idea about this threshold, they would possibly not respond by means of interest rate adjustment or liquidity reserve requirement so often, at every miss of the target.

If there are indeed such thresholds, estimating them would assist monetary authorities in not taking drastic policy measures when ‘small and inconsequential’ target misses are encountered particularly when such measures would induce macroeconomic instability.

Considering how important inflation expectations are in the inflation targeting framework, this study examines the dynamics of inflation expectations in South Africa from 2000 to 2020 when its economy was under an inflation targeting regime.

1.1.1 Research Questions

This study utilizes South African data to answer these questions in modern monetary policy practice:

1. Is there an inflation target-miss threshold beyond which economic agents start raising inflation expectations?
2. To what extent can inflation expectations be predicted using the level of credibility of a central bank?
3. How do economic shocks such as the 2008 global crisis affect the causal link between inflation expectations and its determinants?

The choice of South Africa for this analysis is driven by (1) little research on inflation expectations having been conducted in the country despite it being one of the early birds in Africa to adopt an inflation targeting framework (2) As an emerging economy, the country may provide different perspectives on how inflation expectations are formed (3) consistent data on inflation expectations is hard to find and South Africa has such rich data of inflation expectations.

1.1.2 Summary of Findings

Results from the study establish that economic agents revise their inflation expectations when the central bank misses the target by more than 1.5 percentage points. The results further suggest that inflation expectations can be predicted by each of the variables: central bank credibility, target miss, and policy rate. Further, the novel time-varying Granger causality analysis suggests that the relationship between inflation expectations and their determinants is unstable around periods of economic downturns.

The implication of the results is that central banks may have some room for keeping policy interest rates unchanged following small and temporary deviations of inflation from the announced targets and can instead intensify clear communication to anchor inflation expectations. Further, the study finds that the causality link between inflation expectation and target-miss, credibility, and the policy rate is not stable across the time span of the sample, suggesting that some episodes had stronger causal links than others with an unstable link being experienced during economic downturns.

1.2 Background

1.2.1 The Monetary Policy Framework in South Africa

The responsibility for formulation and implementation of monetary policy in South Africa rests with the Reserve Bank. The Bank is mandated by the constitution to protect the value of the local currency (rand) by keeping inflation low and steady. Before 2000, South Africa's monetary policies oscillated primarily around exchange rate targeting, monetary targeting, and discretionary monetary policy frameworks. However, South Africa adopted the

IT monetary policy regime in 2000 and its inflation target bounds were between 3-6 percent. Initially, the target was based on calendar year annual average inflation for CPI inflation. However, since 2009, the target was based on headline inflation between 3 to 6 percent on a continuous basis. The target is set by the Minister of finance in consultation with the governor. The Bank has been striving to keep inflation within the 3-6 percent range, suggesting that any deviations outside the range would trigger remedial policies to realign inflation back into the inflation target band.

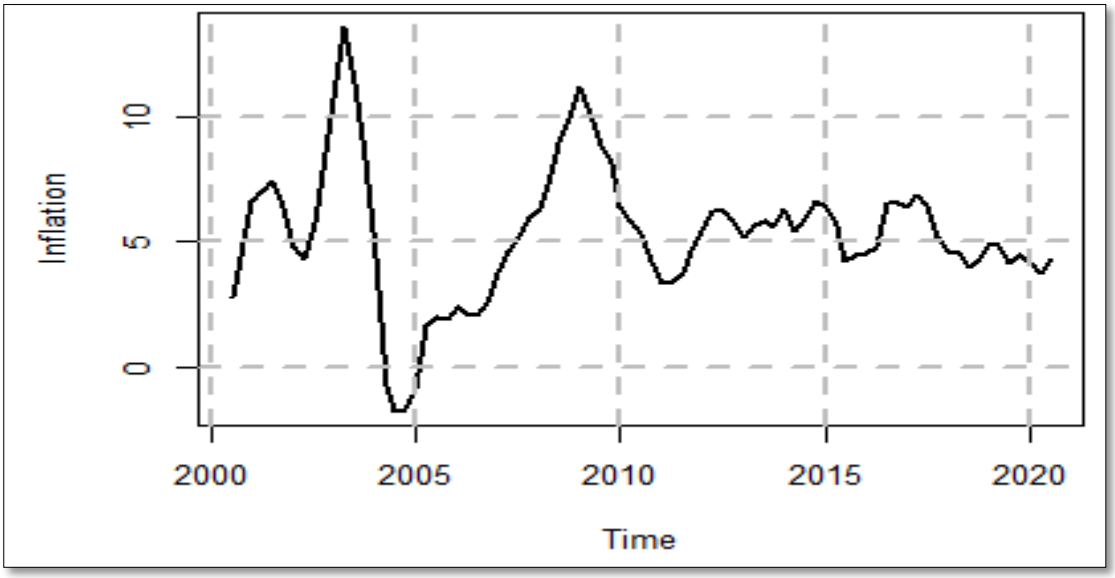
The adoption of IT in South Africa did not yield immediate rewards. Inflation was rarely within the targeted bounds during the first decade of IT adoption. This could be explained in two ways. Firstly, the averaging of inflation as a target was masking the monthly or quarterly swings of inflation if the average was within the target. Secondly, the 2007-2009 financial crisis might have caused havoc on the inflation stability agenda. Kabundi et al. (2015) further state that the volatility of inflation during the period was largely influenced by the depreciation of the South African rand and the rise in food prices and inflation had risen above the 10 percent mark.

When inflation-targeting central banks opt for a range and not a point target, central banks will be called to action when inflation is outside this range[1] and more seriously when inflation exceeds the upper bound. The action of the central bank when inflation is above the mid-point of the range will depend on whether the monetary policy authority is *hawkish* or *dovish*. For the hawkish central bank, it will already start pre-empting the potential soar in inflation that would get out of the target range eventually. In an inflation-targeting framework, central banks would be incentivized to act pre-emptively to anchor inflation expectations. It is

[1] For emerging and developing countries, inflation is rarely worrisomely low below the target as such this problem is never discussed in monetary policy formulation board rooms.

now popular in the modern economic theory that inflation expectations are one of the key drivers of actual inflation (Leduc et al., 2007). It is argued that households and firms consider the expected inflation in their economic decisions such as wage contracts and pricing decisions (see Bullard, 2016). These decisions are reflected in the actual inflation. Therefore, a central bank that cares about inflation stability—inflation around the target—will pay closer attention to both inflation trends and expected inflation.

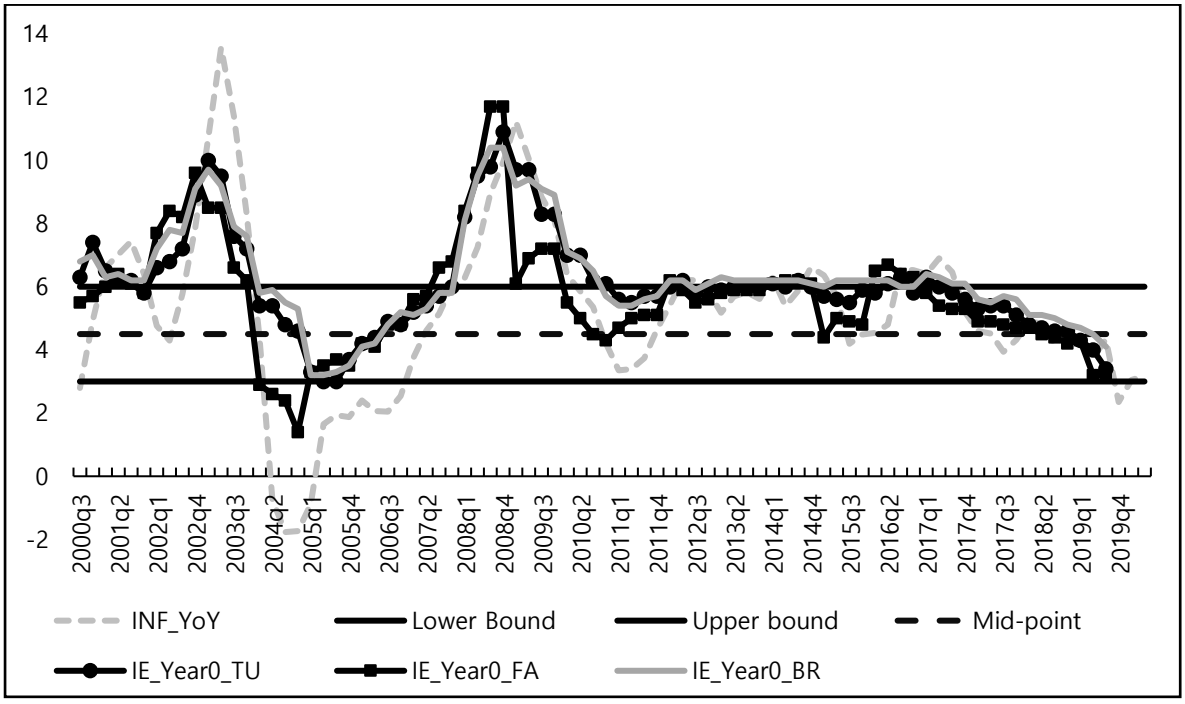
Figure 1. 1 Inflation in South Africa



Note. Data sourced from Reserve Bank of South Africa

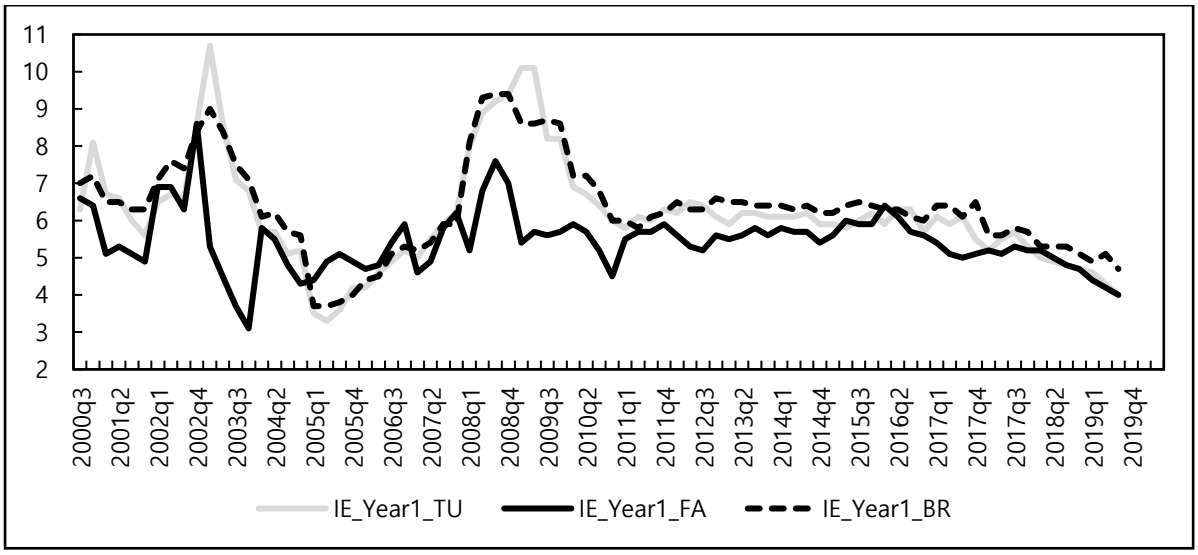
Inflation expectations are determined by many factors. For example, (Başkaya et al., 2012) hypothesize that controlling for other macroeconomic factors, inflation expectations could be influenced by developments in the past inflation and the prevailing announced target.

Figure 1. 2: Inflation Expectations by Category—Current Year



Notes. Data sourced from Reserve Bank of South Africa. IE=Inflation Expectations, Year0=Current year, Year1=next one year, BR=Business representatives, TU=Trade Unionists, FA=Financial Analysts.

Figure 1. 3 Inflation Expectations by Category—One year Ahead



Notes. Data sourced from Reserve Bank of South Africa.
IE=Inflation Expectations, Year0=Current year, Year1=next one year, BR=Business representatives, TU=Trade Unionists, FA=Financial Analysts.

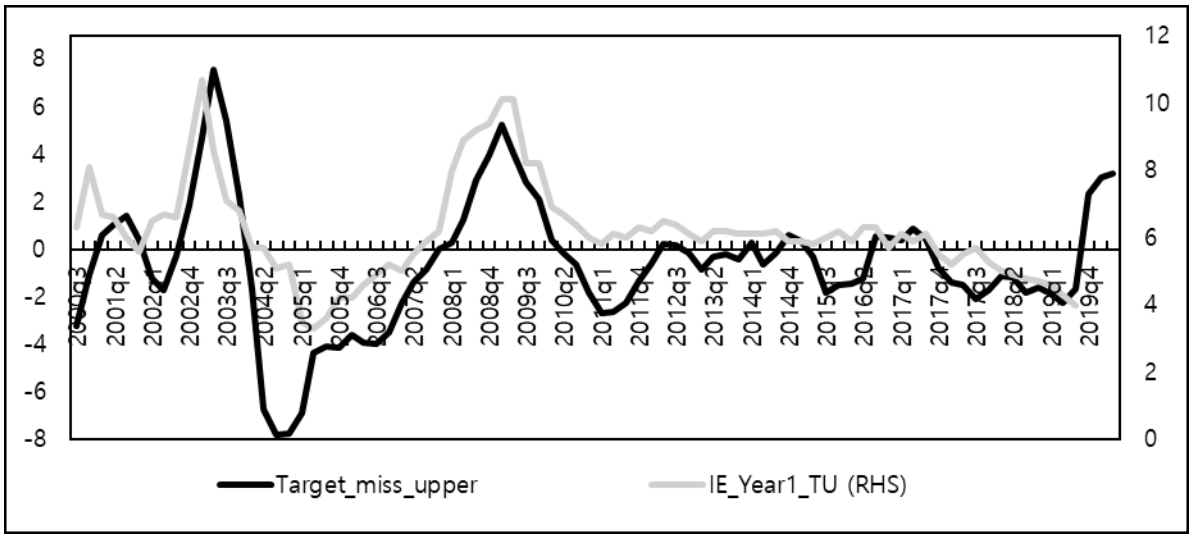
The South African Reserve Bank surveys inflation expectations of members of trade unions, business representatives, and financial analysts. This way of soliciting inflation expectations is widely used in the literature. The United States conducts the Michigan Survey

of Consumers and the New York Fed Survey of Consumer Expectations, while the United Kingdom conducts the Barclays Basix and Bank NOP surveys. The European Commission conducts harmonized household surveys for all European countries (Coibion et al., 2020). Figures 1.2 and 1.3 suggest that when the current inflation is on an upward or downward trajectory, the inflation expectations behave in a similar pattern. This is true for both expectations for the current year (Figure 1.2) and one year ahead (figure 1.3). The economic agents are likely to benchmark their expectations on what is happening to inflation in the current period when their inflation expectations are poorly anchored to the target. The role of the central bank, therefore, is to ensure that the economic agents make reasonable expectations about future inflation regardless of the current trends by providing credible monetary policy communication and applying the available monetary policy tools to show commitment to the communication.

Perhaps what would matter for the expectations of economic agents in the inflation targeting setting like the case of South Africa is the gap between the target and actual inflation. Figure 1.4 shows a high correlation between the deviation of actual inflation from the target and inflation expectations. Precisely, when the deviation is positive, agents expect future deviation to be positive. One of the objectives of this study is founded on whether the agents' reaction to the central bank's miss of the inflation target is linear or non-linear. If the relationship is non-linear, I hypothesize that agents will ignore small misses and react only to 'significant' deviations. If this is true, then central banks are justified to ignore such small misses as well, particularly when they are temporary and when action by the central bank could destabilize the economy more than doing nothing. Moreover, central banks do not find pleasure in changing policy rates too often as it is considered as having destabilizing effects on the economy. Specifically, Tuna and Almahadin (2021) find that interest rate fluctuations lead to

the instability of financial institutions and systems. Under inflation targeting, central banks are faced with a policy dilemma. If they do nothing, the economic agents will interpret it as if the monetary authorities are not committed or *hawkish* enough to keep inflation within the target bounds and that economic agents are likely to raise their inflation expectations.

Figure 1. 4 :Deviation from the announced target and expectations



Notes. Compiled using data from the Reserve Bank of South Africa. Target-miss-upper= Gap between actual inflation and the upper bound inflation target. IE_Year1_TU=One year ahead inflation expectations by trade unionists.

If central banks respond to every deviation from the target—small or large—the economy could be subjected to frequent policy-induced shocks that would confuse the economic agents and may cause unwarranted noise in the economy. The results from this study would, therefore, provide an empirical justification for why central banks need not to adjust policy rates too frequently.

There is merit in expecting that the relationship between target-miss and inflation expectations could be non-linear and that there could be some threshold relationship. For instance, Coibion and Gorodnichenko (2012) provide some evidence suggesting the delayed response of mean forecasts to macroeconomic shocks for economic agents. Further evidence reported by Coibion et al. (2020) suggests that when inflation is low, neither households nor firms' expectations significantly change in response to monetary policy shocks

which supports the motive of this study to explore the non-linear behavior of inflation expectation. Moreover, using both piecewise and threshold models, Cristini and Ferri (2021) find evidence that the US price Phillips curve is convex in nature, using data from 1961 to 2019, and this evidence support convexities and discontinuities of the Phillips curve and Oral (2013) finds that non-linear regression model for inflation expectations is the best model to measure inflation expectations.

1.3 Literature Review

1.3.1 Theoretical Underpinnings

Determinants of Inflation Expectations

Ezekiel (1938) and other early studies assumed that inflation expectations are determined naively by looking at previous inflation. Economic agents' expected price is equal to or close to the recently observed price. Nunn and Elliott (1975) argue that those naïve expectations are a precursor of the extrapolative expectations hypothesis. The extrapolative expectations hypothesis is summarized by:

$$\pi_t^e = \alpha_0 + \alpha_1 \pi_t + \alpha_2 (\pi_t - \pi_{t-1}) \qquad (1)$$

where π_t^e is the inflation expectation one period ahead made at time *t,* π_t is the actual inflation rate at period *t* and π_{t-1} is inflation in the previous period. The original version of the model assumed $\alpha_0=0$ and $\alpha_1=1$. The α_2 can be >0 or <0. If it is greater than zero, it means the trend will continue while when $\alpha_2 <0$, the trend is expected to reverse itself. When $\alpha_2 =0$, it means the current inflation is expected to persist. Related to extrapolative expectations is the adaptive expectation hypothesis which is widely popular in the literature.

The hypothesis is summarized as follows:

$$\pi_t^e = \pi_{t-1}^e + \beta\,(\pi_t - \pi_{t-1}^e) \qquad 0 < \beta < 1 \qquad (2)$$

First used independently by Cagan (1956) and Nerlove (1956), the adaptive expectations hypothesis suggests that the economic agents will review their expectations proportionately to the difference between the actual rate of inflation and the rate that was expected (Nunn & Elliott, 1975). It, therefore, suggests that agents will not revise their expectations either upwards or downwards vis-à-vis the currently expected inflation in the next period if their expected inflation and actual inflation matched in the previous period.

It is easy to see that in the presence of an inflation target announced by the central bank, individuals' expectations—guided by the adaptive expectations hypothesis—would be shaped by two related developments. Firstly, agents will review their expectations based on how the actual inflation deviated from their own expectations in the previous period (the original adaptive expectations equation). Secondly, equation (2) could be augmented by adding a term that would suggest that the agents would also revise their expectations if actual inflation deviated from the announced target.

$$\pi_t^e = \pi_{t-1}^e + \lambda\,(\pi_t - \pi_{t-1}^e) + \gamma\,(\pi_t - {}_t\pi^{Tar}{}_{t-1}) \qquad 0<\lambda,\ \gamma<1 \qquad (3)$$

This suggests that even when the agents match their previous expectations with the actual inflation, the fact that the central bank missed its target would affect the expectations formation process of the agents.

Non-linear relationships: Threshold Analysis

Threshold autoregression (Tong, 1983), where the dependent variable is a function of its own lags, is one of the most widely used nonlinear models in economics. Other innovations in the field include the threshold cointegration introduced by Balke and Fomby (1997), in which the TAR model by Tong (1983) and Engle and Granger (1987) cointegration models popularly known as the vector autocorrection model are combined. Tsay (1998) also introduced a similar vector TAR (VTAR) model with possible threshold cointegration while Hansen (2000) developed both a threshold regression algorithm and the test of the presence of a threshold for a given regression model.

The basic presentation of threshold regression can be described as:

$$\pi_t^e = \mathrm{x}_t\beta + \mathrm{z}_t\delta_1 + \varepsilon_t \qquad \text{if } -\infty < w_t \leq \gamma$$

$$\pi_t^e = \mathrm{x}_t\beta + \mathrm{z}_t\delta_2 + \varepsilon_t \qquad \text{if } \gamma < w_t < \infty \qquad (5)$$

where π_t^e is the dependent variable which is inflation expectations, x_t is a vector of explanatory variables, β is the region-invariant parameters vector, ε_t is an *i.i.d* error with mean 0 and variance σ^2. w_t is a threshold variable which is an element of a set of vector z_t of exogenous variables with region-specific coefficient vectors δ_1 and δ_2. The key parameters that will be important are β, δ1, and δ2. Since the system of equations assumes one threshold, γ, for simplicity the system estimates the regressions for values of w_t below the threshold for one region and another region for values of w_t above γ.

This study hypothesizes that the relationship represented by γ in equation (3) above would not be linear such that at small inflation deviations from the target, agents do not respond with elevated inflation expectations until some threshold deviation magnitude is reached. I

hypothesize two reasons that would lead to a non-linear relationship. For firms or producers, changing inflation expectations—which eventually leads to changes in actual prices—after a small target miss might not be necessary due to menu costs. For trade unionists, the expected change in wages due to the small 'miss of the target' might be too small to warrant the hard and winding battles with the employer. They would, therefore, be better off not raising expectations because the costs of fighting for wage increases are higher than the reward. Therefore, households and firms must have some threshold level that would trigger them to swing into action. Firms raise expectations and the selling prices while households raise expectations and start wage negotiations. If central banks know this behavior by households and firms, they would not be moved by small inflation deviations off the target if such deviations are small and temporary. This study tests if such a threshold exists and attempts to estimate it.

Central banks around the world are learning to communicate their monetary policy decisions even when they adopt a 'stay' stance. Monetary policy communication has therefore become one of the important ways of anchoring inflation expectations without the actual hard-core monetary policy action such as raising interest rates or increasing liquidity reserve requirement (LRR). Therefore, when policymakers realize that the target-miss is below the estimated threshold (not warranting tightening), they would still need to find a way of communicating to the public—including business players, financial analysts, and workers—to tone down inflation expectations. It is well documented in the literature that monetary policy communication is a least-cost mechanism to anchor inflation expectations (Blinder et al., 2008).

1.3.2 The Empirical Literature

Inflation Expectations

Literature is not in short supply of studies on inflation expectations. Bulut (2018) sets out to explore how inflation expectations react to changes in the past inflation rate, output gap, exchange rate, inflation target, and oil prices in Turkey. The study uses the Autoregressive Distributed Lag (ARDL) to investigate whether there is cointegration among these variables. The findings are not surprising: the 12-month ahead expected inflation is found to be positively related to previous inflation, output gap, nominal exchange rate, and oil prices. The previous inflation and exchange rate are also found to be positively related to 24-month-ahead inflation expectations. While policymakers would be interested to know the determinants of inflation expectations, they will be more interested in understanding how the magnitudes of the determinants matter in triggering the expectations. The narrative should therefore proceed by asking: how much change in the determinants should matter? For example, are agents' expectations altered by small deviations of inflation from the target?

Easaw et al. (2013) wonder whether households can consistently, timely and frequently update their expectations with any incoming latest information. This thinking has led to the introduction of the notion of rational inattentive behavior in the literature which suggests that non-experts form expectations sporadically. To an extent that Reis (2006) argues that producers and consumers have some periods when they are inattentive—they do not care what economic news is trending until such a time they need such news. Easaw et al. (2013) suggest that the costs of collecting information and re-optimization contribute to the delayed spread of information among the general population.

Using micro data set for Austria, Fritzer and Rumler (2015) found that inflation expectations are determined primarily by age, gender, education, and economic literacy. These could be important findings, particularly in packaging pre-emptive communication to tone down inflation expectations. For instance, in recent years, central banks across the world have embarked on economic literacy initiatives in the form of monetary policy communication at least to ensure that the non-expert population makes rational inflation expectations.

Meeting an inflation target is key to achieving credibility. The central bank is credible if it does what it says. If a central bank announces an inflation target, it must achieve it, or at least there should be a convincing explanation for why the target was not met. If the central bank claims to be independent, it must act objectively and if it claims to be transparent, it must live by such openness standards. Since Cukierman and Meltzer (1986), central bank credibility has been considered a key feature of policymakers, both in developed and emerging economies. Literature has unanimously concluded that the central bank's credibility, as measured by the ability to manage public expectations, is critical to the effectiveness of the monetary policy. This approach has been used to anchor inflation expectations and reduce monetary policy uncertainty. Credibility becomes even more relevant in the unpredictable economic and financial environment (Cukierman & Meltzer, 1986; Faust & Svensson, 2001; Cecchetti & Krause, 2002).

Using data from the United States and Japan, Ueda (2010) shows that inflation expectations are more sensitive to changes in external prices and monetary policy-related shocks than actual inflation. Moreover, the study shows that compared to Japan, the impact of exogenous price shocks on inflation and inflation expectations is not only significant but also persistent, with expectation shocks having a self-fulfilling effect on inflation. From the existing

empirical literature, the relationship between inflation expectations and the past inflation target performance of the central bank has not been explored. Firstly, there is no formal investigation of how inflation expectations are determined by the knowledge that the central bank missed the target. Secondly, it is not known whether this link is linear. It is still not clear whether the economic agents have some level of an inflation 'target-miss' that triggers their expectations higher. This study, therefore, aims at closing these gaps.

1.3.3 Application of Threshold Regressions in Empirical Literature

Threshold time series modeling and its applications have grown more relevant in economics and finance studies since Tong's (1978; 1983) pioneering work. Indeed, threshold regressions are widely applied in the literature to answer threshold-related questions. Reinhart and Rogoff (2010) report that across advanced and emerging economies, debt-to-GDP ratios over 90 percent are detrimental to economic growth. Specifically, they found that in countries where gross foreign debt exceeds 60 percent of GDP, annual growth rates fall by about two percentage points; in countries where gross external debt exceeds 90 percent of GDP, growth rates are nearly halved, on average. Later, Hansen (2017) applied a kink threshold model to annual United States data on the growth rate of real GDP and the debt-to-GDP ratio from 1792 to 2009 and determined the threshold to be 43.8 percent.

Alfada (2019) examines the impact of corruption on economic growth in Indonesia, employing a nonlinear technique to estimate the corruption threshold beyond which it can become harmful to growth. The study hypothesized that low-corruption provinces (corruption below the threshold) could benefit from corruption by promoting their economic growth while when corruption surpasses a certain threshold, it might impede economic progress. The analysis used the sample-splitting threshold model proposed by Hansen (2000).

1.4 Data and Methods

The study uses monthly time series data from South Africa from 2000 to 2020. The dependent variable for this study is inflation expectations. South African Bureau for Economic Research (BER) surveys inflation expectations for the South African Reserve Bank. The respondents to the survey were drawn from a panel of 1061 business representatives, 40 participants from the financial sector, and 25 participants representing the labor market. To obtain inflation expectations for a given period, the unweighted average of the responses is calculated. Respondents are given a questionnaire in which they must indicate how high they expect CPI inflation to be in each period ahead. The questionnaires of the Livingston Survey of the Federal Reserve Bank of Philadelphia and the Survey of Expectations of the Reserve Bank of New Zealand serve as a guide. An important explanatory variable is the deviation of inflation from the target. South Africa uses the band target instead of the point target, I calculate the gap between the upper bound of the target band and actual inflation. Table 1.1 shows the descriptive statistics of the variables.

Table 1. 1 Descriptive statistics

Variable	*Obs.*	*Mean*	*Std. Dev.*	*Min*	*Max*
Oil price	240	64.959	29.603	18.690	128.033
Inflation	240	5.327	2.706	-1.800	13.800
Target-miss	240	-.673	2.706	-7.800	7.800
Credibility	240	.960	.081	.612	1.000
Policy rate	240	7.685	2.459	3.500	13.500
Exchange rate	240	9.613	3.03	5.465	17.192
Total expectations	240	5.996	1.605	3.200	11.400
Expectations by trade unionists	240	6.089	1.628	2.900	11.100
Expectations by business representatives	240	6.265	1.573	2.800	10.700
Expectations by financial analysts	240	5.669	1.837	1.200	12.800

Notes. Inflation expectations are in three flavors: expectations by trade unionists, business representatives, and financial analysts. Total expectations are the unweighted average of all the categories of expectations. The target-miss= the difference between the upper bound of the inflation target range (3%-6%) and the realized inflation. Exchange rate= nominal exchange rate of South African rand per US$. Credibility is a measure of central bank credibility developed by Cecchetti & Krause (2002) with modifications, the oil price is the international brent crude oil price and the policy rate is the central bank interest rate used for implementing monetary policy. Policy rate, exchange rate, and inflation are from IMF statistical database. Inflation expectations are from the Reserve Bank of South Africa.

The study employs two models to answer the research questions and the models used are the threshold regression model and the time-varying Granger causality model which is

implemented within the environment of a lag-augmented vector autoregressive framework. For threshold analysis, this study specifies a parsimonious model as suggested by Hansen (2000). The use of such parsimonious specifications is not new in the literature (for example, Kabundi et al., 2015). Hansen (2011) argues that such a specification allows important nonlinearities in the conditional expectations function to manifest without overparameterization. The control variables used are the exchange rate of the rand against the US dollar, crude oil prices, the policy rate, and credibility. To examine the time-varying relationship between inflation expectations and the main explanatory variables, we use the recent recursive subsampling methods to identify the causal change in potentially integrated systems proposed by Shi et al. (2020) and further applied by Baum et al. (2021).

For the threshold analysis, the study uses the following framework:

$$\pi_t^e = \beta_1' x_t + \epsilon_t \qquad \omega_t \leq \gamma$$
$$\pi_t^e = \beta_2' x_t + \epsilon_t \qquad \omega_t > \gamma \qquad (6)$$

where π_t^e is consumer price inflation expectations for i periods ahead. x_t is a vector of explanatory variables including the threshold variable ω_t, which is the gap between the announced inflation target and inflation outcome (target-miss). In this analysis, explanatory variables are the exchange rate, crude oil prices, and central bank policy rate. Hansen (2000) argues that models such as these need not be overparameterized.

Predicting Inflation Expectations: Time-Varying Granger Causality

The conventional reduced VAR models have been widely utilized to establish causation in time series econometric studies. These models entail a causal ordering that serves as the foundation for the computation of impulse responses (Baum et al., 2021). Typically, the

ordering is prescribed on theoretical grounds. Nevertheless, without any theoretical basis, the ordering is based on the concept of causality proposed by Granger (1969, 1988). The important assumption for a basic VAR is, however, that the variables should be stationary. Due to these limitations, Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) suggest estimating a lag-augmented VAR (LA-VAR) model. The LA-VAR is simply the basic VAR model of lag length m, augmented with additional lags d, where d is the maximum order of integration based on unit root testing. The model can be illustrated as the following bivariate framework without loss of generality:

$$y_{1t} = \alpha_{10} + \alpha_{11}t + \sum_{i=1}^{m+d} \varphi_{1i} y_{1t-i} + \sum_{i=1}^{m+d} \delta_{1i} y_{2t-i} + \varepsilon_{1t} \qquad (7a)$$

$$y_{2t} = \alpha_{20} + \alpha_{21}t + \sum_{i=1}^{m+d} \varphi_{2i} y_{1t-i} + \sum_{i=1}^{m+d} \delta_{2i} y_{2t-i} + \varepsilon_{2t} \qquad (7b)$$

Here, y_{1t} and y_{2t} are the time series variables of interest, while m denotes the lag order of the original VAR model, t is the time trend and ε_{it} is the error terms. The model system is extended by d additional lags determined by the maximum integration order of the variables. The variable y_{1t} Granger cause y_{2t} if the past values of y_{1t} have predictive power for the present value of y_{2t}. For example, to test for Granger causality from y_{1t} to y_{2t}, a joint test of φ_{2i} (for $i = 1,2 \ldots m$) is performed using the Wald test. This strategy uses robust econometric procedures that do not entail detrending or differencing at the outset and that explicitly account for the possibility of unexpected changes in the causal relationships. The LA-VAR framework in which Granger causality tests are conducted is robust to time series integration and cointegration. Nevertheless, Granger causality tests from VAR models may be susceptible to the period for which VAR is estimated, according to Baum et al. (2021). Therefore, I follow a technique developed and applied by Shi et al. (2018) and was later also

applied by Baum et al. (2021) which employs recursive estimation procedures that allow for temporal variation in the Granger causal order to date stamp the timing of changes. Three test statistics are proposed to operationalize this strategy. The test statistics are the Forward Expanding Window (FW), Rolling Window (RW), and Recursive Evolving (REW) algorithms. Assume a time series sample size of up to T observations $\{x_0 \ , x_1 \ , x_2 \ \ldots x_T \ \}$, a number λ such that $0< \lambda < 1$ and $T\lambda$ is the product's integer component. The Wald test statistic is calculated over the subsample from $x_{[T\lambda 1]}$ to $x_{[T\lambda]}$.

The FW algorithm follows the standard forward recursion of Thoma (1994) where the first Wald test is estimated over the minimum sample size (window length) then the sample expands gradually by one observation until the last observation with the last Wald test is computed using the whole sample. When using a rolling window approach, the sample size is kept constant (at the minimum level), but the window shifts are each followed by the computation of the Wald statistic. Further, the recursive evolving window approach combines the advantages of a rolling window and forward expanding window (see figure) (1.5c). A schematic representation of the methods is in Figure 1.5, where each arrow stands for a workable sub-sample that can be used to calculate the relevant test statistic.

The analysis will be done in two ways. Firstly, I evaluate the full sample Wald statistics of the three algorithms described above against the bootstrap percentiles. The bootstrap methods are used to deal with issues of multiplicity in recursive testing as suggested by Shi et al. (2020). Secondly, the FW, RW, and REW statistics are plotted and evaluated in relation to the plotted bootstrap percentiles, hence it will be easy to identify episodes in which potential Granger causal relations fluctuate substantially (Shi et al., 2020). The variables for the estimations in this analysis are inflation expectations, credibility (of the central bank), target-

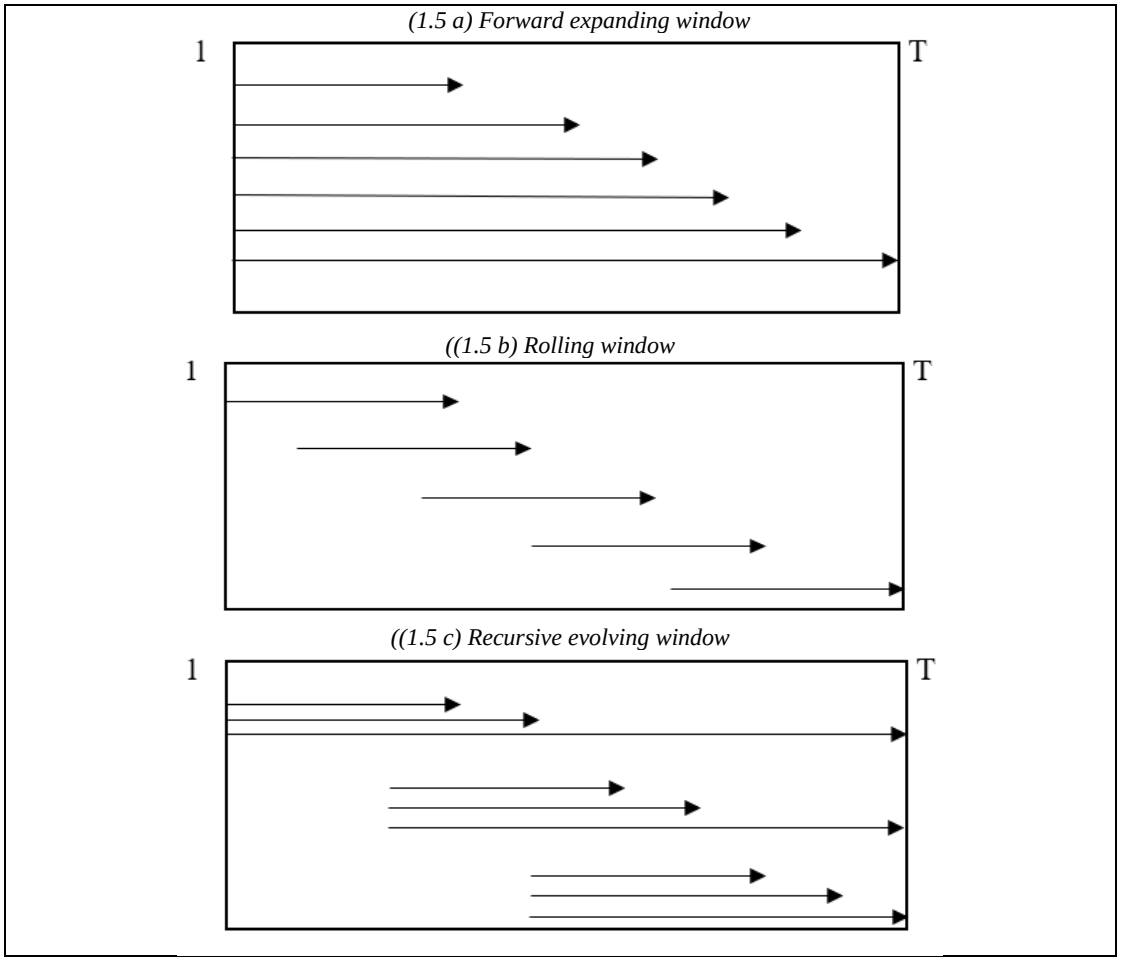
miss (of inflation), and policy rate.

Credibility is measured by an approach proposed by Cecchetti and Krause (2002) as depicted illustrated in equation 8 in which π^t is the inflation target and $E(\pi)$ is the inflation expectations. According to Cecchetti and Krause, if the expectations are equal to or below the target, the credibility index value is 1 and when average expectations are above 20 percent, the index is 0, or no credibility.

$$\text{Credibility Index}=\begin{cases} 1 & if\ E(\pi)\ \leq \pi^T & (8a) \\ 1\ -\ \frac{1}{0.2-\pi^T}\ (E(\pi)-\pi^T) & if\quad \pi^T < E(\pi) < 20\% & 8(b) \\ 0 & if\ E(\pi) \geq 20\% & 8(c) \end{cases}$$

If expectations are above the target but below 20%, the index is between 0 and 1. Cecchetti and Krause consider inflation above 20% to suggest that the central bank has no credibility at all. However, unlike Cecchetti and Krause (2002) who used the average of actual inflation for the previous 5 years as a proxy for expected inflation, I use the actual inflation expectations as reported by the survey respondents.

Figure 1. 5 Sample sequences and widths of windows



Notes. Figure 1.5 is showing examples of window widths and sequences. The examples are adapted from Baum et al. (2021)

1.5 Results

Stationarity tests results

I performed the maximum augmented Dickey-Fuller (ADF) test recommended by Leybourne, (1995), which has higher test power and is likely to reveal false stationarity compared to the standard ADF test, which has low power according to DeJong et al. (1992). The results are shown in table1.2. The unit root test indicates that the variables are stationary at a 5 percent level of significance, except for the exchange rate, which is significant at a 10 percent level of significance.

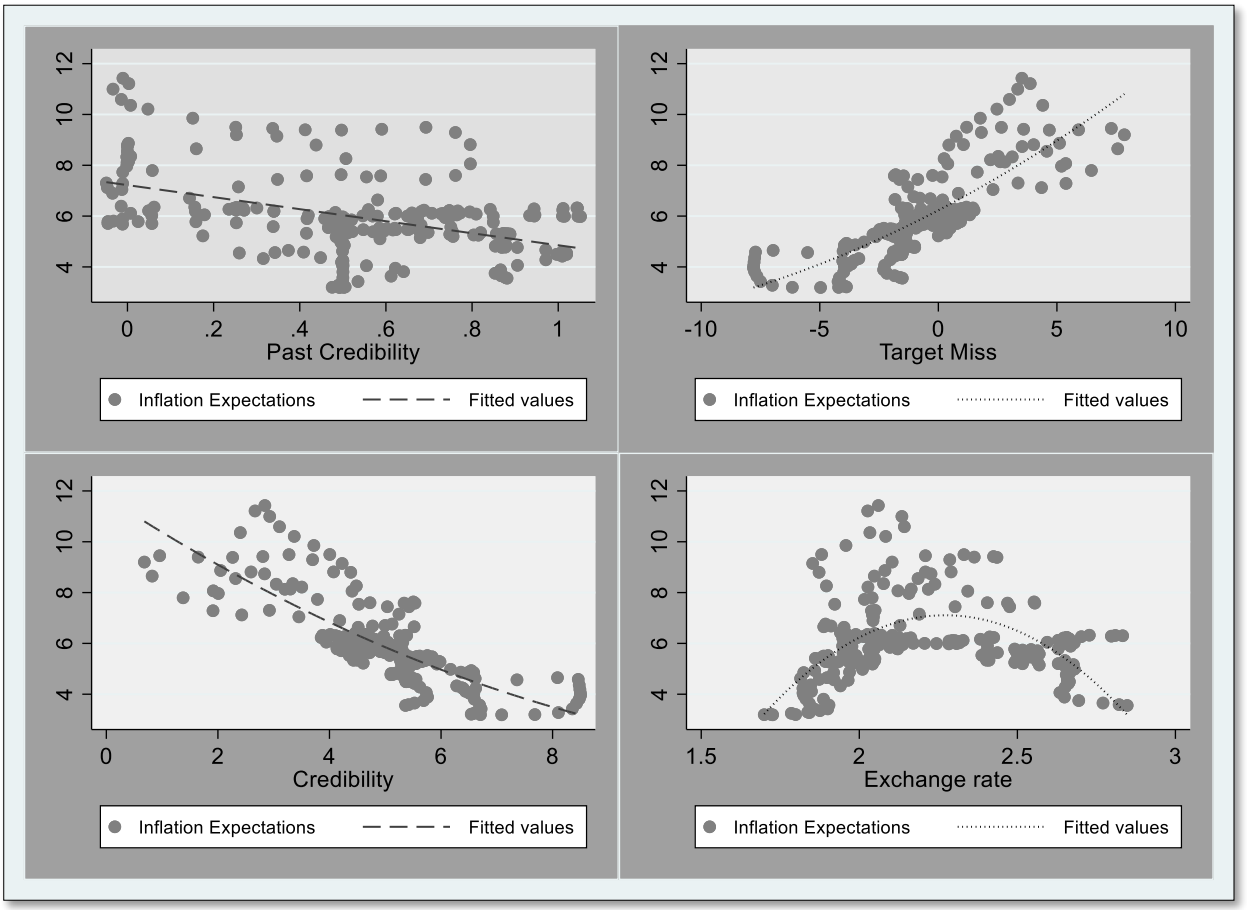
Table 1. 2: Maximum Augmented Dickey-Fuller Unit Root Test results

Criteria	Lags	ADF-max stat.	p-value	1%	5%	10%
Total expectations						
AIC	1	-3.345	0.004	-3.045	-2.435	-2.122
SIC	1	-3.345	0.004	-3.018	-2.423	-2.115
Target-miss						
AIC	1	-6.097	0.000	-3.045	-2.435	-2.122
SIC	1	-6.097	0.000	-3.018	-2.423	-2.115
Credibility						
AIC	1	-4.354	0.000	-3.045	-2.435	-2.122
SIC	1	-4.354	0.000	-3.018	-2.423	-2.115
Policy rate						
AIC	3	-2.459	0.050	-3.089	-2.461	-2.141
SIC	3	-2.459	0.046	-3.031	-2.427	-2.115
Exchange rate						
AIC	1	-2.13	0.098	-3.045	-2.435	-2.122
SIC	1	-2.13	0.097	-3.018	-2.423	-2.115
Oil price						
AIC	1	-3.354	0.004	-3.045	-2.435	-2.122
SIC	1	-3.354	0.003	-3.018	-2.423	-2.115

Notes. This is the maximum augmented Dickey-Fuller unit root test proposed by Leybourne (1995), which is shown to be more powerful than the standard ADF test. The model includes a constant. The Ho: unit root and Ha: stationarity. The exchange rate is not stationary at the standard 5% significance level but at 10%. There are three types of inflation expectations in the dataset: Expectations of trade unionists, economic agents, and financial analysts. Total expectations are the unweighted average of all categories of expectations. Target miss= the difference between the upper bound of the inflation target range (3%-6%) and realized inflation. Exchange rate= nominal exchange rate of the South African Rand per US$. Credibility is a measure of the credibility of the central bank proposed by Cecchetti & Krause (2002) with modifications, the oil price is the international Brent crude oil price and the policy rate is the central bank interest rate used to conduct monetary policy. AIC=Akaike Information Criterion and SIC = Black Criterion. The 1% CV, 5% CV, and 10% CV are critical values for the unit root at 1%, 5%, and 10% significance levels, respectively.

Figure 1.6 shows a series of two-sided scatter plots examining how inflation expectations correlate with other key variables. As expected, higher previous credibility is negatively correlated with inflation expectations with a correlation coefficient of 0.65 (see top left graph). In addition, the bottom left chart shows that current credibility is negatively correlated with inflation expectations with a correlation coefficient of 0.80. It is noticeable that missing the target in the current period is associated with higher expectations and that there is a positive correlation between the exchange rate as measured by the domestic currency per foreign currency.

Figure 1. 6 Scatter Plots for Key Variables



Notes. Past credibility is measured by how often the central bank achieved the inflation target in the past one year. Target-miss the difference between the current inflation and the inflation target. Credibility is measured by a tool developed by Cecchetti & Krause (2002) with modifications.

Threshold Analysis Results

Table 1.3 shows the results of threshold regressions for inflation expectations. As described above, the 'target miss' is the threshold variable. The starting point is to test for the existence of the threshold relationship between inflation expectations and the target-miss. Certainly, the justification for the application of a threshold model will be derived from the outcome of this test. The Hansen (2000) algorithm for LM-test is utilized. The null hypothesis of no threshold relationship is rejected, suggesting the existence of a threshold relationship. The results of this test are summarized in table 1.3. The use of the threshold model is therefore admissible for this analysis. The results from the threshold regressions indicate that the threshold is about 1.5 percentage points above the upper bound of the target range. The certainty of the estimate of the threshold value increases as the regression adds more control variables. The narrow confidence intervals, according to Hansen (2000), are important evidence of the certainty of the threshold value.

A nearly 1.5 percentage points threshold value is reasonable for the South African Economy. The economy has had experiences of high and volatile inflation. For instance, over the sample period, inflation averaged 5.2 percent, with some episodes having inflation as high as 13 percent. Ehrmann and Tzamourani (2012) and Malmendier and Nagel (2016) report that economic agents in high-inflation environments have systematically high inflation expectations. High inflation expectations would entail a relatively higher threshold value. Therefore, central banks may maintain the monetary policy stance even when the inflation outcome is temporarily off-target, so long as the 'miss' is below the threshold, holding other factors constant. The dummy for whether the central bank missed its inflation in the previous quarter(s) or not is insignificant to inflation expectations and its inclusion in the threshold

equation does not affect the threshold value itself. This could mean that the economic agents are less backward-looking. When the sample was split based on observations below and above the estimated thresholds, following Hansen (2000), the target-miss is consistently significant in explaining the inflation expectations when the estimates are for observations above the threshold suggesting that economic agents do not care much when the target miss is below the threshold. The results are summarized in Table A2 in the appendix.

Table 1. 3 Threshold Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	Total expectations	Total expectations	Total expectations	Total expectations	Total expectations	Total expectations
Target-Miss	0.472***	0.384***	0.394***	0.3172 ***	0.308***	0.228***
	(0.030)	(0 .024)	(0.026)	(0.031)	(.037)	(0.023)
Policy rate		0.241***	0.227 ***	0.368***	0.367***	0.506***
		(.026)	(0.026)	(0.041)	(0.042)	(0.031)
Exchange rate			-0.032 **	0.0211	0.0234	-0.102***
			(0.016)	(0.020)	(0.021)	(0.021)
Oil price				0.0156**	0 .016***	0.001
				(.003)	(0.003)	(0.002)
Previous Miss Dummy					0.022	
					(0.068)	
Structural-Break-2008-Dummy						1.899***
						(0.158)
Constant	6.314***	4.402***	4.828***	2.170***	2.120 ***	1.969***
	(.070)	0.178	(0.261)	(0.661)	(0.669)	(0.499)
Threshold	1.641	1.507	1.507	1.507	1.507	1.769
0.95 Confidence Interval:	[1.460, 1.641]	[1.507, 2.473]	[1.507, 2.306]	[1.507, 1.507]	[1.507, 1.507]	[1.507, 1.815]
Heteroskedasticity-robust	Yes	Yes	Yes	Yes	Yes	Yes
LM-test for No threshold	18.224	20.993	27.613	27.613	19.964	48.476
Bootstrap P-Value for No Thresh. test:	0.0004	.0006	0.000	0.000	0.004	0.000
R-squared	0.633	0.747	0.750	0.796	0.796	0.87
Degrees of Freedom	238	236	236	236	236	234

Notes. The Target miss is benchmarked on the upper bound of the inflation target range which is 3% - 6%. The estimates are based on a threshold model built by Bruce Hansen (2000, Econometrica). Exchange rate, Inflation, Oil prices data, and inflation expectations are sourced from the South African Bureau of Statistics and International Financial Statistics of IMF.

Inflation expectations and Credibility: Time-varying Granger causality results

The Bayesian Information criterion (SBIC) and Hannan and Quinn information criterion (HQIC) suggest an optimal lag of 3, while final prediction error (FPE), and Akaike's information criterion (AIC) suggest an optimal lag of 4. In the spirit of having a relatively parsimonious model, I use the optimal lag of 3 in the estimations. The stationarity tests suggest that the maximum order of integration is 1, therefore the additional lag d>0 will be specified as 1 for the lag-augmented VAR (LA-VAR) modeling framework.

(a) Full sample Analysis

This section tests whether there is no Granger causality between the inflation expectations variable and any of the following variables: central bank credibility, target-miss, and policy rate at any point throughout the sample period. Table 1.4 shows the output of the tests with overall inflation expectations as a dependent variable.

Table 1. 4 Overall inflation Expectations

Variable	Max_Wald_Forward Expansion	Max_Wald_rolling window	Max_Wald recursive evolving window
Target-Miss	8.618*	16.917***	19.157***
	(8.132)	(8.172)	(8.671)
	[11.168]	[11.075]	[11.460]
	{16.195}	{15.826}	{16.460}
Credibility	8.759	29.431***	34.997***
	(11.864)	(11.700)	(12.400)
	[14.621]	[15.449]	[15.954]
	{20.666}	{22.021}	{22.556}
Policy rate	25.862**	142.272***	153.495***
	(14.402)	(14.724)	(15.644)
	[18.715]	[19.198]	[19.857]
	{29.129}	{35.670}	{35.715}

Notes: The H_0 for the Wald tests is that each of the target miss, central bank credibility, and the monetary policy interest rate has no Granger causal effect on inflation expectations for the next 12 months. Credibility is calculated using a modified framework developed by Cecchetti and Krause (2002). The 90th, 95th, and 99th percentiles of bootstrap test statistics are in parenthesis (), brackets [], and curly brackets, respectively. *, **, ***mean the Wald test exceeds the 90th, 95th, and 99th percentiles, respectively, of crucial bootstrap values.

In the Wald test for the forward expansion window, the H_0 of no Granger causality is rejected at the 95th percentile for the policy rate and the 90th percentile for target miss. Credibility is found to be insignificant. However, there is overwhelming evidence for the rejection of the null hypothesis when the RW and REW algorithms are used. Central bank credibility, target-miss, and policy rate are significant at the 99th percentile. It suggests that each of the three variables has Granger-caused inflation expectations at some period within the sample period. This suggests that central bank credibility, inflation target-miss, and the policy rate can predict the evolution of inflation expectations. The results are presented in Table 1.5.

Table 1. 5 Overall inflation Expectations with historical Poor Target Performance

Variable	Max_Wald_Forward Expansion	Max_Wald_rolling window	Max_Wald recursive evolving window
Target-Miss	7.480	30.306***	35.968***
	(10.940)	(11.666)	(12.159)
	[14.937]	[15.368]	[15.903]
	{21.954}	{25.520}	{25.520}
Credibility	4.702	53.847***	74.295***
	(13.527)	(13.741)	(14.268)
	[17.566]	[18.425]	[19.510]
	{27.718}	{26.522}	{27.718}
4 period-Target Performance Dummy	8.086	59.962***	64.912***
	(8.808)	(9.054)	(9.368)
	[11.119]	[11.058]	[11.795]
	{ 21.238}	{20.934}	{ 21.293}
Credibility with Performance Dummy	12.958 **	42.367***	43.848***
	(9.417)	(9.452)	(10.181)
	[11.655]	[11.976]	[12.332]
	{19.204}	{20.217}	{22.131}
Policy rate	29.595***	42.628***	93.669***
	(16.052)	(16.902)	(17.318)
	[20.131]	[21.827]	[23.489]
	{29.541}	{31.557}	{31.786}

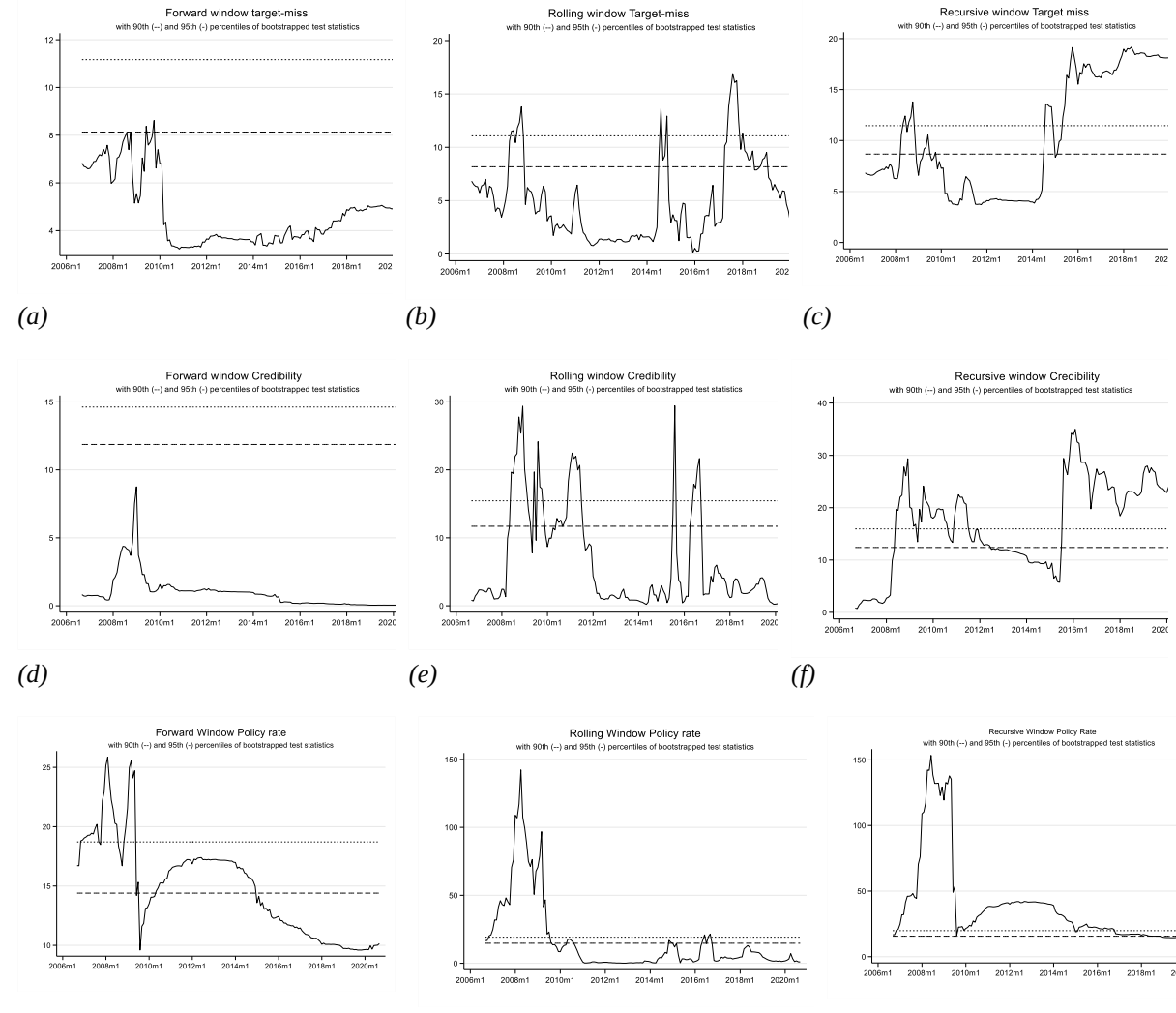
Notes. In parenthesis (), square brackets []and curly brackets are the 90th, 95th, and 99th percentiles of bootstrap test statistics. *, **, *** indicate that the Wald test exceeds the respective percentiles of crucial bootstrap values.

The interaction term between our measure of credibility and the history of achieved targets is significant at the 95th percentile for the Forward Expansion algorithm and significant at the 99th percentile for the Rolling Window and Evolving Window algorithms. Moreover, the two interacting variables are not significant individually for the Forward Expansion algorithms, but the interaction term becomes significant for all three algorithms, suggesting that the credibility of a central bank coupled with its reputation in meeting inflation targets is important for inflation expectations formation.

(b) Date Stamping

In this section, I display the sequence of test statistics from the FW, RW, and REW algorithms in form of graphs to understand how the Granger causality between variables evolves over time. Precisely, I pay attention to how the Granger causal link behaves during a period of crisis or economic downturn in South Africa. Figure 1.7 plots 9 charts, for each algorithm and variable. The graphed test statistics are evaluated against the 90^{th} and 95^{th} percentiles of the empirical distribution. Consistent with the full sample results, the time-varying Granger causality tests suggest episodes of causality from credibility, target-miss, and policy rate to inflation expectations. The key observation from the charts is that the relationships become unstable when the economy is passing through recessionary periods. There are big spikes in the test statistics during the 2008 – 2010 period and around 2016. South African economy experienced a significant downturn during 2008-2009 and in 2016. In 2016, the economy experienced the lowest output slump since the global 2008-2009 financial crisis. There is also evidence that missing or achieving an inflation target in South Africa has predictive power on inflation expectations.

Figure 1. 7 Time-varying causality tests for target-miss, credibility, and policy rate on total inflation expectations



Notes. The first row is time-varying Granger causality tests from target-miss, the second row is causality from credibility and the third row is causality from Policy rate to total average expectations. The number of lags for the basic VAR model is 3 based on SBIC and Hannan and Quinn information criterion (HQIC) and it is augmented by lag 1 based on the maximum order of integration in the series used for estimation. The estimations also account for time trends and the Wald statistics are robust to heteroskedasticity. The bootstrapping for critical values is based on 499 repetitions following Baum et.al (2021). Each point on the graph is the last observation in the rolling window.

Robustness Checks

Thresholds with Structural Breaks

Time series data is susceptible to structural breaks. When there is a structural break, using the full sample might not be plausible as the parameters would vary between the two sides of the break. I tested for a structural break with an unknown break date algorithm and found some evidence of a structural break in 2008. I estimated the threshold regression as in table 1.3, but with two separate datasets: one for the period before the structural break and another after the break. The results are tabulated and placed in table A4 in the appendix. I find evidence of a threshold in both pre-2008 and post-2008 estimations. The pre-2008 estimation has a threshold of 1.507 percentage points while the post-2008 estimations show a threshold of 3.12. The higher threshold in the latter datasets suggests that the central bank is successfully anchoring inflation expectations despite missing the target, likely through intensified monetary policy communication. This could also explain the toned-down volatility of realized inflation after 2010 as illustrated in figure 1.1. Indeed, Reid and Siklos (2020) observe that after the global financial crisis, central bank communication has evolved from being a complement to a substitute for monetary policy actions. Specifically, the South African central bank's communication was intensified after the global financial crisis and the central bank made clear intentions to improve the clarity of its communication (Segawa, 2021).

Thresholds with Expectations of Different Economic Agents

Considering that different economic agents can have different perceptions about inflation expectations, I replicated the analysis in table 1.3 using inflation expectations by business representatives, trade unionists, and financial analysts to test the sensitivity of the results found for overall inflation expectations. The results are compiled in table A3 in the appendix. As described above the target-miss is the threshold variable. The results indicate that the thresholds for the three groups are in the range of [1.0 - 1.5] percentage points above the upper bound of the target range. In addition, it is evident that expectations for these groups have only one threshold and it is positive. Two important issues emerge from this revelation. Firstly, it may mean that these groups of economic agents only care about positive inflation 'target miss'. If inflation is below or within the target range, it does not concern them. Secondly, it may also suggest that the agents begin to care about the target miss when they observe that it is getting out of hand when inflation misses the target in excess of the threshold. For monetary authorities, this finding may suggest that they can exercise patience before acting on small deviations of inflation from the target and avoid frequent changes in policy rates and other instrument adjustments which would confuse the economic agents and potentially destabilize the economy. Naturally, the monetary authorities need to exercise this patience cautiously, precisely when there are no other risk factors apart from the dampened inflation expectations.

Time-varying Granger Causality with Expectations of Different Economic Agents

Like results for overall expectations, tests under the FW algorithm suggest no rejection of the null hypothesis of no Granger causality for credibility when the variable of expectations by financial analysts is used as shown in table 1.6. However, for RW and REW, the null hypothesis is rejected for all three variables and the Wald test is significant at least at the 95th percentile.

Table 1. 6 Inflation Expectations by Financial Analysts

Variable	Max_Wald_Forward Expansion	Max_Wald_rolling window	Max_Wald recursive evolving window
Target-Miss	18.726**	70.215**	70.287**
	(8.061)	(8.301)	(8.666)
	[10.527]	[10.584]	[11.193]
Credibility	7.31	36.008**	36.008**
	(9.18)	(10.004)	(10.301)
	[11.483]	[12.13]	[12.591]
Policy rate	16.118*	74.747**	94.330**
	(13.471)	(13.996)	(14.543)
	[16.447]	[17.001]	[17.708]
N	236	236	236

Notes: In parenthesis (), square brackets [] are the 90th, and 95th, percentiles of bootstrap test statistics. *, **, indicate that the Wald test exceeds the respective percentiles of crucial bootstrap values.

Table 1. 7 Expectations by business representatives

Variable	Max_Wald_Forward Expansion	Max_Wald_rolling window	Max_Wald recursive evolving window
Target-Miss	3.323	7.473	13.758**
	(7.154)	(7.829)	(7.905)
	[9.298]	[8.822]	[9.298]
Credibility	8.518	74.164**	75.675**
	(10.207)	(10.654)	(11.045)
	[13.442]	[12.746]	[14.017]
Policy rate	26.480**	56.608**	61.198**
	(12.298)	(13.015)	(13.708)
	[16.670]	[17.065]	[18.003]

Notes. In parenthesis (), square brackets [] are the 90th, and 95th, percentiles of bootstrap test statistics. *, **, indicate that the Wald test exceeds the respective percentiles of crucial bootstrap values.

The results are broadly and qualitatively the same when business representatives' expectations and trade unionists' expectations are used. Additionally, the results are consistent with Ueda (2010) who found that inflation expectations respond to monetary policy shocks using data from Japan and United States. De Mendonça (2018) found a weak association between credibility and inflation expectation in emerging markets such as Brazil, Chile, Colombia, and Turkey.

Table 1. 8 Inflation Expectations by trade unionists

Variable	Max_Wald_Forward Expansion	Max_Wald_rolling window	Max_Wald recursive evolving window
Target-Miss	4.568	54.875**	56.075**
	(7.781)	(8.024)	(8.787)
	[9.803]	[10.346]	[10.754]
Credibility	7.288	47.502**	49.928**
	(10.897)	(11.964)	(12.484)
	[15.540]	[15.789]	[16.234]
Policy rate	31.777**	104.661**	110.142**
	(12.679)	(13.592)	(13.998)
	[16.586]	[17.729]	[19.154]

Notes. In parenthesis (), square brackets [] are the 90th, and 95th, percentiles of bootstrap test statistics. *, **, indicate that the Wald test exceeds the respective percentiles of crucial bootstrap values.

Diagnostics Tests

(a) Auto-correlation tests

Time series analysis is susceptible to serial correlation. I conducted a serial correlation test and found that there is no serial correlation at lags (4). Table 1.9 presents the results from the Lagrange-multiplier test. The null hypothesis of no autocorrelation is not rejected at a 5% significance level.

Table 1. 9 *Lagrange-multiplier test*

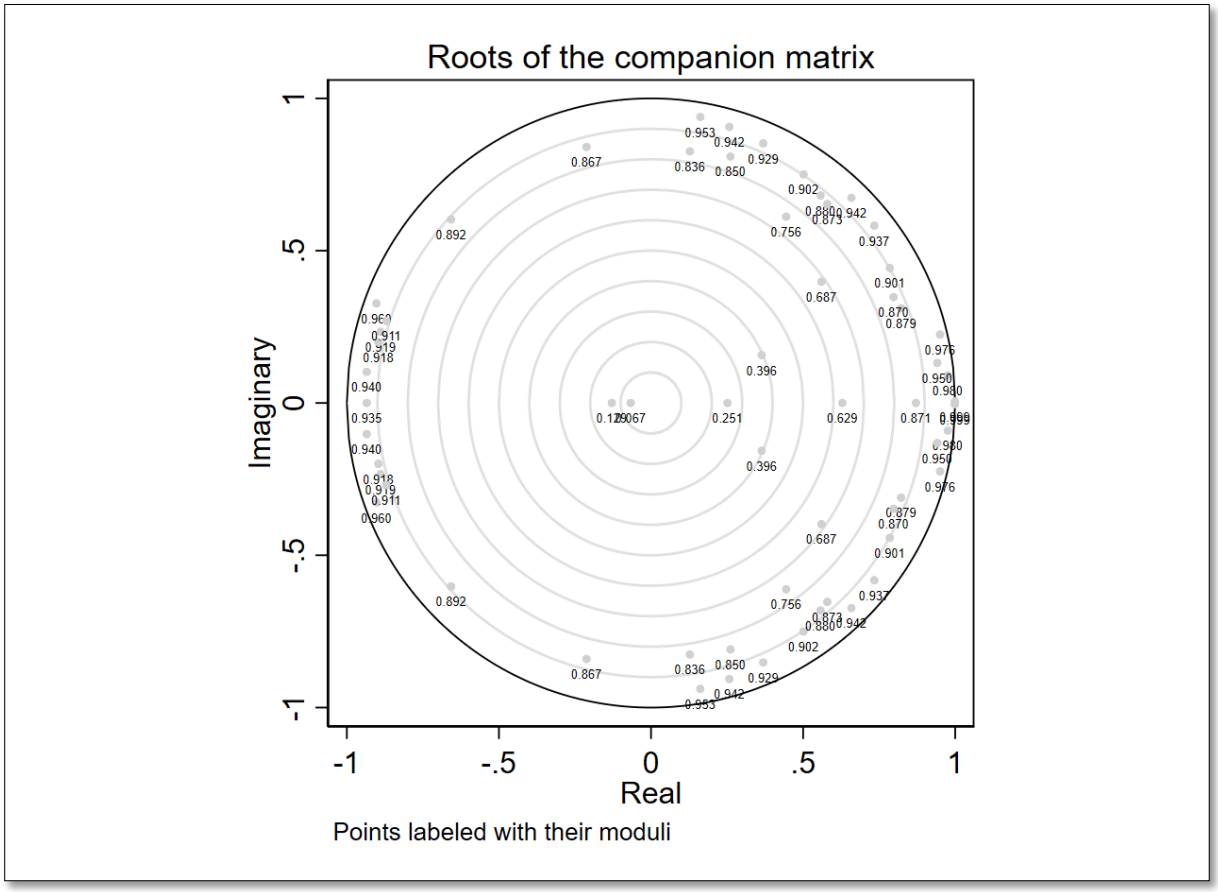
	chi2	Df	Prob>Chi2
	18.240	25	0.832

Notes. H0: no autocorrelation at lag order. The optimal lag selection criteria from SBIC and HQIC suggest an optimal lag of 3 and since this is an LA-VAR model that is augmented by a maximum order of integration as extra lags, the lags used in the LA-VAR model is 4 and it has no evidence of autocorrelation.

(b) Stability of the LA-VAR estimates

An important procedure after the estimation of a VAR model is to check the stability condition of the estimates. I implemented a stability condition test within the environment of LA-VAR estimates, and I find that all the eigenvalues lie inside the unit circle. This suggests that the estimates are stable and reliable.

Figure 1. 8 VAR stability Conditions



Notes: All points are inside the circle suggesting that the estimates are stable. All the values must be less than |1|.

1.6 Conclusion

The study was designed to answer three important questions. Whether there is a threshold of target-miss beyond which economic agents react in the form of inflation expectations revision; whether inflation expectations can be predicted by the level of current and past credibility of a central bank and policy rate movements; and how the causal relationship between inflation expectations and their determinants is affected by economic shocks such as the global financial crisis.

The finding that there is some threshold of 'target-miss' at which expectations start to rise is groundbreaking. It simply suggests that holding other factors constant, monetary authorities might choose to withhold a substantial monetary policy action after the inflation target has been missed, especially if the miss is seen as temporary and below a threshold. Currently, semi-structural models that have become the workhorse of monetary policy analysis and forecasting in most central banks, propose that any small miss of inflation target should be followed by some policy rate adjustment—a policy guidance that this paper finds unnecessarily inflexible. Given the findings in this study, the authorities could use monetary policy communication to smoothen out minor fluctuations in expectations, as the public may not immediately react strongly to small target misses if they are below a certain threshold. In other words, there is a non-linearity in the way the public adjusts its inflation expectations after the central bank misses the inflation target. Using South African data, this study estimates that economic agents begin to react at a target miss of more than 1.5 percentage points.

This study further finds evidence to suggest that—with good monetary policy communication and credibility—the threshold could be larger. Time-varying Granger causality suggests that central bank credibility, inflation target-miss, and the policy rate have predictive power for inflation expectations in South Africa. The predictive power of the three variables proved unstable during periods of economic downturn.

While this study finds evidence of the existence of a threshold relationship between inflation expectations and target-miss, the actual threshold value found in this analysis cannot be applied to other economies with different historical inflation paths and volatilities, the nature of monetary policy frameworks, and the level of the inflation target. I, therefore, suggest that each economy should estimate its own threshold based on the underlying fundamentals of the economy.

References

Alfada, A. (2019). The destructive effect of corruption on economic growth in Indonesia: A threshold model. *Heliyon*, *5*(10), e02649.

Ang, A., Bekaert, G., & Wei, M. (2007). Do macro variables, asset markets, or surveys forecast inflation better? *Journal of Monetary Economics*, *54*(4), 1163–1212.

Balke, N. S., & Fomby, T. B. (1997). Threshold Cointegration. *International Economic Review*, *38*(3), 627–645. https://doi.org/10.2307/2527284

Başkaya, Y. S., Gülşen, E., & Kara, H. (2012). Inflation expectations and central bank communication in Turkey. *Central Bank Review*, *12*(2), 1–10.

Baum, C. F., Hurn, S., & Otero, J. (2021). The dynamics of US industrial production: A time-varying Granger causality perspective. *Econometrics and Statistics*.

Blinder, A. S., Ehrmann, M., Fratzscher, M., De Haan, J., & Jansen, D.-J. (2008). Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence. *Journal of Economic Literature*, *46*(4), 910–945. https://doi.org/10.1257/jel.46.4.910

Bulut, U. (2018). Inflation Expectations in Turkey: Determinants and Roles in Missing Inflation Targets. *Journal of Central Banking Theory and Practice*, *7*(3), 73–90. https://doi.org/10.2478/jcbtp-2018-0024

Cagan, P. (1956). The monetary dynamics of hyperinflation. *Studies in the Quantity Theory of Money*.

Cecchetti, S. G., & Krause, S. (2002). Central bank structure, policy efficiency, and macroeconomic performance: Exploring empirical relationships. *Review-Federal Reserve Bank of Saint Louis*, *84*(4), 47–60.

Coibion, O., & Gorodnichenko, Y. (2012). What can survey forecasts tell us about information rigidities? *Journal of Political Economy*, *120*(1), 116–159.

Coibion, O., Gorodnichenko, Y., Kumar, S., & Pedemonte, M. (2020). Inflation expectations as a policy tool? *Journal of International Economics*, *124*, 103297.

Cristini, A., & Ferri, P. (2021). Nonlinear models of the Phillips curve. *Journal of Evolutionary Economics*, *31*(4), 1129–1155. https://doi.org/10.1007/s00191-021-00736-5

Cukierman, A., & Meltzer, A. H. (1986). *The credibility of monetary announcements*.

de Mendonça, H. F. (2018). Credibility and Inflation Expectations: What we can tell from seven emerging economies? *Journal of Policy Modeling*, *40*(6), 1165–1181. https://doi.org/10.1016/j.jpolmod.2018.06.001

DeJong, D. N., Nankervis, J. C., Savin, N. E., & Whiteman, C. H. (1992). The power problems of unit root test in time series with autoregressive errors. *Journal of Econometrics*, *53*(1–3), 323–343.

Dolado, J. J., & Lütkepohl, H. (1996). Making Wald tests work for cointegrated VAR systems. *Econometric Reviews*, *15*(4), 369–386.

Easaw, J., Golinelli, R., & Malgarini, M. (2013). What determines households' inflation expectations? Theory and evidence from a household survey. *European Economic Review*, *61*, 1–13. https://doi.org/10.1016/j.euroecorev.2013.02.009

Ehrmann, M., & Tzamourani, P. (2012). Memories of high inflation. *European Journal of Political Economy*, *28*(2), 174–191.

Engle, R. F., & Granger, C. W. J. (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. *Econometrica*, *55*(2), 251–276. https://doi.org/10.2307/1913236

Ezekiel, M. (1938). The Cobweb Theorem. *The Quarterly Journal of Economics*, *52*(2), 255. https://doi.org/10.2307/1881734

Faust, J., & Svensson, L. E. (2001). Transparency and credibility: Monetary policy with unobservable goals. *International Economic Review*, *42*(2), 369–397.

Fritzer, F., & Rumler, F. (2015). Determinants of Inflation Perceptions and Expectations: An Empirical Analysis for Austria. *Monetary Policy & the Economy*, *1*, 11–26.

Gil-Alana, L., Moreno, A., & Pérez de Gracia, F. (2012). Exploring survey-based inflation forecasts. *Journal of Forecasting*, *31*(6), 524–539.

Granger, C. W. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica: Journal of the Econometric Society*, 424–438.

Granger, C. W. (1988). Some recent development in the concept of causality. *Journal of Econometrics*, *39*(1–2), 199–211.

Grothe, M., & Meyler, A. (2015). *Inflation forecasts: Are market-based and survey-based measures informative?* (No. 928991680X). ECB Working Paper.

Gürkaynak, R. S., Levin, A. T., Marder, A. N., & Swanson, E. T. (2007). Inflation targeting and the anchoring of inflation expectations in the western hemisphere. *Series on Central Banking, Analysis, and Economic Policies, No. 11*.

Hansen, B. E. (2000). Sample Splitting and Threshold Estimation. *Econometrica*, *68*(3), 575–603.

Hansen, B. E. (2011). Threshold autoregression in economics. *Statistics and Its Interface*, *4*(2), 123–127. https://doi.org/10.4310/SII.2011.v4.n2.a4

Hansen, B. E. (2017). Regression kink with an unknown threshold. *Journal of Business & Economic Statistics*, *35*(2), 228–240.

Inflation Expectations: Important to Central Bankers | St. Louis Fed. (n.d.). Retrieved February 22, 2021, from https://www.stlouisfed.org/publications/regional-economist/april-2016/inflation-expectations-are-important-to-central-bankers-too

Kabundi, A., Schaling, E., & Some, M. (2015). Monetary policy and heterogeneous inflation expectations in South Africa. *Economic Modelling*, *45*, 109–117.

Leduc, S., Sill, K., & Stark, T. (2007). Self-fulfilling expectations and the inflation of the 1970s: Evidence from the Livingston Survey. *Journal of Monetary Economics*, *54*(2), 433–459.

Leybourne, S. J. (1995). Testing for unit roots using forward and reverse Dickey-Fuller regressions. *Oxford Bulletin of Economics and Statistics*, *57*(4), 559–571.

Malmendier, U., & Nagel, S. (2016). Learning from inflation experiences. *The Quarterly Journal of Economics*, *131*(1), 53–87.

Nerlove, M. (1956). Estimates of the Elasticities of Supply of Selected Agricultural Commodities. *American Journal of Agricultural Economics*, *38*(2), 496–509. https://doi.org/10.2307/1234389

Nunn, G., & Elliott, C. (1975). Inflation Expectations: Theories and Evidence. *Nebraska Journal of Economics and Business*, *14*(3), 19–28.

Oral, E. (2013). *Consumer inflation expectations in Turkey*. Bank for International Settlements.

Reid, M., & Siklos, P. (2020). *Building Credibility and Influencing Expectations-The Evolution of Central Bank Communication*.

Reinhart, C. M., & Rogoff, K. S. (2010). Growth in a Time of Debt. *American Economic Review*, *100*(2), 573–578.

Reis, R. (2006). Inattentive consumers. *Journal of Monetary Economics*, *53*(8), 1761–1800. https://doi.org/10.1016/j.jmoneco.2006.03.001

Segawa, A. (2021). Communication by the South African Reserve Bank: Has time yielded clarity? *Communicare: Journal for Communication Sciences in Southern Africa*, *40*(2), 1–20.

Shi, S., Hurn, S., & Phillips, P. C. B. (2020). Causal Change Detection in Possibly Integrated Systems: Revisiting the Money–Income Relationship*. *Journal of Financial Econometrics*, *18*(1), 158–180. https://doi.org/10.1093/jjfinec/nbz004

Shi, S., Phillips, P. C., & Hurn, S. (2018). Change detection and the causal impact of the yield curve. *Journal of Time Series Analysis*, *39*(6), 966–987.

Thoma, M. A. (1994). Subsample instability and asymmetries in money-income causality. *Journal of Econometrics*, *64*(1–2), 279–306.

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of Econometrics*, *66*(1–2), 225–250.

Tong, H. (1978). *On a threshold model*.

Tong, H. (1983). *Threshold Models in Non-linear Time Series Analysis*. Springer-Verlag. https://doi.org/10.1007/978-1-4684-7888-4

Tsay, R. S. (1998). Testing and Modeling Multivariate Threshold Models. *Journal of the American Statistical Association*, *93*(443), 1188–1202. https://doi.org/10.1080/01621459.1998.10473779

Tuna, G., & Almahadin, H. A. (2021). Does interest rate and its volatility affect banking sector development? Empirical evidence from emerging market economies. *Research in International Business and Finance*, *58*, 101436. https://doi.org/10.1016/j.ribaf.2021.101436

Ueda, K. (2010). Determinants of households' inflation expectations in Japan and the United States. *Journal of the Japanese and International Economies*, *24*(4), 503–518.

APPENDIX

TABLE A1: Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Oil price	1.000								
(2) Target-miss	0.104	1.000							
(3) Credibility	0.041	-0.625	1.000						
(4) Policy rate	-0.482	0.401	-0.676	1.000					
(5) Exchange rate	-0.099	0.123	0.136	-0.259	1.000				
(6) Total expectations	0.068	0.795	-0.887	0.629	-0.068	1.000			
(7) Expectations by trade unionists	0.069	0.794	-0.867	0.602	-0.128	0.974	1.000		
(8) Expectations by business representatives	0.021	0.769	-0.866	0.584	-0.063	0.970	0.979	1.000	
(9) Expectations by financial analysts	0.094	0.717	-0.815	0.618	-0.006	0.927	0.826	0.821	1.000

Figure A1: Expectations by Group

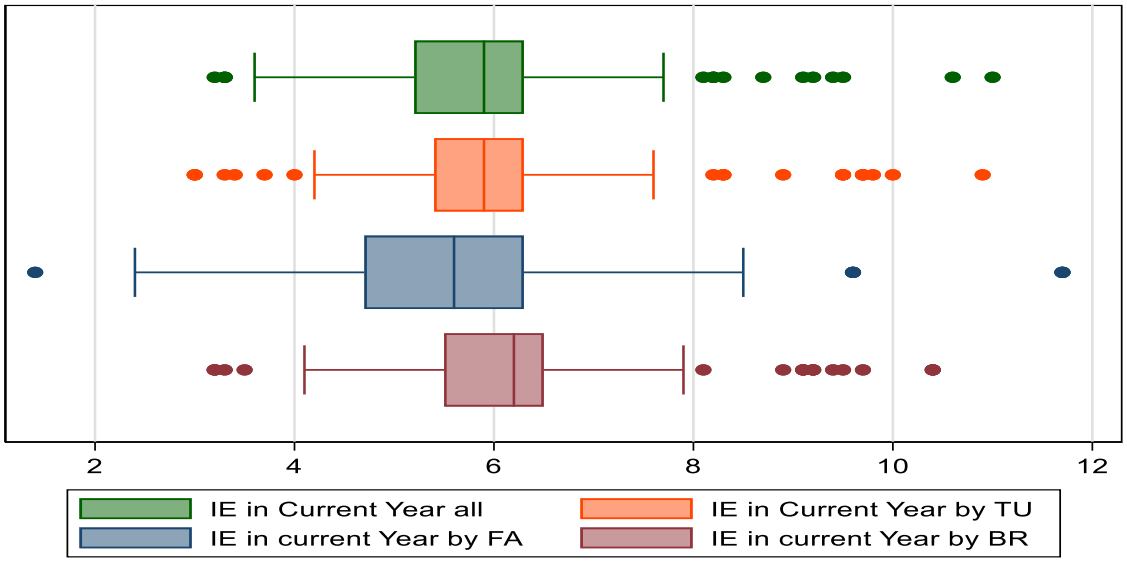
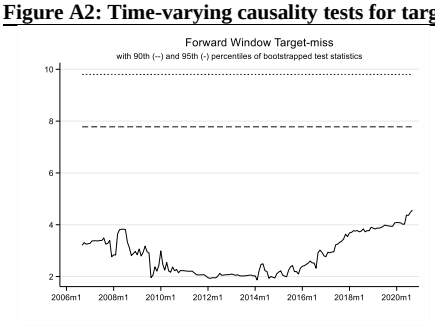


Figure A2: Time-varying causality tests for target-miss, credibility, and policy rate on inflation expectations by trade unionists



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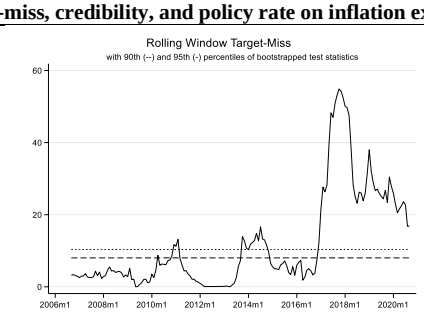
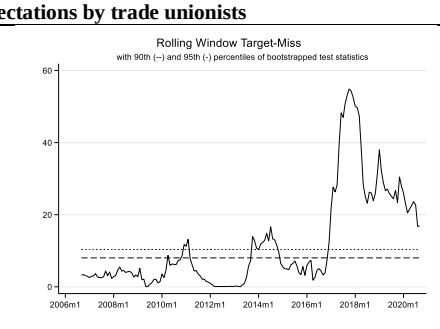


(b)



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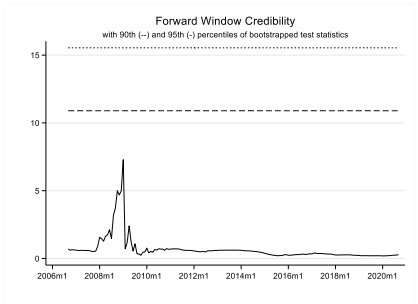

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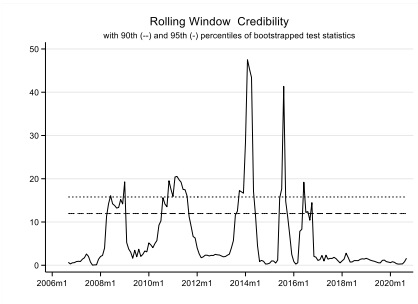

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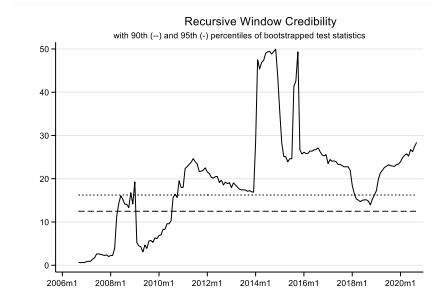

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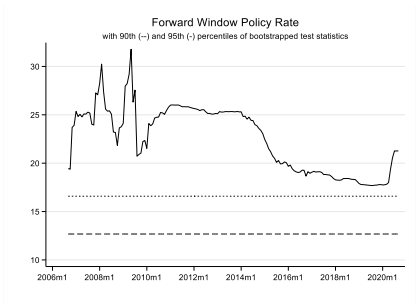

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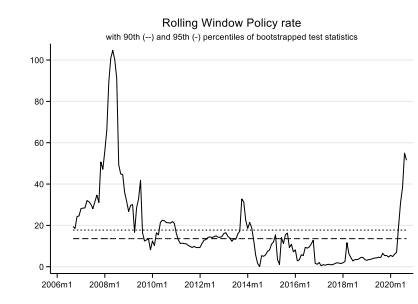

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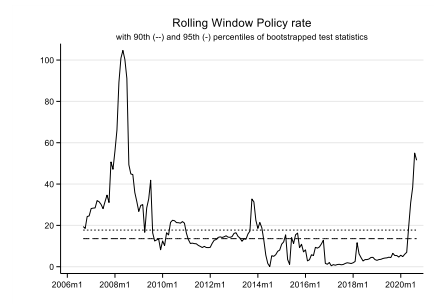
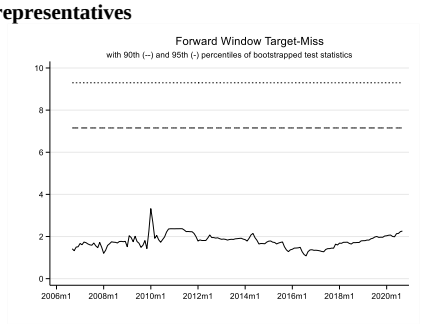


(i)

Notes: The first row is time-varying Granger causality tests from target-miss, the second-row causality from credibility and the third row is causality from Policy rate to expectations by trade unionists. The number of lags for the basic VAR model is 3 based on SBIC and Hannan and Quinn information criterion HQIC and it is augmented by lag 1 based on the maximum order of integration in the series used for estimation. The estimations also account for time trends and the Wald statistics are robust to heteroskedasticity. The bootstrapping for critical values is based on 499 repetitions following Baum et.al (2021). Each point on the graph is the last observation in the rolling window.

Figure A3: Time-varying causality tests for target-miss, credibility, and policy rate on inflation expectations by business representatives



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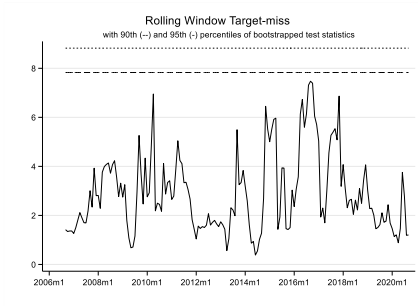

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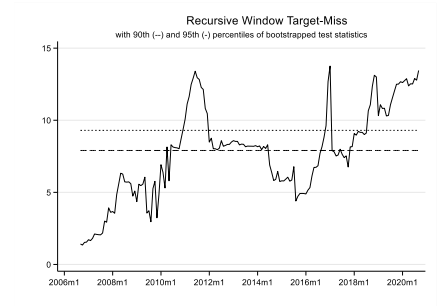

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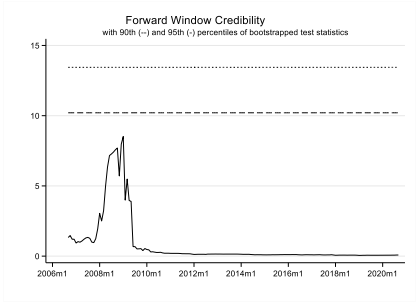

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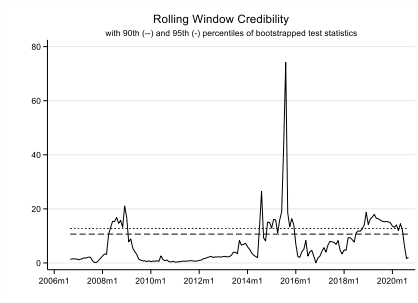

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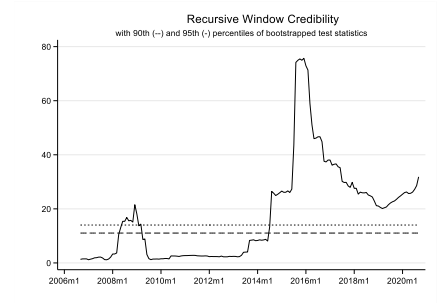

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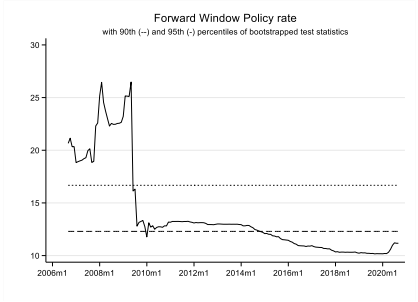

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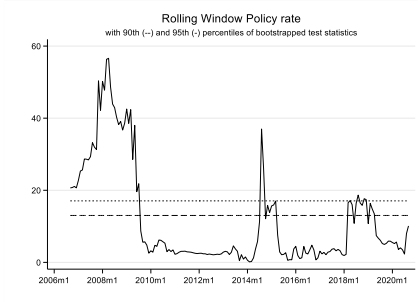

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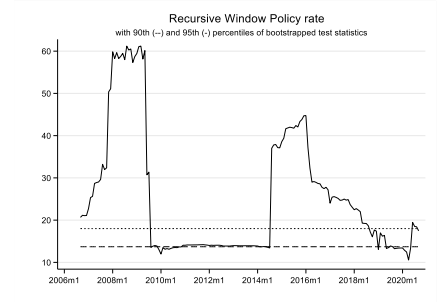
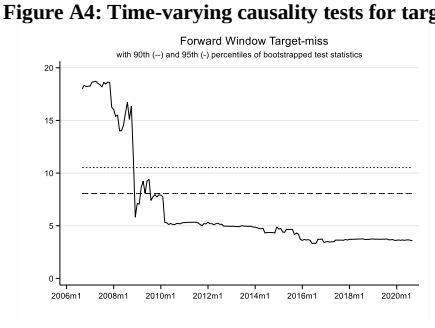


(i)

Notes: The first row is time-varying Granger causality tests from target-miss, the second-row causality from credibility and the third row is causality from Policy rate to expectations by business representatives. The number of lags for the basic VAR model is 3 based on SBIC and Hannan and Quinn information criterion HQIC and it is augmented by lag 1 based on the maximum order of integration in the series used for estimation. The estimations also account for time trends and the Wald statistics are robust to heteroskedasticity. The bootstrapping for critical values is based on 499 repetitions following Baum et.al (2021). Each point on the graph is the last observation in the rolling window.

Figure A4: Time-varying causality tests for target-miss, credibility, and policy rate on inflation expectations by financial analysts



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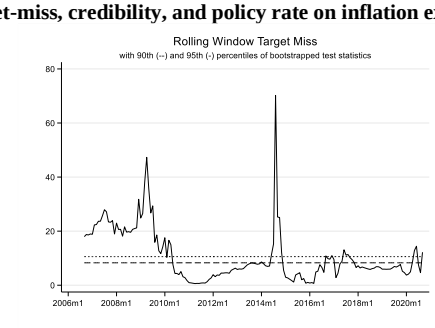

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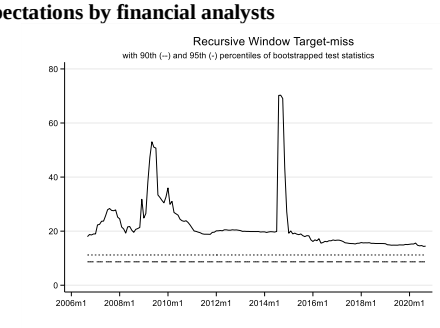

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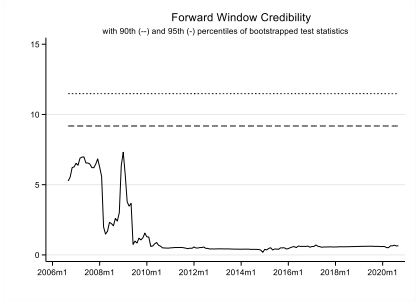

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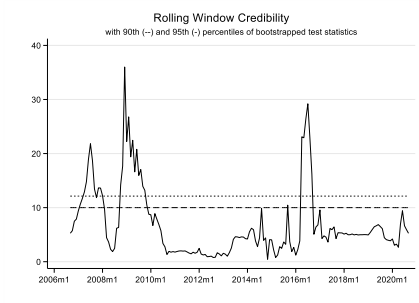

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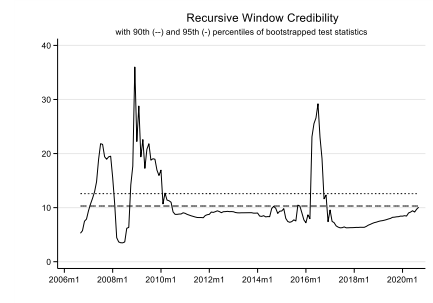

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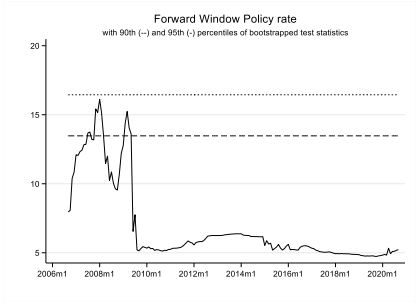

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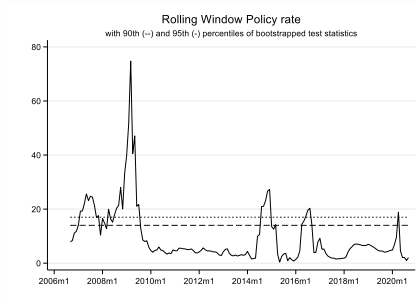

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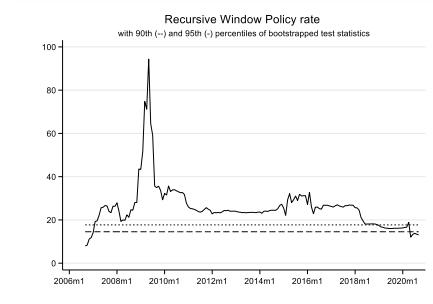


(i)

Notes: The first row is time-varying Granger causality tests from target-miss, the second-row causality from credibility and the third row is causality from Policy rate to expectations by financial analysts. The number of lags for the basic VAR model is 3 based on SBIC and Hannan and Quinn information criterion HQIC and it is augmented by lag 1 based on the maximum order of integration in the series used for estimation. The estimations also account for time trends and the Wald statistics are robust to heteroskedasticity. The bootstrapping for critical values is based on 499 repetitions following Baum et.al (2021). Each point on the graph is the last observation in the rolling window.

Table A2: Estimates below and above the Threshold

	(<1.641)	(>1.641)	(<1.507)	(>1.507)	(<1.507)	(>1.507)	(<1.507)	(>1.507)
VARIABLES	Total expectations	Total expectations	Total expectations	Total expectations	Total expectations	Total expectations	Total expectations	Total expectations
Target-miss	0.0351	**0.382*** **	0.0309	**0.417*** **	0.0682	**0.444*** **	-0.0719	**0.269*** **
	(0.131)	(0.0278)	(0.131)	(0.0283)	(0.101)	(0.0293)	(0.0972)	(0.0279)
Exchange Rate			0.160	-0.0706***	0.484***	-0.0809***	0.288*	0.0390**
			(0.207)	(0.0179)	(0.174)	(0.0179)	(0.161)	(0.0177)
Oil Price					0.0245***	-0.00577***	0.0214***	0.0165***
					(0.00526)	(0.00199)	(0.00463)	(0.00253)
Policy Rate							0.248***	0.374***
							(0.0747)	(0.0335)
Constant	8.699***	6.081***	7.344***	6.820***	2.957*	7.339***	2.759*	1.749***
	(0.560)	(0.0684)	(1.844)	(0.198)	(1.701)	(0.265)	(1.469)	(0.541)
R-squared	0.002	0.479	0.022	0.516	0.441	0.535	0.598	0.713

Table A 3. Threshold Regressions

Variable	Business Rep.	Trade Unionists	Financial Analysts
Exchange rate	0.105***	0.082***	.057***
	(0.025)	(0.024)	(0.014)
Oil price	0.024***	0.028***	0.015***
	(0.003)	(0.002)	(0.002)
Policy rate	0.547***	0.588***	0.287***
	(0.033)	(0.033)	(0.036)
Constant	-0.512	-1.046*	1.843***
	(0.627)	(0.593)	(0.423)
Threshold	**1.507**	**1.507**	**0.993**
Heteroskedasticity-robust	Yes	Yes	Yes
LM-test for No threshold	60.972	58.728	45.966
Bootstrap P-Value for No Thresh. test:	0.000	0.000	0.000
R-squared	0.495	0.550	0.664
Degrees of Freedom	236	236	236

Table A 4. Threshold Regressions Before and after the 2008 Financial Crisis

	Pre-2008	Post-2008
Variable	Total Expectations	Total expectations
Target-Miss	0.169***	0.358***
	(0.025)	(0.043)
Policy rate	0.381***	0.405***
	(0.057)	0.038
Exchange rate	0 .256***	-0.135***
	(0.043)	(0.020)
Oil price	-0.002	-0.001
	(0.003)	(0.003)
Constant	0 .464	5.074***
	(0.581)	(0.543)
Threshold	1.507	3.12
0.95 Confidence Interval:	[0.180, 1.507]	[2.61, 3.35]
Heteroskedasticity-robust	Yes	Yes
R-squared	0.93	0.88
Degrees of Freedom	82	148

2.0 CHAPTER TWO: EFFECTS OF MONETARY POLICY COMMUNICATION ON KEY FINANCIAL VARIABLES IN DEVELOPING COUNTRIES[2]

ABSTRACT

This study utilizes a newly built dataset drawn from more than 850 monetary policy statements from 21 developing countries over an 11-year horizon to establish that unclear statements are associated with higher foreign exchange (FX) rates volatility. The text mining tools permitted us to construct a set of monetary policy statements complexity and readability measures, identify statements topics and assess central banks' sentiments about the economic situation. Our results were not only consistent with previous related studies but also robust to different measures of readability and complexity indicators. The results for Lending, Money Market, and Treasury bill rates are however not robust. We observe that the adoption of central bank communication as a tool for monetary policy is not enough for better monetary policy outcomes. There is a need for appropriate execution and messages are required to be clear, simple, and easier to comprehend by markets.

Keywords: monetary policy, communication, complexity, readability, FX rate, lending rate, money market rate, treasury bill rate, volatility.

[2] Co-authored with Iegor Vyshnevskyi

2.1 Introduction

Over the last two decades, central banks have become more interested in communicating monetary policy. This contrasts with previous central bank beliefs, in which central banking issues, and particularly monetary policy issues, were treated almost like a secret cult, and markets were usually driven by "surprise". Therefore, the markets had no clue what to expect, the public never understood why certain policy decisions were made and the central bank owed no one an explanation for its actions. For example, the then chairman of the Fed Paul Volcker declined to disclose the Fed's decisions immediately in 1984 on the basis that announcing the decisions immediately would mean commitment. Similarly, Chairman Alan Greenspan, opposed the Fed's decision to be made public right away in 1989 because he feared that "public announcement requirement also could impede timely and appropriate adjustment to policy" (Blinder et al., 2008), although he changed his stance later in 2003 and explicitly managed expectations by telling everyone the forward guidance on the direction of Federal funds rate.

The popularity of monetary policy communication altered the rules of the game. Most monetary authorities are now forthright and willing to disclose the fundamental assumptions underlying their decisions; they are also keen to explain what could go wrong and what could go right in the short and medium term as well as what they would do depending on the future economic conditions. Indeed, central banks are now prepared to reveal their anticipated moves and the rationale behind them. A major question arises on why there is a sudden change of heart by central banks. Amato et al. (2002) identify three reasons. Firstly, since many central banks have earned independence, they need to increase accountability which demands more open communication with the public about policymakers' ideas and monetary policy operations. Secondly, many industrialized and developing market nations have embraced inflation

targeting since New Zealand first implemented it in 1990—a monetary policy regime that places importance on the communication practices of central banks. Finally, the significance of financial markets in many countries and the critical role of market players in determining market prices necessitates the need to anchor and manage such expectations, which is a critical component of monetary policy. This would be a near-impossible task without a strong line of communication with market participants.

The evidence on the impact of monetary policy communication on financial market variables is in abundance for advanced economies but still scanty for developing markets. According to Guthrie & Wright (2000), the Reserve Bank of New Zealand's communications—termed “open mouth operations” by the authors—were found to have a long-lasting effect on interest rates across the maturity range. Furthermore, Kohn & Sack (2003) claim to have found evidence that the Federal Open Market Committee's pronouncements have an impact on interest rates over the short and medium term. Similar evidence is found by Reeves and Sawicki (2007) in England and Musard-Gies (2006) in European Central Bank (ECB). A handful of studies on the subject are also available for emerging markets. For example, Ahokpossi et al., (2020) report that financial surprises have a significant impact on money market rates in Indonesia while Su et al. (2020) state that informal communication appears to be more effective than formal communication in China.

This study departs from the earlier related studies in two ways. Firstly, most of the studies on this topic have been done in advanced economies where financial markets are well developed and the response of financial markets is almost guaranteed. In developing countries, there is no such luxury. Financial markets are usually slow to react to news and at times no response at all. For instance, when a sitting president in Malawi suddenly died in April 2012, the stock market indices were intact around those dates. In developed economies, the response to such tragic news would have been noticeable if not strong. Now that most central banks in

the developing world have begun producing statements in the last decade, it is timely to investigate whether the impact of communication on financial markets experienced in advanced economies could be observed in the developing world. Secondly, our study is unique because it uses over 850 statements from 21 central banks of developing countries. This diverse data is expected to provide robust results which can be easily inferred from other countries with similar characteristics.

Results show that the complexity and readability of statements are both essential variables in the determination of foreign exchange rates volatility, whereas they are weak in the driving of lending rates, money market rates, and local treasury bill (T-bill) rates in developing nations. The results further suggest that central banks' views about economic situations can affect exchange rate and interest rate movements in developing markets.

This paper contributes to the related literature in various respects. First, we study the monetary policy statements of developing countries' central banks utilizing a newly created dataset. We further quantify these statements' complexity and readability as well as central banks' sentiments about the economic situation. Furthermore, we make use of forward guidance tools since we discovered that with the exception of a few economies forward guidance tools are rarely used in developing countries. In line with the literature, we find evidence suggesting that ambiguous statements are linked to high exchange rate volatility, but no evidence that monetary policy statements are associated with market rates volatility.

The study is organized as follows. Section 2 details the theoretical underpinnings of monetary policy communication and the expected response from the financial markets. This section also unveils studies that have been conducted in this area and the results. Section 3 contains the research questions and hypotheses we explore. Section 4 describes the data used in this study while section 5 contains the methodological framework this study uses. Empirical

results and discussion are presented in section 6 while section 7 concludes the study with policy recommendations.

2.2 Literature Review

2.2.1 The Theory of Monetary Policy Announcements

In a broad sense, the central bank monetary policy communication refers to the process when the information is made public by the central bank regarding its present and future policy objectives, the current economic outlook, and the expected route for future monetary policy choices (Blinder et al., 2008). In theory, effective monetary policy announcements make policy decisions more predictable and anchor long-run inflation expectations (Lewis et al., 2019). Over the recent decades, central banks have been able to inform the general public about monetary policy decisions, objectives, strategies, and outlooks for macroeconomic conditions. This approach is most prevalent in developed countries where central banks regularly provide information on the economic outlook and the potential for future monetary policy adjustments (Lewis et al., 2019). Similarly, Mathur and Sengupta (2020) report that communication is less effective in most emerging economies due to asymmetric information, weak financial institutions, and smaller financial markets. Therefore, existing literature covers extensive communication in developed countries (Ahokpossi et al., 2020).

Blinder et al. (2008) present a persuasive theory of central bank communication. They argue that a central bank's power to impact the economy is dependent on its ability to alter market expectations about the future course of the overnight interest rate. Term structure theories dictate that longer-term interest rates, R_t, should mirror future overnight rates.

$$R_t = a_n + \frac{1}{n}(r_t + r^e_{t+1} + r^e_{t+2} + \cdots + r^e_{t+n-1}) + \varepsilon_{1t} \quad (1)$$

Where R_t denotes interest rates of longer-term instruments, r_t is the current overnight rate, and r^e_{t+1} is the expectation of tomorrow's overnight rate, a_n is a term premium. Equation (1)

states unequivocally that intermediate and long-term interest rates should be mostly determined by public expectations about future central bank actions. Present overnight interest rates are mostly irrelevant, as what counts is the anticipation of future rates, which is influenced by central bank communication (Bernanke et al., 2004). This idea is incorporated into the macroeconomic framework which is designed to illustrate the role of central bank communication (signals).

$$y_t = \mathrm{D}(r_t - \pi^e_{t,}\, R_t - \pi^e_{t,} \ldots) + \varepsilon_{2t} \qquad (2)$$

If we consider r as the short rate in equation (1) and R as the long rate, aggregate demand is, therefore, dependent on r, R and expected inflation $\pi^e_{t,}$ among other factors. It is easy to understand how aggregate demand driven by expectations in equation (2) affects aggregate supply in equation (3).

$$\pi_t = \beta \mathrm{E}(\pi_{t+1} + \gamma(y_t - y^*_t) + \varepsilon_{3t} \qquad (3)$$

Where π_t is actual inflation and y_t and y^*_t are actual and potential output, respectively. The reaction function in (4) closes the model.

$$r_t = \mathrm{G}(y_t - y^*_t,\, \pi_t, \pi^*_{t,} \ldots) + \varepsilon_{4t} \qquad (4)$$

Where $\pi^*_{t,}$ is the central bank's inflation target.

This theoretical framework suggests that if the economic environment is stationary, the central bank is credible in its commitment to the policy rule, and expectations are rational, then bank communication is immaterial. Woodford (2005) contends that any regular pattern in the central bank's actions can be correctly inferred. In practice the economy is nonstationary, expectations might be nonrational or information cannot be symmetric between the bank and the public (Blinder et al. 2008). Moreover, Bernanke et al. (2004) believe that defining a strict policy rule from which the central bank would never stray is impractical. Additionally, Blinder

et al. (2008) argue that the number of possible policy responses that a central bank can pursue is effectively unlimited. As such, central bank communication becomes relevant.

When there is asymmetric information, the economic environment is not stationary and expectations are not entirely rational, it allows the central bank to boost economic performance by disclosing its long-run inflation target (Bernanke et al., 2004). In many cases, offering more information solves an information problem. It helps to anchor expectations. The economy cannot converge to the rational expectations equilibrium if the public does not know the central bank's reaction function. In this simplified approach, we capture these notions by specifying an explicit equation for interest rate expectations, such as:

$$r_{t+1}^{e} = H_j(y_t\ R_t\ r_t\ , \dots,\ \boldsymbol{s_t}) + \varepsilon_{5t} \qquad (5)$$

where $\boldsymbol{s_t}$ is a vector of central bank signals ranging from obvious signals such as an announcement of an inflation target to more cryptic signals.

In summary, the above theory suggests that there are three different conduits in which central bank communication diffuses into the economy which are as follows: the direct effect of the overnight rate on aggregate demand (equation 2); the direct effect of central bank signals on expected future short rates (equation 5); and the effect of changes in the short rate on expected future short rates (equations (1) and (5)), and their subsequent feedback onto long rates (R_t) (equation 1).

The theory further postulates that monetary policy statements guide interest rate and inflation expectations, promote transparency and accountability, and help ensure the credibility of central bank operations (Ahokpossi et al., 2020). For example, the public can assess central bank performance based on its ability to keep inflation within target limits. There is consensus in the literature that communication is an essential and effective monetary policy tool to ensure the success of central banks (Ahokpossi et al., 2020; De Fiore, Lombardi & Schuffels 2021;

Lewis et al., 2019; Mathur & Sengupta 2020). Jenkins (2004) found that effective monetary policy communication is directly linked to achieving good economic outcomes. With effective communication, Pescatori (2018) acknowledged that economic agents are less surprised by the actions of central banks, thereby curbing asset price volatility.

The information provided by central banks has a significant impact on the economy. For this reason, the effectiveness of communication depends on its clarity (Ahokpossi et al., 2020). Well-transmitted monetary policy tends to be more effective (Jenkins, 2004). Similarly, Demiralp and Jorda (2002) report that concisely communicating the central bank's intentions to the public increases the likelihood that interest rates will stabilize. Ambiguous communication leads to different interpretations by the public, causing fluctuations in financial markets and thus impeding economic development (Mathur & Sengupta 2020).

It is also widely discussed in the literature on economic agents' asymmetric responses to bad and good news. Agents are thought to react more strongly to bad news than to good news (Barberis et al., 1998). This implies that market reaction may be affected not only by the size of the monetary policy shock but also by whether the shock is inherently good or bad news. Recognizing this theoretical underpinning, central banks tend to issue longer monetary policy statements when delivering bad news or during economic downturns. It is not surprising, then, that Coenen et al. (2017) and Smales and Apergis (2017b) observe that Federal Open Market Committee (FOMC) statements have become noticeably longer and more difficult to read since the financial crisis, even though the trend has recently reversed.

Evolution of Monetary Policy Announcements

Before the 1970s, central banks acted secretly to surprise markets. However, the sharp inflation of the 1970s highlighted the need to effectively manage expectations for economic outcomes through increased transparency (Assenmacher et al., 2021). Yet, for example, only in February 1994 FOMC issued a statement in support of the decision. Blinder et al. (2017) add that the global financial crisis of 2008 further amplified the need for broader communication with the public. This led to a paradigm shift from deliberate secrecy to increased transparency in the operations of central banks around the world (Assenmacher et al., 2021; Jenkins, 2004). Since then, the focus has been on monetary policy communication to support the financial sector's stability. In the years after the crisis, the central banks' communication intensified exponentially and have been focusing more on the general public (Haldane, 2017).

The introduction of new monetary policy frameworks, such as the inflation-targeting approach in most developing and developed countries, has further increased the need for transparency from the central banks. This approach involves disclosing the medium-term inflation target and strategies to achieve it (Assenmacher et al., 2021). If agents are aware of future inflation, their actions are in line with their expectations, thereby stabilizing the macroeconomic environment (Jenkins, 2004). Mathur and Sengupta (2020) argued that in most emerging markets, inflation targeting tends to be more effective in influencing the expectations of economic agents that are in line with central bank targets. This has made the communication approach an important mechanism of monetary policy (see Mishkin & Posen 1998). More generally, Hansen and McMahon (2016) state that to moderate inflation expectations, central banks have turned to communication as a major instrument.

Most central banks in developed countries use forward guidance to actively communicate with the public, although the US FED recently declared the abandonment of this

policy. [3] Forward guidance includes informing the public about the future direction of the policy rate (Woodford, 2008). Den Haan (2013) explains that the economic logic of forward guidance is that it links the decisions made during the current period to the public's expectations for the future. It was first developed as a monetary policy tool in 1999 by the Bank of Japan (Den Haan, 2013). Before its introduction, it had been tested for decades in the United States, Japan, and Europe (Woodford, 2008). Zeidy (2020) shows that forward guidance was refined in the United States at the beginning of the 2008 Great Recession. Since then, the FED has provided a transparent outlook for future base interest rate paths. Woodford (2012) points out that forward guidance is more effective when it is coupled with commitment, not just prediction. However, Blinder (2018) believes that forward guidance is and will always be about forecasting, not commitment. Non-commitment forecasts are called Delphic forward guidance and the opposite is called Odyssean forward guidance (Campbell et al., 2012). Effective forward guidance helps ease financial conditions and stimulate economic growth and job creation (see Williams, 2013).

Moreover, some central banks have moved toward the digital frontier in recent decades with significant advances in information technology and telecommunications (Assenmacher et al., 2021). This has changed the way information is communicated to the general public. Changes in the functioning of financial markets have required the central bank to disseminate its economic outlook and policy stance more quickly (Ehrmann & Talmi 2020). Ahokpossi et al. (2020) also recognize that central banks in countries like Indonesia are adapted to the digital age, for instance, social media is also used extensively to communicate with the public.

[3] For example, see https://www.wsj.com/articles/goodbye-fed-guidance-let-us-hope-jerome-powell-federal-reserve-inflation-monetary-policy-11658955848

Forms of Monetary Policy Communications

The forms of monetary policy communications in most economies are common. Reeves and Sawicki (2007) found that the Bank of England uses four major channels to convey information to the public. These are minutes of the Monetary Policy Committee (MPC) meetings, Inflation Reports, Speeches, and Testimonies by the MPC. The minutes of the MPC meetings are published thirteen days following a meeting. They provide timely and valuable information on monetary policy stance, economic outlook, and risks to economic agents. The inflation reports are forward-looking, published quarterly, and include projections of GDP growth and inflation and the underlying economic assumptions. On the other hand, speeches and interviews are given by all the MPC members. Luangaram and Wongwachara (2017) argue that central banks in advanced economies tend to provide well-structured information than in emerging economies. It was further noted that communications in emerging economies are more diverse both in content and style.

Most low-income countries use similar communication channels as the developed economies, but the literature alleges that they are inefficient. For instance, Pinshi (2020) reports that the Central Bank of Congo (BCC) uses five means of communication, monetary policy report, post-MPC meeting statements, press conferences, conjuncture notes, and annual reports. It was reported that information from the BCC is unclear and ineffective which undermines the confidence of the economic agents. As highlighted by the author, the communication failures included a lack of publication series, failure of the monetary policy report, delay of annual reports, and lack of an adaptive website.

2.2.2 Empirical Literature

Two closely related papers on Canada of Hendry and Madeley (2010) and Hendry (2012) studied the impact of central bank communication on financial markets. They both utilize several different text mining methods. Followed by Hansen and McMahon (2016) who assessed the Federal Open Market Committee (FOMC) of the USA, released information on the conditions of the economy, as well as its direction on future monetary policy actions (forward guidance), using computation linguistic tools, more specifically LDA topic modeling and dictionary methods. They further applied the factor augmented vector-autoregressive (FAVAR) framework to find that communication had no significant impact on actual economic variables.

To better understand the effects of monetary policy-related announcements on financial markets in South Korea, Sohn et al. (2006) conducted a comprehensive study using 138 monetary policy-related announcements. The study concluded that monetary policy announcements had increased the volatility of financial variables but had an insignificant effect on their actual levels. The study further reveals that government monetary policy-related pronouncements are seen as disruptive variables that impair the effectiveness of monetary policy announcements and elevate market volatility without having any independent effect on financial markets.

Luangaram and Wongwachara (2017) recommend using computational linguistic tools to analyze the impact of monetary policy announcements. The study focussed on the three fundamental facets of policy communications; readability, topics (key themes of the statements), and tone of the statements. Latent Dirichlet Allocation (LDA) and dictionary techniques were used to extract subjects and the tone of the announcements. The authors argued

that the readability of the statements is crucial, consequently, the Flesch-Kincaid grade (FK) and the Educational Testing Service in the United States (ETS) index were used to decide the clarity of the statements. In each technique, the average number of words per sentence was recommended as a good indicator of clarity. Econometric evaluation displays that lowering the average number of words per sentence tends to enhance the clarity of the statements. The study further assessed the impact of communication topics and tone on key macroeconomic variables. The findings show that an increase in the proportion of growth topics was correlated with GDP growth and with the unemployment rate. Likewise, inflation topics were closely related to the actual inflation change.

Further, Mathur and Sengupta (2020) proposed the use of computational linguistics techniques to measure the impact of monetary policy communication on Indian financial markets. The study evaluated changes in the way central banks communicate with the public before and after the introduction of the inflation-targeting approach in 2016. Word length and readability in statements were used as indicators of language complexity. They adopted the Farr-Jenkins-Paterson (FJP) index, which is a widely used standard index for readability. The FJP index measures the number of single-syllable words per 100 words. The higher the index value, the better the readability of the statement. Readability indicators from the popular Flesch-Kincaid and Gunning-Fog were also used to check robustness. The usual ordinary least squares (OLS) regression model was used to econometrically measure the impact of communications on financial markets. The study assumes that as statement complexity increases, market volatility increases. A one percent increase in the number of words increased the volatility of the stock and currency markets by 0.24 percent and 0.23 percent respectively. However, there was no statistical evidence of its impact on the bond market. In addition, the readability of the statement was not important in explaining volatility fluctuations in equity, currency, and bond markets

Similarly, Ahokpossi et al. (2020) investigated the impact of monetary policy communications in Indonesia. The study focused on the transparency and clarity of the Bank of Indonesia's monetary announcements. The readability of the announcement was measured using Flesch-Kincaid's readability index. Like most readability indicators, it assumes that longer sentences reduce the intelligibility of the announcements. This study analyzed 314 statements in both English and Indonesian Bahasa between 2006 and 2018. Most statements were difficult to read and found to require at least 11 years of education to comprehend the presentation. According to the survey, monetary policy announcements played no role in explaining fluctuations in market interest rates. The study further looked at the impact of monetary policy surprises on financial markets (money, bonds, and exchange rate). The surprises were measured as the difference between the central bank's actual interest rate determination and the forecasted interest rate. Econometric analysis was performed using the OLS regression model. The results prove that financial surprises have a significant impact on money market rates, but not on bond and currency markets.

Smales and Apergis (2017) argued that complex statements are more challenging to comprehend and may be interpreted differently by several agents. Due to this, market participants' beliefs become more diverse, which leads to an increase in market activity. They found that the amount of trade and volatility in the equities, bond, and currency futures markets are significantly impacted by the linguistic complexity (readability and word count measured through the Flesch-Kincaid Grade Level Index and word count, respectively) of the language used in the US Fed FOMC statement.

In one of the most recent studies, Gonzalez and Tadle (2021) using linguistic tools such as LDA, an automated language method, analyzed and compared the information included in monetary press releases from a collection of inflation-targeting nations. They found that the complexity of press releases in most countries needs some college degree. To understand the

press releases from the remaining countries, one needs at least a tenth-grade high school education. Furthermore, they discovered that the length of press releases is converging, with shorter press releases growing in length and originally longer press releases decreasing in the average word count.

McMahon et al. (2018) conducted a corresponding survey on communication at the Central Bank of China. According to this survey, the People's Bank of China (PBC) uses four major channels to communicate with the public; Monetary Policy Executive Reports, Press Releases on Monetary Policy Committee Meetings, Speeches and Press Conferences, and Open Market Operations Announcements. First, the OLS regression model was employed to assess the impact of these channels on interest rate fluctuations. It is indicated that the monetary policy executive report is associated with lower volatility of the short-term notes. Precisely, this channel was associated with 0.03 % and 0.01 % volatility reductions for 1-month short-term notes and 3-month short-term notes, respectively. Similarly, speeches and press conferences were associated with a 0.023% drop in market volatility. However, the study also found that heterogeneous variance and autocorrelation affected the estimates. Therefore, the authors adopted a general autoregressive conditional heteroscedastic (GARCH) model to obtain robust results. A class of GARCH called Nelson's EGARCH model (non-linear model) was used. The results of the survey suggest that PCB financial communications have had a significant impact on short-term market interest rates.

In a similar study, Wang and Mayes (2012), focused on New Zealand, the United Kingdom, Australia, and the Eurozone. They used an event study method to measure the impact of monetary policy announcements. Initially, short-term returns of stock indices (period around an announcement) were regressed against monetary policy surprises. However, the possibility of endogenous problems was recognized. To mitigate this issue, they used a one-day event window. In addition, a threshold regression approach was adopted to illustrate the impact of

the business cycle. Consistent with several other studies, monetary policy announcements have been observed to affect stock prices.

Rosa and Verga (2008) used an intra-day dataset to investigate the impact of ECB communications on asset prices. The study adopted an event-study approach for econometric analysis. In addition, the study estimated the regression model using the autoregressive process. The results show that the asset market reacts quickly if the announcement deviates from general expectations. This is in line with our hypothesis that monetary policy communication is the key to influencing financial markets.

Mpofu and Peters (2017) use the event study technique to investigate the impact of monetary policy communication on South African exchange rates. The study argues that the approach is valuable because it systematically quantifies the unexpected effects of other events on the outcome variable. The survey found that the announcement was an important factor influencing the exchange rates. Approximately 66% of the published announcements were important in explaining exchange rate fluctuations. The authors concluded that the South African rand could rise or fall when the central bank announced a rate hike. This shows the reaction of the foreign exchange market to monetary communications.

In the same way as the previous studies, we conduct a quantitative study of central bank monetary policy statements and examine their influence on financial market variables. Nevertheless, we utilize both complexity/readability as well as sentiment analyses of MPS to cover the financial market's reaction of the developing countries.

2.2.3 Research Questions and Hypotheses

Most studies from the field focus on either developed countries or some single developing country's monetary policy communication issues. In this study, we are mainly investigating

whether financial markets in developing countries care about central bank communication and indeed whether changes in financial market variables reflect central bank messages. As central banks across the globe are being encouraged to adopt communication as one of the important tools to facilitate monetary policy effectiveness, it is timely to explore how the readability and complexity dimensions of such communication affect the variables of the financial market. Specifically, this study will answer the following questions:

1. Does clarity of central bank communication affect financial market variables in developing countries?
2. Do financial market variables respond to monetary policy stances and signals?
3. Do financial market variables respond to central banks' sentiments about economic conditions in the economy?

Following the literature related to advanced and some developing countries, we believe that the more complex the central banks' MPS are, and the less readable the central banks' MPS are, the more unclear the statements become. Consequently, the more unfavorable reaction from the financial market variables they face. Longer sentences in policy statements have a high likelihood to relay unclear information and present a higher probability for market players to have a large variance in their judgments regarding the current and prospective policy. Considering the different MPS readability measures, we further expect that unclear statements tend to have an unfavorable effect on financial markets as uncertainty caused by such MPS is quickly reflected in asset prices and market rates and indexes while increasing market volatility. We also expect that the negative tone of a statement pertaining to the economic situation at a given point in time would be associated with adverse effects on financial markets. Formally, this study has the following hypotheses:

1. The increase in average sentence length of central banks' MPS is associated with the increase of local currencies exchange rates volatility, a few days after the date of statement publication, and associated with an increase in volatility of lending rates, money market rates, and treasury bills rates;
2. The increase in readability scores of central banks' MPS is associated with the increase of local currencies exchange rates volatility, a few days after the date of statement publication, and associated with an increase in volatility of lending rates, money market rates, and treasury bills rates;
3. The negative view on the economic stance of the central banks' MPS at a given point in time is associated with a negative impact on local currencies exchange rates volatility a few days after the date of statement publication and associated with an increase in volatility of lending rates, money market rates and treasury bills rates.

2.3 Data and Descriptive Statistics

In this study, we have applied textual analysis to measure the clarity of official Monetary Policy Statements focusing on their complexity and readability aspects, and information on the state of the economy across several countries, which we further use for the empirical analysis. In addition, we utilize a number of control variables from various sources such as IHS Markit, International Monetary Fund, and central banks' websites. As such, the purpose of this section is to describe the sample creation process and provide information about the data sources.

2.3.1 Sample formation

Since the interest of this study is not on advanced economies, we looked for all countries that belong to the group of low and lower-middle-income economies based on the

World Bank June 2020 classification[4] as possible candidates for our sample. Then, we compiled official Monetary Policy Statements[5] (MPS) released publicly soon after monetary policy meetings on the related authorities' websites. Due to the technical limitation of analyzing non-English or manually translated into English textual data, and for purposes of standardization / same study base, we follow Gonzalez and Tadle (2021), by focusing on statements that are in English only, originally, or the related authorities' translation into English. Therefore, we have excluded some countries from our sample because of three reasons. Firstly, because English statements were not available. Secondly, there are two groups of countries that belong to monetary unions, as such, they do not have a country-based monetary authority and, hence, no related statements (5 countries from the Bank of Central African States and 8 countries from the Central Bank of the West African States). Finally, other countries simply did not have any related official information.

Overall, we ended up with a sample of 21 countries with a total of 889 statements from 2010 until 2021 (Table 2.1). We have discovered several interesting insights regarding the cross-country similarities and differences in monetary policy communication while looking through the sources and descriptions of these MPS. For example, as expected, the main authority in charge of policy rate setting and communication is a central bank, where a discussion on the rate is largely conducted by Monetary Policy Committee (MPC). In addition, there are several communication types, namely press releases, press conferences, and statements. Meanwhile, on average LMIE (Lower-Middle Income Economies) countries from our sample have more statements and a longer policy rate communication history than LIE

[4] Low and lower middle income countries classification are often interchangeably used with "developing countries" term, though the definition of the former is not harmonized worldwide.
[5] In our study by Monetary Policy Statement we mean any official communication of authorities in charge of the monetary policy, mainly from Monetary Policy Committees, related to key policy rate (or its analogue) decisions together with explanation on such decisions. Statements without numerical Appendixes and personal statements transcriptions.

(Low-Income Economies) countries. This suggests that issues regarding monetary policy communication are well established in the advanced economies and are now diffusing through to emerging and developing countries. This is the reason this study is timely, to establish whether communication is working in these developing markets.

Table 2. 1 Sample structure

#	Country	Income Group	Statements Number	Statement Type	Discussion Level	Source
1	Egypt	LMIE	85	Press Release	Monetary Policy Committee	Central Bank of Egypt
2	Eswatini	LMIE	39	Monetary Policy Statement	Monetary Policy Consultative Committee	Central Bank of Eswatini
3	The Gambia	LIE	25	Press Release	Monetary Policy Committee	Central Bank of The Gambia
4	Ghana	LMIE	51	Press release	Monetary Policy Committee	Bank of Ghana
5	Kenya	LMIE	34	Press Release	Monetary Policy Committee	Central Bank of Kenya
6	Lesotho	LMIE	23	CBL MPC Statement	Monetary Policy Committee	Central Bank of Lesotho
7	Liberia	LIE	9	Communique	Monetary Policy Committee	Central Bank of Liberia
8	Malawi	LIE	21	Statement of MPC	Monetary Policy Committee	Reserve Bank of Malawi
9	Moldova	LMIE	119	Monetary policy decision	Executive Board	National Bank of Moldova
10	Mongolia	LMIE	45	Monetary Policy Statement	Monetary Policy Committee	Bank of Mongolia
11	Mozambique	LIE	26	Communique	Monetary Policy Committee	Bank of Mozambique
12	Nigeria	LMIE	65	Communique	Monetary Policy Committee	Central Bank of Nigeria
13	Pakistan	LMIE	54	Monetary Policy Statement	Monetary Policy Committee	State Bank of Pakistan
14	Rwanda	LIE	12	Press Release	Monetary Policy Committee	National Bank of Rwanda
15	Sierra Leone	LIE	10	MPS	Monetary Policy Committee	Bank of Sierra Leone
16	Sri Lanka	LMIE	96	Press Release	Monetary Board	Central Bank of Sri Lanka
17	Tajikistan	LIE	13	Press Release / MPA	Monetary Policy Committee	National Bank of Tajikistan
18	Uganda	LIE	80	MPS	Monetary Policy Committee	Bank of Uganda
19	Ukraine	LMIE	59	Press Release	Monetary Policy Committee	National Bank of Ukraine
20	Uzbekistan	LMIE	4	Press Release	The Board of the Central Bank	The Central Bank of the Republic of Uzbekistan
21	Zambia	LMIE	19	MPC Statement	Monetary Policy Committee	Bank of Zambia

Note. LIE - Low-Income Economies; LMIE - Lower-Middle Income Economies.

2.3.2 Complexity and readability measures of statements' clarity

To assess the clarity through MPS complexity and readability, we follow previous studies (Benoit et al., 2019; Bonsall et al., 2017; Gonzalez and Tadle, 2021; see also, Li 2008; Loughran & McDonald, 2011; 2014; 2016; Mathur & Sengupta 2020) by applying linguistic analysis tools widely used in the literature on the monetary policy communication, finance, and policy studies.[6] Here we are motivated by (Levin 2014) that clarity appears to be important in improving the efficacy of monetary policy.

To measure the linguistic complexity, we utilize the following proxies: the number of sentences per statement, the average sentence length (number of words over the number of sentences per document), the average number of syllables in a word, and the type-token ratio (dividing the number of types in a text by its number of tokens). We have assessed each statement to estimate the measures mentioned.

Table 2.2 contains the average complexity measures for each country based on the available statements. We observe that, on average, the maximum number of sentences per statement is around 90 and the minimum is 9, while the mean is 39. Further, we see that the longest average sentence length is above 31 words per sentence and the shortest is about 19 words per sentence, while the average is 24. Meanwhile, it is understood that longer sentences have higher information-processing costs (see Li, 2008). In terms of the complexity measures through the number of syllables per word, we found that the sample is more concentrated around the average of 1.80 with a maximum and minimum of 1.87 and 1.70, respectively. The fewer syllables the words contain (on average), the "easier" the text is (Flesch 1979).

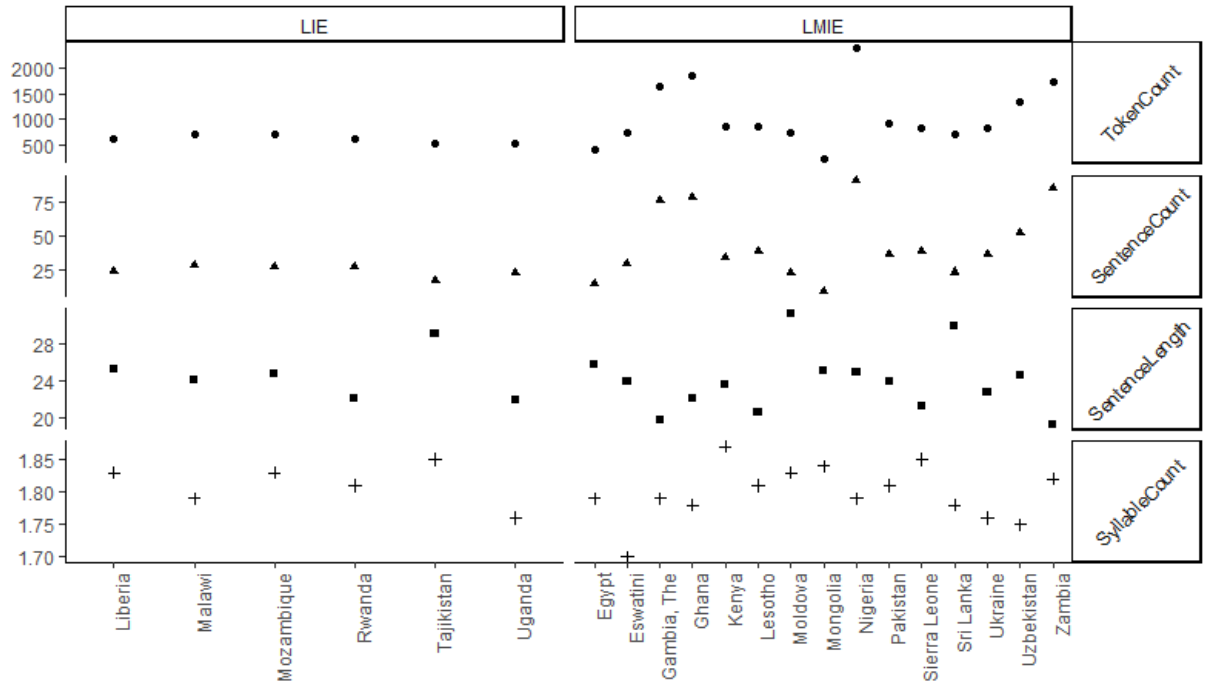
Table 2. 2 Countries' averages for each complexity measure

#	Country	Income Group	Token Count	Sentence Count	Sentence Length	Syllable Count
1	Egypt	LMIE	403.76	14.96	25.82	1.79
2	Eswatini	LMIE	747.38	29.79	23.89	1.70
3	Gambia, The	LMIE	1,629.36	76.68	19.71	1.79
4	Ghana	LMIE	1,856.25	78.84	22.10	1.78
5	Kenya	LMIE	850.91	34.41	23.61	1.87
6	Lesotho	LMIE	877.26	39.17	20.62	1.81
7	Liberia	LIE	637.00	24.22	25.30	1.83
8	Malawi	LIE	720.43	28.38	24.14	1.79
9	Moldova	LMIE	748.06	22.94	31.37	1.83
10	Mongolia	LMIE	241.89	9.27	25.09	1.84
11	Mozambique	LIE	702.50	27.31	24.76	1.83
12	Nigeria	LMIE	2,390.78	91.25	25.02	1.79
13	Pakistan	LMIE	912.85	36.61	23.94	1.81
14	Rwanda	LIE	637.33	27.83	22.16	1.81
15	Sierra Leone	LMIE	845.80	38.50	21.22	1.85
16	Sri Lanka	LMIE	709.39	23.51	30.05	1.78
17	Tajikistan	LIE	525.69	17.46	29.12	1.85
18	Uganda	LIE	522.09	22.53	21.98	1.76
19	Ukraine	LMIE	834.14	36.26	22.72	1.76
20	Uzbekistan	LMIE	1,357.50	53.00	24.58	1.75
21	Zambia	LMIE	1,742.42	85.68	19.29	1.82
	Sample Max		2,390.78	91.25	31.37	1.87
	Sample Min		241.89	9.27	19.29	1.70
	Sample Mean		947.28	38.98	24.12	1.80

Notes. Sentence count is the average number of sentences per statement for a given country; Sentence length stands for an average sentence length per statement for a given country; Syllable count is the average syllable number per word in a statement for a given country; Token count stands for an average number of tokens per statement for a given country. In this case, tokens are equal to words because all other types of semantic units were removed. LIE - Low-Income Economies; LMIE - Lower-Middle Income Economies.

Figure 2.1 illustrates the statements' complexity measures across the sampled countries. On average, countries with long statements (by the number of sentences) have shorter sentence lengths (for example, The Gambia, Zambia, etc.).

Figure 2. 1: Countries' averages for each complexity measure



Notes. Sentence count is the average number of sentences per statement for a given country; Sentence length stands for an average sentence length per statement for a given country; Syllable count is the average syllable number per word in a statement for a given country; Token count stands for an average number of tokens per statement for a given country. In this case, tokens are equal to words because all other types of semantic units were removed. LIE - Low-Income Economies; LMIE - Lower-Middle Income Economies.

To capture the other dimension of clarity, we assess the MPS readability. We have constructed the Flesch reading ease score, the Flesch-Kincaid score, the ARI, the SMOG Score, and the Gunning Fog index as readability proxies used in this study.[7]

The Flesch Reading Ease (FL) score is one of the most well-known and extensively used readability metrics of Flesch (1948) and is defined by:

$$FL = 206.835 - 1.015\left(\frac{words}{sentences}\right) - 84.6\left(\frac{syllables}{words}\right),$$

[7] For more on these indexes please refer to (Flesch, 1948; Gunning, 1952; Kincaid et al., 1975; McLaughlin, 1969; Senter & Smith, 1967). True to say that there is a large discussion in the literature regarding the best acceptable readability measurement, which is yet to be clear. Some say that current indexes approach to measure readability has some pitfalls, see, for example, (Bonsall et al. 2017; Loughran and McDonald 2016) for more on this. Yet, taking into consideration the nature of MPS/A, we follow (Mathur and Sengupta 2020) and see chosen indexes as an appropriate and one of the most efficient approaches in terms of time spent and output quality balance.

where *words* and *sentences* correspond to their numbers in each of the MPS, and *syllables* stand for the total number of syllables in a statement. The FL sees statements with longer words and sentences as ones harder for reading. The FL higher value means a text is easier to read (a text with a score of 100 is very easy to read), while a score closer to zero means indicates that a text is very challenging to read.

The Flesch-Kincaid (FK) readability score, also known as the FK grade level, is one of the most famous and widely applicable readability measures (Kincaid et al., 1975) and is given by:

$$FK = 0.39\left(\frac{words}{sentences}\right) + 11.8\left(\frac{syllables}{words}\right) - 15.59,$$

where *words* and *sentences* correspond to their counted numbers in each of the MPS, and *syllables* stand for the total number of syllables in a statement. The FK gives a grade level, where a score of 4 means that the text is easy to read and can be read by a 4^{th}-grade of U.S grade level while a score of 18 and higher implies that the text is extremely hard to read and is for professionals.

The Automated Readability Index (ARI) of (Senter and Smith 1967) is calculated as

$$ARI = 0.5\left(\frac{words}{sentences}\right) + 4.71\left(\frac{characters}{words}\right) - 21.34,$$

where all *words* and *sentences* are used in the same meaning as in the formulas above, while *characters* stand for the number of letters for each word. To generate a readability score, ARI utilizes long words and long sentences. The reasoning is that the more characters in a word, the more difficult it is to read. Hence, the ARI score indicates how difficult it is to read the text. Each score corresponds to a proficiency reading level and can be matched to some U.S. grade level. As such, a score of 12 suggests that the text can be comprehended by 12^{th} graders or 17-year-olds and above.

The Gunning Fog (FOG) index of (Gunning 1952) is defined as

$$FOG = 0.4[\left(\frac{words}{sentences}\right) + 100\left(\frac{complex\ words}{words}\right)],$$

where all *words* and *sentences* are used in the same meaning as in the formulas above, while *complex words* refer to the number of words with 3-syllables or more. FOG interprets the statements with longer words and lengthy sentences as hard to read. A typical result ranges from 0 to 20, with the direct result matching the respective US grade level.

The Simple Measure of Gobbledygook (SMOG) of (McLaughlin 1969) is given by

$$SMOG = 1.0430\sqrt{polysyllables} * \frac{30}{sentences} + 3.1291,$$

where *sentences* are used in the same meaning as in the formulas above, while *polysyllables* refer to the number of words with 3 or more syllables. SMOG sees statements with longer words as documents that are harder to read. The index gives a grade-level score that matches the difficulty of the text. For example, a score of 6 means that the text may be understood by 6^{th} grade of the U.S grade level and above.

To assess, all mentioned above measures of complexity and readability we have utilized the quanteda package in R of Benoit et al. (2018).

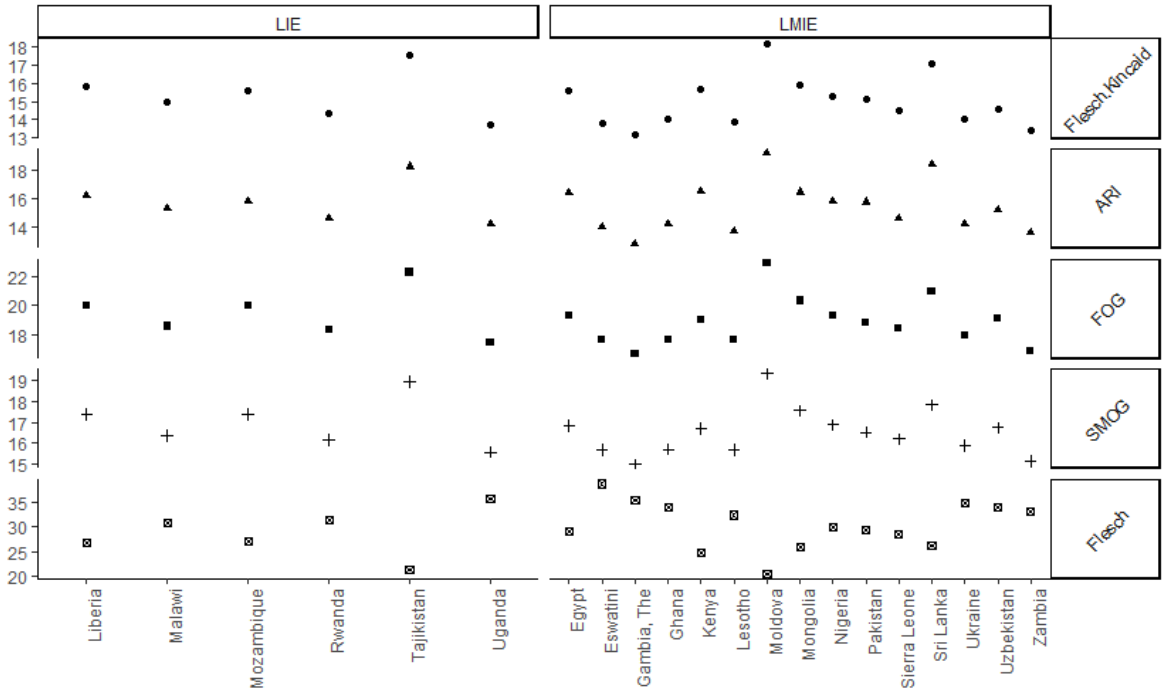
Table 2.3 contains the average readability measures for each country for all available statements. We discovered that, overall, the average readability scores of statements evidence that MPS are difficult to read. For example, an average FK of 15 means that statement is hard to understand and requires at least a college education level for comprehension. Furthermore, an average score of FL of about 30 also suggests that statements are difficult to read on average and require at least college-level education.

Table 2. 3 Countries' averages for each readability measure

#	Country	Income Group	FL	FK	ARI	FOG	SMOG
1	Egypt	LMIE	29.01	15.63	16.37	19.32	16.84
2	Eswatini	LMIE	38.85	13.77	14.04	17.66	15.67
3	Gambia, The	LMIE	35.53	13.20	12.81	16.65	14.98
4	Ghana	LMIE	33.92	14.02	14.20	17.64	15.70
5	Kenya	LMIE	24.80	15.67	16.46	19.01	16.69
6	Lesotho	LMIE	32.46	13.86	13.74	17.65	15.68
7	Liberia	LIE	26.68	15.82	16.18	20.01	17.37
8	Malawi	LIE	30.91	14.94	15.33	18.56	16.35
9	Moldova	LMIE	20.31	18.22	19.13	22.88	19.33
10	Mongolia	LMIE	25.88	15.88	16.43	20.32	17.57
11	Mozambique	LIE	27.12	15.63	15.79	19.97	17.37
12	Nigeria	LMIE	29.88	15.31	15.83	19.29	16.88
13	Pakistan	LMIE	29.39	15.11	15.74	18.79	16.52
14	Rwanda	LIE	31.45	14.38	14.62	18.31	16.16
15	Sierra Leone	LMIE	28.59	14.54	14.62	18.43	16.20
16	Sri Lanka	LMIE	26.16	17.08	18.36	20.94	17.84
17	Tajikistan	LIE	21.16	17.54	18.21	22.27	18.94
18	Uganda	LIE	35.86	13.72	14.22	17.48	15.57
19	Ukraine	LMIE	34.91	14.03	14.23	17.96	15.89
20	Uzbekistan	LMIE	34.11	14.61	15.16	19.11	16.75
21	Zambia	LMIE	33.17	13.42	13.64	16.89	15.13
	Sample Max		38.85	18.22	19.13	22.88	19.33
	Sample Min		20.31	13.20	12.81	16.65	14.98
	Sample Mean		30.01	15.07	15.48	19.01	16.64

Notes. FK is the Flesch-Kincaid readability score; FL Flesch reading ease score; ARI stands for the Automated Readability Index; FOG is the Gunning Fog index; SMOG is the Simple Measure of Gobbledygook. LIE - Low-Income Economies; LMIE - Lower-Middle Income Economies.

Figure 2. 2 :Countries' averages for each readability measure



Notes. FK is the Flesch-Kincaid readability score; Flesch is the Flesch reading ease score; ARI stands for the Automated Readability Index; FOG is the Gunning Fog index; SMOG is the Simple Measure of Gobbledygook. LIE - Low-Income Economies; LMIE - Lower-Middle Income Economies. Y-axis – scores.

Figure 2.2 illustrates the statements' readability measures across the sampled countries. On average, we observe that there is a clear pattern and a correlation between all indexes.

Descriptive analysis: complexity and readability

To describe complexity and readability, we use metrics from Moldova and The Gambia as examples. The former is the country with the largest average sentence length, while the latter is the second lowest one. From tables 2.1,2.2, and 2.3 above, we know that Moldova has 109 MPS, with an average sentence length ranging from 21.1 to 44.5 and averaging 31.4, and FK ranging from 13.6 to 23.1 and averaging 18.2. It shows that on average, Moldova has relatively complex statements to comprehend. If we pick the closest statement to the average statement of Moldova by FK, for September 29, 2016, we see that the number of sentences is 31 and the tokens are 1029.[8] As such, the average sentence length is about 33.2 words, while the effective length for most technical communication is an average of 15 to 20 words. It means this statement is indeed hard to comprehend. Meanwhile, Gambia has 25 statements with an average sentence length of 17.5 to 23.1 and an average of 19.7, an FK range from 11.8 to 14.7, and an average of about 13.2. The closest to the average statement by FK is the MPS as of November 28, 2018, which has 81 sentences and 1674 tokens. Hence, the average sentence length is 20.7. This means that despite the statement being long, the actual complexity depends more on the sentences' complexity. Lastly, the FK of the chosen Gambian statement is 13.2, while the Moldova one is 18.2, which means that the latter is more complex. As such, it suggests that on average, Moldova has relatively complex (measured by an average sentence length and an average FK) statements, while the Gambia has relatively easier-to-

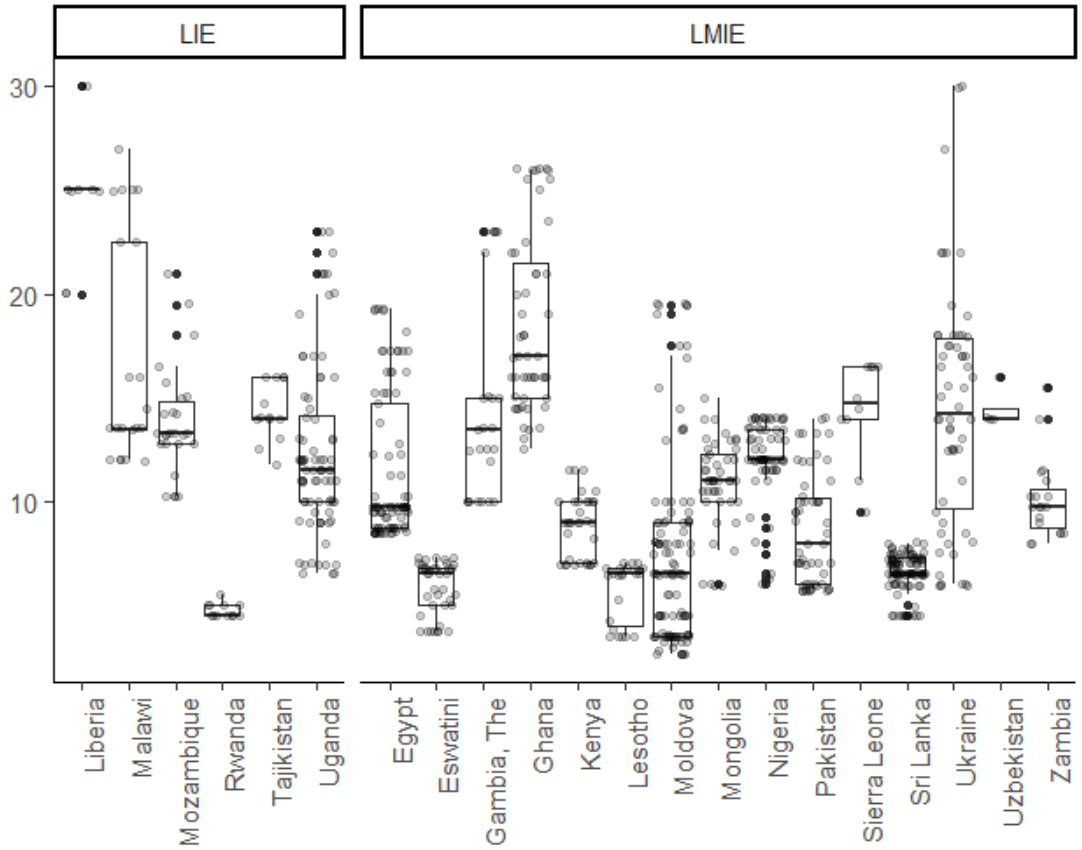
[8] Please see the examples of the statements for both countries in the Appendix.

comprehension MPS, despite the fact that on average, the Gambia's statements have more sentences than Moldova ones.

Measures of monetary policy dimensions and economic stance

Next, we examine the content of MPS through several dimensions. First, we look for the traditional aspect of monetary policy – the policy stance.

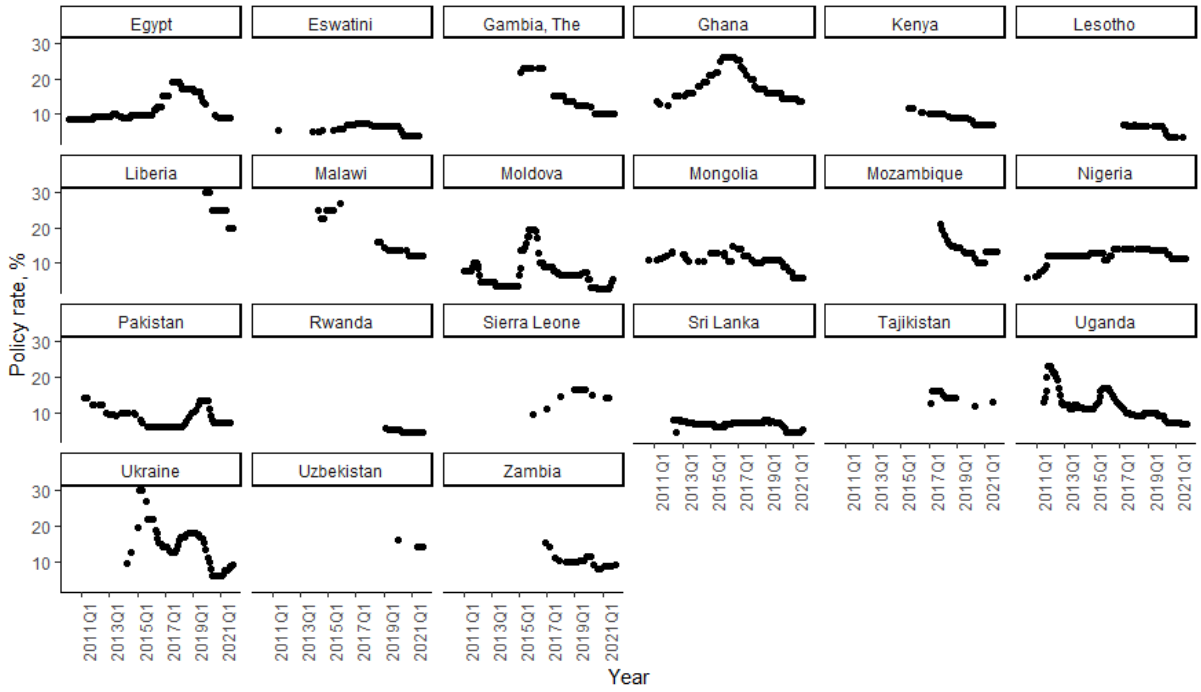
Figure 2. 3 : Countries' policy rates distribution and raw data points.



Note. LIE - Low-Income Economies; LMIE - Lower-Middle Income Economies. Y axis – policy rate in %.

As such, we collected the data on key policy rates of sampled countries, and depending on the dynamics of the rate we assessed whether the monetary policy for a given period was either tight, loose, or neutral (i.e., no changes). Figure 2.3 shows that countries' policy rates vary greatly. In addition, the historical dynamics since 2010 are shown in Figure 2.4.

Figure 2. 4: Countries' policy rates dynamics



Notes. LIE - Low-Income Economies; LMIE - Lower-Middle Income Economies. Y axis – policy rate in %.

Second, we have followed Hansen and McMahon (2016) to measure the central banks' views about the economy through content analysis of the statements.[9] We utilized the Latent Dirichlet Allocation (LDA) algorithm of Blei and Lafferty (2009) to estimate the topic of each sentence for each policy statement for each sampled country.[10] This allows us to identify and isolate sentences with topics related to the economic situation of each country. Each country has its optimal number of topics related to the economy, which were chosen through a twofold algorithm. First, we run several evaluation metrics of Arun et al. (2010), Cao et al. (2009), Deveaud et al. (2014) and Griffiths and Steyvers (2004) for up to 20 topics to assess the optimal

[9] We have removed punctuations and specific symbols, capitalization, stop words, numbers, highly frequent related words (like policy rate, monetary policy, central bank, etc.), extra space. We also stem words.

[10] Please see (Hansen and McMahon 2016) and (Benchimol, Kazinnik, and Saadon 2020) for detailed explanation on LDA and text mining application for the sake of statements analysis and further estimations.

number of topics.[11] For example, Figure 1A shows that the optimal number of topics for Egypt is in a range between 8 and 10.[12] Second, we check these numbers through manual identification based on the read statements. Then we identify topics related to the economic situation only. In the next step, we measured the tone of selected sentences (ones related to economic development) through the dictionary method, more specifically, word counting. We have utilized positive and negative finance-related word lists (see Loughran and McDonald 2011) and updated them for specific words related to monetary policy statements. Table 1A contains some words that we associated with economic expansion and contraction. As in Hansen and McMahon (2016), based on the isolated sentences, we count words associated with economic stance to create the measure of the MPS on the economic situation (ES) of sampled countries by:

$$ES = \frac{n_{pos,it} - n_{neg,it}}{total\ words_{it}},$$

where $total\ words_{it}$ stands for the total number of words about the economic situation, it is country i at time t ; and $n_{pos,it}$ $(n_{neg,it})$ is the positive (negative) word number per sentence. Therefore, we have a quantified view of a central bank on the economy. Figure 2A contains the ES index for Egypt. [13]

Lastly, we have analyzed the statements for monetary policy forward guidance.[14] Our initial plan was to follow Hansen and McMahon (2016) to quantify and measure the character of forward guidance and utilize this in our further analysis. Though after the stage of identification of the forward guidance relevant parts (e.g., sentences) of each MPS, by manually reading

[11] Based on our observations, the statements of our sample have not more than 20 topics.
[12] As an example, we show only one country.
[13] As an example, we show only one country.
[14] We understand forward guidance as in (Campbell et al. 2012; Hansen and McMahon 2016), where statements contain the forward looking views about key policy rate decisions at future meetings.

through all statements, we have seen that just a few sampled countries have forward guidance in their statements. We found that out of 21 countries of our sample only 5 have forward guidance in their MPS. And out of that 5, only two countries (Uganda and Ukraine) have a relatively stable application of forward guidance in their MPS. As such, we have a very limited number of related observations for further cross-country analysis.

Panel formation

As we aim to analyze market response to monetary policy decisions, we need to take into consideration the prompt financial markets response to the central bank movements and signals. For this sake, we need to keep the lowest date-unit possible (either days, weeks, or months).

Since most collected statements differ by date and frequency (total number and even months of statements do not match) per year, for further analysis, we have structured our raw data from its original daily dates form to a uniform period basis. This allows us to keep the original frequency and quality of our data on MPS to further conduct our econometric analysis. Although, some studies applied data transformation to quarterly frequency data by calculating the averages needed (e.g., Luangaram & Wongwachara 2017).[15] As such, we have constructed an unbalanced panel with a total of 874 observations and a large enough number of panels (21 countries) and periods (40 periods on average).

Overall, the MPS of 21 countries' central banks, collected from their official websites, comprise our raw data. For each sampled country we collected all available statements that are in line with the abovementioned criteria for MPS. Then we measured several dimensions of monetary policy (policy stance, economic conditions, and forward guidance) and utilized data

[15] For instance, for countries with several meetings in a quarter they calculate a simple average of these meetings, while for countries without a meeting in a quarter the use the data of the previous nearest meeting.

related to sampled country monetary policy collected from respective central banks' websites. Proxies for financial market reaction on MPS, i.e., our dependent variables, were collected from the World Economic Service of IHS Markit and the International Finance Statistics (IFS) of the International Monetary Fund. In addition, some missing data on interest rates were directly collected from central banks' websites. Further, monthly data on macroeconomic fundamentals (consumer price index – CPI and balance of payment – BoP international reserves), banking sector characteristics (foreign assets), and countries' risk profiles were collected from the same sources.

2.4 Econometric Methodology

The overarching objective of this study is to examine the relationship between monetary policy communication and key financial variables. We set the daily volatility of local currencies exchange rates to USD, and the monthly volatility of treasury bill rates, money market rates, and lending rates as dependent variables. The selection of these variables is well supported in the literature (for example, Ahokpossi et al., 2020; McMahon et al., 2018; Mpofu and Peters 2017; Sohn et al., 2006). We take advantage of the availability of daily exchange rate data to construct a set of the volatility of exchange rate dependent variables for periods of 3, 5, and 10 business days after the monetary policy announcement. This will allow us to understand how exchange rates react to announcements, immediately after the announcements. We calculated annualized volatility based on standard deviations for each period. The market rates volatilities will be used in logarithm form. For volatility of treasury bill rates, interbank rates, and lending rates, we calculate 3-month volatility based on monthly data. Indeed, unlike exchange rates that are likely to have an immediate response, interest rate adjustments are gradual by different banks after an announcement, particularly in developing countries. As such, we do not lose valuable information by using monthly data. The key descriptive/explanatory variables are the

various measures of clarity of monetary policy communication which were described above. Specifically, in the description part, we use log-transformed data of the following: the Flesch reading ease score, the Flesch-Kincaid readability score, the Automated Readability Index, the Gunning Fog index, the Simple Measure of Gobbledygook, the type-token ratio, the average sentence length, the number of sentences, and the average number of syllables in a word. While these independent variable measures are different in measurement, they are in principle related. Therefore, following Hayo et al. (2022), our main estimations will use the Flesch reading ease score and the average sentence length as key explanatory variables. These variables are widely used in the literature. The control variables in this study include a measure of the state of the economy, monetary policy stance change (dummy equals 1 if a policy rate was changed, otherwise 0), inflation, money supply (M1), level of international reserves, and others. It is worth mentioning that referred to in several related studies monetary policy surprise effect is captured through monetary policy stance and related dummies in our study. Meanwhile, as macro conditions may also have an impact on markets and statements length, we account for this by utilizing the computed economic stance index (ES).

As observed from the related literature, most studies employed Ordinary Least Squares (OLS) to establish the relationship between monetary policy communication and various macroeconomic indicators (see Ahokpossi et al. 2020; Mathur & Sengupta 2020; McMahon et al. 2018). Others used Factor Augmented Vector Autoregressive (FAVAR) models for similar analysis (Hansen and McMahon 2016). Taking into account the type of our data, which is a panel of 21 developing countries with data spanning from 2010 to 2021 we specify the following panel regression with fixed effects:

$$y_{it} = \beta_0 + X_{it}\beta + Z_{it}\delta + \alpha_i + T_i + \mu_{it} \qquad (1)$$

Where, y_{it} is the dependent variable for period *t* for country i;

X_{it} is a vector of independent variables of interest;

Z_{it} is a vector of control variables;

α_i are country-specific intercepts that capture heterogeneities across countries;

T_i is time as a binary (dummy) variable, so we have *t-1* time periods to capture fixed effects;

β is the coefficient of interest for our key explanatory variable;

μ_{it} is an error term.

To minimize the possible impact of outliers, we log-transformed complexity and readability scores estimated by respective measures. Although some studies, for example, (Mathur & Sengupta 2020), employ the lag of dependent variables to account for the impact of their past values and persistence. In our model, the score of economic stance includes the past realization of market rates.

We look for non-stationarity to examine if the means, variances, and autocorrelation patterns of our data have remained constant throughout time. We use panel unit root tests to account for the imbalanced structure of our panel data sample and discover that most of the data are stationary at the 1% significance level. The Kao panel-data cointegration test is also used to see if the combination of our non-stationary variables is stationary over time (Kao 1999). We find that reserves, domestic credit, debt service risk, and GDP per capita risk all cointegrate in the long run. As a result, these series are included in the panel fixed-effects models in log form, ensuring that no spurious regression findings are produced. The findings of the Fisher Augmented Dickey-Fuller (ADF) tests and the cointegration test are presented in Appendix Tables 4A and 5A, respectively as well as correlation checks in Tables 2A and 3A.

Table 2.4 below summarizes all the key variables for our regression analysis in this study and their descriptive statistics.

Table 2. 4 *Summary statistics*

Variable	N	Mean	Std. Dev.	Min	Max	Short definition
			Dependent variables			
FX volat 10d	874	-4.29	1.75	-9.21	0.33	Log of the 10 days foreign exchange rates volatility annualized
FX volat 5d	874	-4.56	1.89	-9.21	0.68	Log of the 5 days foreign exchange rates volatility annualized
FX volat 3d	874	-4.86	2.07	-9.21	0.86	Log of the 3 days foreign exchange rates volatility annualized
Lending rate volat 3m	819	-3.22	1.49	-6.91	-0.03	Log of the 3 months lending rates volatility annualized
Money market rate volat 3m	707	-2.21	1.85	-6.91	3.57	Log of the 3 months money market rates volatility annualized
Treasury bill rate volat 3m	732	-2.45	1.40	-6.91	3.43	Log of the 3 months treasury bill rates volatility annualized
			Independent variables			
FL	872	3.34	0.31	1.18	4.10	Log of Flesch reading ease score
Sentence length	874	3.21	0.18	2.72	3.81	Log of average sentence length
			Robustness check variables			
Sentence count	874	3.35	0.70	1.10	4.93	Log of number of sentences
Syllable count	874	0.58	0.04	0.44	0.74	Log of mean word syllables
FK	874	2.73	0.13	2.16	3.14	Log of Flesch-Kincaid readability score
ARI	874	2.76	0.15	2.13	3.23	Log of Automated Readability Index
FOG	874	2.96	0.12	2.56	3.37	Log of Gunning Fog index
SMOG	874	2.82	0.95	2.51	3.17	Log of Simple Measure of Gobbledygook
			Controls			
Policy rate change	874	0.35	0.48	0.00	1.00	Dummy for a monetary policy stance change
Economic situation	798	-0.02	0.07	-0.33	0.40	Economic situation index
Reserves	831	8.47	1.45	0.00	10.83	Log of international reserves BoP
CPI	848	4.87	0.43	3.55	5.98	Log of consumer price index
Inflation risk	784	2.01	0.19	1.10	2.30	Log of risk for inflation
Budget risk	784	1.53	0.30	0.41	2.08	Log of risk for budget balance
War risk	784	1.33	0.13	0.92	1.39	Log of war risk
International liquidity risk	784	-0.23	2.10	-4.61	1.61	Log of risk for international liquidity
Money supply M1	698	12.04	3.17	0.00	16.82	Log of M1 money supply
GDP pp risk	784	-2.11	2.02	-4.61	0.01	Log of risk for per capita GDP

Notes. Control variables and exchange rate data are obtained from IHS Markit, Treasury Bills and interest rates from IHS Markit, IFS of International Monetary Fund, and central banks' websites, complexity and readability indicators are computed by the authors using the algorithm in R. Interest rates are used in terms as in IFS of IMF: Lending rate is the rate used by other depository corporations to satisfy the private sector's short- and medium-term financial needs; Money market rate - the rate at which short-term loans are made between financial institutions; Treasury bill rate - short-term government debt is issued and sold on the market. Volatility is calculated based on the standard deviation of rates either with daily or monthly frequency and further annualized.

2.5 Empirical Results and Discussion

This section contains the estimation results for analyzing the implication of monetary policy communication on financial markets in developing countries. We further discuss the findings.

2.5.1 Results: FX rates

We begin by checking the impact of MPS' complexity and readability measures on foreign exchange rates volatility. Table 2.5 contains the results of the regression analysis of statement complexity measured by sentence length and the Flesch reading ease score. We observe that on average sentence length increases FX rate volatility in the horizon of 3, 5, and 10 business days after the statement release date, though not statistically significant, ceteris paribus. It means that a statement that is linguistically complex, i.e., difficult to comprehend, is associated with higher volatility of local currencies' exchange rates in the short run. Next, it is shown that the relationship between MPS readability, measured by the Flesch reading ease score, and FX rates volatility are negative and statistically significant for all periods and specifications. Good communication is expected to have calming effects to exchange rates as reported by Fišer and Horvath (2010) in their analysis of Czech National Bank communication and macroeconomic news on exchange rate volatility. The increased volatility of the exchange rate as a result of monetary policy statements may suggest that the statements were largely unclear. For instance, the FL score has an average of 20.3 (see table 2.3), suggesting that the statements are hard to understand and hence are likely not to be clear. Likewise, an average score of 13 for FK, suggests a highly unreadable text and requires at least a college education level for comprehension. As such, instead of the statements playing a calming effect to exchange rate volatility, the statements bring about volatility. Certainly, this is the reason Blinder et al. (2008) argue that ineffective communications due to poor design and execution could cause more harm than good. Moreover, Mathur and Sengupta (2019) found that longer

and more complex monetary policy statements generate greater uncertainty and wider dispersion of information which in turn results in heightened volatility.

Table 2. 5 Panel FE. FX volatility annualized

	3 days		5 days		10 days	
	(1)	(2)	(1)	(2)	(1)	(2)
Sentence length	0.255		0.224		0.602	
	(0.475)		(0.428)		(0.426)	
FL		-0.876**		-0.747*		-0.697**
		(0.368)		(0.349)		(0.310)
MP stance change	0.380	0.362	0.415*	0.404*	0.425*	0.424*
	(0.222)	(0.216)	(0.209)	(0.203)	(0.223)	(0.214)
Economic situation	-0.127	-0.110	-0.312	-0.328	-0.170	-0.167
	(0.726)	(0.734)	(1.003)	(1.065)	(0.637)	(0.668)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Period FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	588.000	586.000	588.000	586.000	588.000	586.000
Countries	13.000	13.000	13.000	13.000	13.000	13.000
R2	0.257	0.266	0.247	0.254	0.233	0.239

Notes. The dependent variables are a log of the 3, 5, and 10 days' foreign exchange rates volatility annualized, own calculation based on IHS Markit data; Sentence length stands for the log of average sentence length based on our calculations; FL stands for the log of Flesch reading ease score based on our calculations; MP stance change is a dummy variable indicating a change in monetary policy stance; Economic situation stands for economic situation index from own estimation. Controls include a log of international reserves BoP; the log of the consumer price index; the log of risk for inflation; a log of risk for budget balance; a log of risk for per capita GDP; a log of risk of war; the log of risk for international liquidity; the log of the M1 money supply). All models are based on panel estimations, account for country-fixed effects, and are controlled for period-fixed effects. A constant is not reported but is included in all specifications. Clustered on countries' robust standard errors in parentheses. Clustered on countries' robust standard errors in parentheses. *, **, and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Furthermore, the monetary policy change causes an increase in FX rate volatility. The explanation for this relationship is two-pronged. Firstly, as observed by Galí and Monacelli (2005) there is a trade-off between policy to stabilize domestic inflation and output gap on one hand and nominal exchange rate stability on the other. It suggests that as the central bank would regularly adjust the policy rate-either upwards or downwards to stabilize the output gap and inflation, it would entail substantially larger volatility of the nominal exchange rate.

Secondly, the result could be due to backward-looking tendencies by economic agents that make the exchange rate volatility highly persistent. As such, despite policy tightening in the current period, for example, the market allocates much weight to the previous exchange

rate volatility. Indeed, as reported by Hassan (2012), the exogenous shocks that affect exchange rate volatility may take time to wane off. Moreover, the monetary policy statements in our sample do not provide adequate forward guidance to assure the market of future economic developments. Out of 21 countries, only two countries attempted to provide forward guidance. Yoon et al. (2020) find similar results for Thailand and Indonesia and referred to this outcome as an "exchange rate puzzle."

2.5.2 Results: Market rates

We also examined the impact of MPS' complexity and readability measures on market rates, namely lending rates, money market rates, and treasury bills rates for 3 months' volatility. The results are presented in Table 2.6. The estimates show that MPS complexity, measured by sentence length, and the MPS readability, i.e., FL index, have no significant relationship with market rates. The results are consistent with Ahokpossi et al. (2020) who found that monetary policy reports do not have a significant impact on market rates and that press releases do not have a significant impact on market rates beyond the impact of the policy rate decision itself.

Similarly, Bulíř et al. (2018) found a weak relationship between the clarity of monetary policy reports for the Czech National Bank, the European Central Bank, the Bank of England, and Sveriges Riksbank and market volatility using the Flesch-Kincaid grade level score and concluded that there is no guarantee that investment in well-drafted monetary policy papers would always correlate with reduced volatility in the financial markets, as previously suggested. The fact that this relationship is consistent both in the advanced and developing world is enlightening. Specifically, the current narrative around monetary policy formulation board rooms, globally, seems to suggest that central bank communication is so important to an extent that the traditional policy tools are being thrown to the periphery.

Table 2. 6 Panel FE. Market rates. 3 months annualized volatility

	Lending rate		Money market rate		Treasury bill rate	
	(1)	(2)	(1)	(2)	(1)	(2)
Sentence length	-0.618		-0.331		0.064	
	(0.628)		(0.752)		(0.827)	
FL		0.519		-0.276		0.069
		(0.405)		(0.467)		(0.297)
MP stance change	0.360***	0.363***	0.354*	0.344*	0.288	0.292
	(0.097)	(0.097)	(0.165)	(0.164)	(0.181)	(0.182)
Economic	-0.811	-0.892	0.834	0.818	-0.669	-0.683
situation	(0.690)	(0.659)	(1.343)	(1.360)	(0.936)	(0.951)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Period FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	579.000	577.000	512.000	510.000	515.000	514.000
Countries	13.000	13.000	13.000	13.000	13.000	13.000
R2	0.194	0.200	0.241	0.242	0.260	0.261

Notes. The dependent variables, log of the 3 months lending rate, money market rate, and treasury bill rate volatility annualized, own calculation based on IHS Markit data; Sentence length stands for the log of average sentence length based on our calculations; FL stands for the log of Flesch reading ease score based on our calculations; MP stance change is a dummy variable indicating a change in monetary policy stance; Economic situation stands for economic situation index from own estimation. Controls include the log of international reserves BoP; the log of consumer price index; the log of risk for inflation; the log of risk for budget balance; the log of risk for per capita GDP; the log of risk of war; the log of risk for international liquidity; the log of the M1 money supply). All models are based on panel estimations, account for country-fixed effects, and are controlled for period-fixed effects. A constant is not reported but is included in all specifications. Clustered on countries' robust standard errors in parentheses. *, **, and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

2.5.3 Robustness checks

For sensitivity analysis of our findings, we have utilized other measures of MPS complexity and readability, while following the methodology from the respective part of this study. Table 2.7 and Table 2.8 comprise estimations with sentence count and syllable count (for complexity measures) as well as FK, ARI, SMOG, and FOG (for readability measures). It is shown in table 8 that readability measures have a positive and statistically significant relationship with FX rates volatility. Specifically, FK and SMOG were found to have a significant relationship with 5 days and 10 days FX rate volatility at a 10 percent significance

level. However, as found in table 2.5, complexity does not have a significant relationship with FX volatility. Overall, this result is consistent with the results stated in Table 2.5.

Table 2. 7 Panel FE. FX rate volatility

Dependent	Explanatory	Coefficient	R^2
3 days FX rate volatility	Syllable count	6.186 (3.775)	0.266
	Sentence count	0.463 (0.380)	0.263
	FK	1.173 (0.723)	0.26
	ARI	0.846 (0.592)	0.259
	FOG	1.329 (0.838)	0.26
	SMOG	1.941 (1.109)	0.261
5 days FX rate volatility	Syllable count	5.842 (3.398)	0.257
	Sentence count	0.358 (0.406)	0.251
	FK	1.083* (0.591)	0.25
	ARI	0.807 (0.504)	0.249
	FOG	1.147 (0.687)	0.249
	SMOG	1.687* (0.902)	0.25
10 days FX rate volatility	Syllable count	4.028 (2.647)	0.237
	Sentence count	0.204 (0.311)	0.233
	FK	1.276* (0.707)	0.236
	ARI	0.954 (0.573)	0.235
	FOG	1.414 (0.847)	0.236
	SMOG	1.885* (1.026)	0.236

Notes. The dependent variables, a log of the 3, 5, and 10 days foreign exchange rates volatility annualized, own calculation based on IHS Markit data; Syllable count is the log of mean word syllables; Sentence count is the log of the number of sentences; FK stands for the log of Flesch-Kincaid readability score based on our calculations; ARI stands for the log of Automated Readability Index based on our calculations; FOG stands for the log of Gunning Fog index based on our calculations; SMOG stands for the log of Simple Measure of Gobbledygook based on our calculations; MP stance change is a dummy for a monetary policy stance change based on own analysis; Economic situation stands for economic situation index from own estimation. Controls include the log of international reserves BoP; the log of consumer price index; the log of risk for inflation; the log of risk for budget balance; the log of risk for per capita GDP; the log of risk of war; the log of risk for international liquidity; the log of the M1 money supply). All models are based on panel estimations, account for country-fixed effects, and are controlled for period-fixed effects. All specifications include controls and have 588 observations. Clustered on countries' robust standard errors in parentheses. Clustered on countries' robust standard errors in parentheses. *, **, and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Further, to check the sensitivity of our findings for market rates from Table 2.6, we again utilize sentence count and syllable count measures as well as FK, ARI, SMOG, and FOG for complexity and readability measures. Table 2.8 contains the results of estimations with SMOG and FOG respectively. Even for other measures, we found that the complexity and readability of MPS have still a weak relationship with market rates. This follows our findings from Table 2.6.

Table 2. 8 Panel FE. Market rates. 3 months' annualized volatility

Dependent	Explanatory	Coefficient	Observations	R^2
Lending rate	Syllable count	-2.836 (2.365)	579	0.196
	Sentence count	0.002 (0.175)	579	0.19
	FK	-1.104 (0.920)	579	0.198
	ARI	-0.932 (0.796	579	0.198
	FOG	-1.147 (1.128)	579	0.197
	SMOG	-1.540 (1.402)	579	0.197
Money market rate	Syllable count	0.499 (2.392)	512	0.241
	Sentence count	0.147 (0.230)	512	0.242
	FK	-0.283 (0.903)	512	0.241
	ARI	-0.517 (0.751)	512	0.242
	FOG	-0.454 (0.971)	512	0.241
	SMOG	-0.571 (1.229)	512	0.241
Treasury bill rate	Syllable count	-0.380 (2.337)	515	0.26
	Sentence count	-0.040 (0.258)	515	0.26
	FK	-0.054 (0.881)	515	0.26
	ARI	0.098 (0.803)	515	0.26
	FOG	-0.174 (0.971)	515	0.26
	SMOG	-0.190 (1.214)	515	0.26

Notes. The dependent variables, log of the 3 months lending rate, money market rate, and treasury bill rate volatility annualized, own calculation based on IHS Markit data; Syllable count is the log of mean word syllables; Sentence count is the log of the number of sentences; FK stands for the log of Flesch-Kincaid readability score based on our calculations; ARI stands for the log of Automated Readability Index based on our calculations; FOG stands for the log of Gunning Fog index based on our calculations; SMOG stands for the log of Simple Measure of Gobbledygook based on our calculations; MP stance change is a dummy for a monetary policy stance change based on own analysis; Economic situation stands for economic situation index from own estimation. Controls include log of international reserves BoP; log of consumer price index; log of risk for inflation; log of risk for budget balance; log of risk for per capita GDP; log of risk of war; log of risk for international liquidity; log of M1 money supply). All models are based on panel estimations, account for country fixed effects and controlled for period fixed effects. All specifications include controls. Clustered on countries robust standard errors in parentheses. Clustered on countries' robust standard errors in parentheses. *, **, and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

2.6 Conclusion and Policy Implications

In this study, we examine central bank communication and its transmission to financial market variables in developing countries. We analyze a large corpus of monetary policy statements of 21 developing countries' central banks for a period from 2010 to 2021. At first, we quantified MPS clarity, i.e., complexity and readability dimensions, across sampled countries over time utilizing text mining tools. Then we empirically explored the MPS transmission to financial markets from the statements' clarity perspectives via panel fixed-effects estimations. Our approach is in line with the existing literature.

The descriptive part of this study shows that on average LMIE countries from our sample have more statements and a longer policy rate communication history than LIE countries. This suggests that issues regarding monetary policy communication are well established in the advanced economies and are now diffusing through to emerging and developing countries. We also notice the shift from highly frequent policy rate decisions (and communication, as a function of meetings) towards less frequent ones (quarterly or semi-quarterly). This may be understood in a way that as time goes by, to lead the markets, central banks do not require frequent policy rate decision interventions. Further, we find that on average, countries with long statements have a shorter sentence length meaning that the basic logic to have a long but more readable statement prevails. Finally, on average, one needs to have at least college-level education to comprehend a monetary policy statement in our sample.

Our empirical analysis revealed that statements' complexity and clarity are important in explaining FX rates volatility but weak in explaining lending rates, money market rates, and local T-bills rates volatilities for developing countries.

This study contributes to the literature strands in several ways. First, we study the monetary policy statements of the central banks in 21 developing countries over 11 years. We quantify these policy statements' complexity and readability and measured the central banks'

views about economic conditions at some particular time. Moreover, we found that forward guidance tools are rarely applied in developing countries, though a few countries do. We find robust evidence suggesting that unclear statements are associated with high exchange rate volatility but there is no evidence to suggest a relationship between monetary policy statements and market rates volatility. These results are adequately supported in the literature.

The study's findings have significant policy consequences. Firstly, central banks must make their communication clearer. While several emerging economies have used central bank communication as a tool for monetary policy, the fact that a monetary policy announcement can only be understood by a college student, on average, is dispiriting. The primary goal of monetary policy communication is to keep economic agents informed about the central bank's actions. Households, businesses, financial analysts, and small enterprise owners are examples of these agents. Given the literacy levels in most developing nations, it may suggest that such communication is poorly comprehended. We argue that ambiguous statements can cause economic destabilization because of dispersing expectations. We contend that central banks should make their communication, including policy pronouncements, as clear as possible. Second, central banks' announcements should incorporate forward advice. One of the primary goals of central bank communication is to anchor expectations. Expectations are anchored when the central bank is not timid to disclose the short- to medium-term pathways of key variables like interest rates and inflation. Only 16 percent of the statements in our sample provided forward direction. A lack of forward guidance could indicate a lack of confidence on the part of central banks, lowering their credibility and elevated uncertainty.

References

Ahokpossi, Calixte, Agnes Isnawangsih, Md. Shah Naoaj, & Ting Yan. 2020. "The Impact of Monetary Policy Communication in an Emerging Economy: The Case of Indonesia." *IMF Working Paper* (WP/20/109). doi: 10.2139/ssrn.3652497.

Amato, Jeffery D., Stephen Morris, & Hyun Song Shin. 2002. "Communication and Monetary Policy." *Oxford Review of Economic Policy* 18(4):495–503.

Arun, R., V. Suresh, C. E. Veni Madhavan, and M. N. Narasimha Murthy. 2010. "On Finding the Natural Number of Topics with Latent Dirichlet Allocation: Some Observations." Pp. 391–402 in *Advances in Knowledge Discovery and Data Mining, Lecture Notes in Computer Science*, edited by M. J. Zaki, J. X. Yu, B. Ravindran, and V. Pudi. Berlin, Heidelberg: Springer.

Assenmacher, Katrin, Gabriel Glöckler, Sarah Holton, Peter Trautmann, Demosthenes Ioannou, Simon Mee, Klara Bakk-Simon, Stephanie Bergbauer, Marco Catenaro, and Evangelos Charalampakis. 2021. "Clear, Consistent and Engaging: ECB Monetary Policy Communication in a Changing World."

Barberis, Nicholas, Andrei Shleifer, and Robert Vishny. 1998. "A Model of Investor Sentiment." *Journal of Financial Economics* 49(3):307–43.

Benchimol, Jonathan, Sophia Kazinnik, and Yossi Saadon. 2020. *Text Mining Methodologies with R: An Application to Central Bank Texts*. Bank of Israel, Research Department.

Benoit, Kenneth, Kevin Munger, and Arthur Spirling. 2019. "Measuring and Explaining Political Sophistication through Textual Complexity." *American Journal of Political Science* 63(2):491–508. doi: 10.1111/ajps.12423.

Benoit, Kenneth, Kohei Watanabe, Haiyan Wang, Paul Nulty, Adam Obeng, Stefan Müller, and Akitaka Matsuo. 2018. "Quanteda: An R Package for the Quantitative Analysis of Textual Data." *Journal of Open Source Software* 3(30):774.

Bernanke, Ben, Vincent Reinhart, and Brian Sack. 2004. "Monetary Policy Alternatives at the Zero Bound: An Empirical Assessment." *Brookings Papers on Economic Activity* 2004(2):1–100.

Blei, David M., and John D. Lafferty. 2009. "Topic Models." Pp. 101–24 in *Text mining*. Chapman and Hall/CRC.

Blinder, Alan S. 2018. "Through a Crystal Ball Darkly: The Future of Monetary Policy Communication." Pp. 567–71 in *AEA Papers and Proceedings*. Vol. 108.

Blinder, Alan S., Michael Ehrmann, Jakob De Haan, and David-Jan Jansen. 2017. "Necessity as the Mother of Invention: Monetary Policy after the Crisis." *Economic Policy* 32(92):707–55.

Blinder, Alan S., Michael Ehrmann, Marcel Fratzscher, Jakob De Haan, and David-Jan Jansen. 2008. “Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence.” *Journal of Economic Literature* 46(4):910–45.

Blinder, Alan S, Michael Ehrmann, Marcel Fratzscher, Jakob De Haan, and David-Jan Jansen. 2008. “Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence.” *Journal of Economic Literature* 46(4):910–45. doi: 10.1257/jel.46.4.910.

Bonsall, Samuel B., Andrew J. Leone, Brian P. Miller, and Kristina Rennekamp. 2017. “A Plain English Measure of Financial Reporting Readability.” *Journal of Accounting and Economics* 63(2):329–57. doi: 10.1016/j.jacceco.2017.03.002.

Bulíř, Aleš, Martin Čihák, and David-Jan Jansen. 2018. “Does the Clarity of Monetary Policy Reports Reduce Volatility in Financial Markets?” *Finance a Uver: Czech Journal of Economics & Finance* 68(1).

Campbell, Jeffrey R., Charles L. Evans, Jonas DM Fisher, Alejandro Justiniano, Charles W. Calomiris, and Michael Woodford. 2012. “Macroeconomic Effects of Federal Reserve Forward Guidance [with Comments and Discussion].” *Brookings Papers on Economic Activity* 1–80.

Cao, Juan, Tian Xia, Jintao Li, Yongdong Zhang, and Sheng Tang. 2009. “A Density-Based Method for Adaptive LDA Model Selection.” *Neurocomputing* 72(7):1775–81. doi: 10.1016/j.neucom.2008.06.011.

Coenen, G., M. Ehrmann, G. Gaballo, P. Hoffmann, A. Nakov, S. Nardelli, E. Persson, and G. Strasser. 2017. “Communication of Monetary Policy in Unconventional Times. ECB Working Paper. No. 2080.”

De Fiore, Fiorella, Marco Jacopo Lombardi, and Johannes Schuffels. 2021. *Are Households Indifferent to Monetary Policy Announcements?* BIS Working Papers 956. Bank for International Settlements.

Demiralp, Selva, and Oscar Jorda. 2002. “The Announcement Effect: Evidence from Open Market Desk Data.” *Federal Reserve Bank of New York Economic Policy Review* 8(May):29–48.

Den Haan, Wouters. 2013. “Forward Guidance: Perspectives from Central Bankers, Scholars and Market Participants.” *Center for Economic Policy Research*.

Deveaud, Romain, Eric SanJuan, and Patrice Bellot. 2014. “Accurate and Effective Latent Concept Modeling for Ad Hoc Information Retrieval.” *Document Numérique* 17(1):61–84.

Ehrmann, Michael, and Jonathan Talmi. 2020. “Starting from a Blank Page? Semantic Similarity in Central Bank Communication and Market Volatility.” *Journal of Monetary Economics* 111:48–62.

Farr, James N., James J. Jenkins, and Donald G. Paterson. 1951. “Simplification of Flesch Reading Ease Formula.” *Journal of Applied Psychology* 35(5):333.

Fišer, Radovan, and Roman Horvath. 2010. “Central Bank Communication and Exchange Rate Volatility: A GARCH Analysis.” *Macroeconomics and Finance in Emerging Market Economies* 3(1):25–31.

Flesch, Rudolf. 1979. *How to Write Plain English: A Book for Lawyers and Consumers.* Harpercollins.

Flesch, Rudolph. 1948. “A New Readability Yardstick.” *Journal of Applied Psychology* 32(3):221–33. doi: 10.1037/h0057532.

Galí, Jordi, and Tommaso Monacelli. 2005. “Monetary Policy and Exchange Rate Volatility in a Small Open Economy.” *The Review of Economic Studies* 72(3):707–34.

Gonzalez, Mario, and Raul Cruz Tadle. 2021. *Monetary Policy Press Releases: An International Comparison*. 912. Central Bank of Chile.

Griffiths, Thomas L., and Mark Steyvers. 2004. “Finding Scientific Topics.” *Proceedings of the National Academy of Sciences* 101(suppl 1):5228–35. doi: 10.1073/pnas.0307752101.

Gunning, Robert. 1952. *Technique of Clear Writing*. New York: McGraw-Hill.

Guthrie, Graeme, and Julian Wright. 2000. “Open Mouth Operations.” *Journal of Monetary Economics* 46(2):489–516.

Haldane, Andrew. 2017. “A Little More Conversation, a Little Less Action.” *Bank of England-Speech*.

Hansen, Stephen, and Michael McMahon. 2016. “Shocking Language: Understanding the Macroeconomic Effects of Central Bank Communication.” *Journal of International Economics* 99:S114–33. doi: 10.1016/j.jinteco.2015.12.008.

Hassan, S. 2012. “Persistence And Asymmetry In Exchange Rate Volatility.” *International Business & Economics Research Journal (IBER)* 11:971. doi: 10.19030/iber.v11i9.7180.

Hayo, Bernd, Kai Henseler, Marc Steffen Rapp, and Johannes Zahner. 2022. “Complexity of ECB Communication and Financial Market Trading.” *Journal of International Money and Finance* 102709. doi: 10.1016/j.jimonfin.2022.102709.

Hendry, Scott. 2012. *Central Bank Communication or the Media’s Interpretation: What Moves Markets?* Bank of Canada.

Hendry, Scott, and Alison Madeley. 2010. *Text Mining and the Information Content of Bank of Canada Communications*. *Staff Working Paper*. Bank of Canada.

Jenkins, P. 2004. “Communication: A Vital Tool in the Implementation of Monetary Policy.” in *Remarks to the FMAC/FMA-USA Joint Conference*.

Kao, Chihwa. 1999. “Spurious Regression and Residual-Based Tests for Cointegration in Panel Data.” *Journal of Econometrics* 90(1):1–44. doi: 10.1016/S0304-4076(98)00023-2.

Kincaid, J. Peter, Robert P. Fishburne Jr, Richard L. Rogers, and Brad S. Chissom. 1975. *Derivation of New Readability Formulas (Automated Readability Index, Fog Count and Flesch Reading Ease Formula) for Navy Enlisted Personnel*. Naval Technical Training Command Millington TN Research Branch.

Kohn, Donald L., and Brian P. Sack. 2003. "Central Bank Talk: Does It Matter and Why?"

Levin, Andrew T. 2014. "The Design and Communication of Systematic Monetary Policy Strategies." *Journal of Economic Dynamics and Control* 49:52–69. doi: 10.1016/j.jedc.2014.09.004.

Lewis, Daniel J., Christos Makridis, and Karel Mertens. 2019. "Do Monetary Policy Announcements Shift Household Expectations?" *FRB of New York Staff Report* (897).

Li, Feng. 2008. "Annual Report Readability, Current Earnings, and Earnings Persistence." *Journal of Accounting and Economics* 45(2):221–47. doi: 10.1016/j.jacceco.2008.02.003.

Loughran, Tim, and Bill McDonald. 2011. "When Is a Liability Not a Liability? Textual Analysis, Dictionaries, and 10-Ks." *The Journal of Finance* 66(1):35–65. doi: 10.1111/j.1540-6261.2010.01625.x.

Loughran, Tim, and Bill McDonald. 2014. "Measuring Readability in Financial Disclosures." *The Journal of Finance* 69(4):1643–71. doi: 10.1111/jofi.12162.

Loughran, Tim, and Bill McDonald. 2016. "Textual Analysis in Accounting and Finance: A Survey." *Journal of Accounting Research* 54(4):1187–1230. doi: 10.1111/1475-679X.12123.

Luangaram, Pongsak, and Warapong Wongwachara. 2017. "More than Words: A Textual Analysis of Monetary Policy Communication." *PIER Discussion Papers* 54.

Markel, Mike, and Michael H. Markel. 2010. *Technical Communication*. 9th ed. Bedford/St Martin's.

Mathur, Aakriti, and Rajeswari Sengupta. 2019. "Analysing Monetary Policy Statements of the Reserve Bank of India." *Available at SSRN 3383869*.

Mathur, Aakriti, and Rajeswari Sengupta. 2020. "Analysing Monetary Policy Statements of the Reserve Bank of India." *SSRN Electronic Journal* (WP-2019-012). doi: 10.2139/ssrn.3383869.

McLaughlin, G. Harry. 1969. "Clearing the SMOG." *Journal of Reading* 13(3). doi: 10.2307/40017271.

McMahon, Michael, Mr Alfred Schipke, and Xiang Li. 2018. *China's Monetary Policy Communication: Frameworks, Impact, and Recommendations*. International Monetary Fund.

Mishkin, Frederic S., and Adam Posen. 1998. "Inflation Targeting: Lessons from Four Countries."

Mpofu, Trust R., and Amos C. Peters. 2017. “The Impact of Monetary Policy Announcements and Political Events on the Exchange Rate: The Case of South Africa.” *Working Paper, Economic Research Southern Africa, South Africa*.

Musard-Gies, Marie. 2006. “Do European Central Bank’s Statements Steer Interest Rates in the Euro Zone?” *The Manchester School* 74:116–39.

Pescatori, Mr Andrea. 2018. *Central Bank Communication and Monetary Policy Surprises in Chile*. International Monetary Fund.

Pinshi, Christian. 2020. “Monetary Policy in DR. Congo: Learning about Communication and Expectations.”

Reeves, Rachel, and Michael Sawicki. 2007. “Do Financial Markets React to Bank of England Communication?” *European Journal of Political Economy* 23(1):207–27.

Rosa, Carlo, and Giovanni Verga. 2008. “The Impact of Central Bank Announcements on Asset Prices in Real Time.” *Thirteenth Issue of the International Journal of Central Banking*.

Senter, R. J., and Edgar A. Smith. 1967. *Automated Readability Index*. Cincinnati Univ OH.

Smales, L. A., and N. Apergis. 2017a. “Does More Complex Language in FOMC Decisions Impact Financial Markets?” *Journal of International Financial Markets, Institutions and Money* 51:171–89. doi: 10.1016/j.intfin.2017.08.003.

Smales, L. A., and N. Apergis. 2017b. “Understanding the Impact of Monetary Policy Announcements: The Importance of Language and Surprises.” *Journal of Banking & Finance* 80:33–50. doi: 10.1016/j.jbankfin.2017.03.017.

Sohn, Wook, Byeongmook Sung, and Hyosung Kwon. 2006. “The Financial Markets’ Responses to Monetary Policy Announcements.” *Economic Papers* 9(1):102–42.

Su, Shiwei, Ahmad Hassan Ahmad, and Justine Wood. 2020. “How Effective Is Central Bank Communication in Emerging Economies? An Empirical Analysis of the Chinese Money Markets Responses to the People’s Bank of China’s Policy Communications.” *Review of Quantitative Finance and Accounting* 54(4):1195–1219.

Wang, Shen, and David G. Mayes. 2012. “Monetary Policy Announcements and Stock Reactions: An International Comparison.” *The North American Journal of Economics and Finance* 23(2):145–64.

Williams, John C. 2013. “Will Unconventional Policy Be the New Normal?” *FRBSF Economic Letter* 29(7).

Woodford, M. 2008. “Forward Guidance for Monetary Policy: Is It Still Possible? VoxEU, 17 January.”

Woodford, Michael. 2012. “Methods of Policy Accommodation at the Interest-Rate Lower Bound.”

Yoon, Deok Ryong, Soyoung Kim, and Jinhee Lee. 2020. “The Impact of Monetary Policy on Exchange Rate and Its Policy Implication.”

Zeidy, Ibrahim A. 2020. *Unconventional Monetary Policy Tools Deployed to Address the Socio-Economic Impact of Covid-19. Special Report*. Lusaka, Zambia: Common Market for Eastern and Southern Africa.

Appendix

Table 1A. Some word associated with economy expansion and contraction.

Expansion	***Contraction***
Acceler	Abnormal
Achieve	Bailout
Advances	Bans
Bolstered	Caution
Booming	Contract
Enhance	Cool
Expand	Crisis
Faster	Decreas
Favorable	Fall
Foster	Lose
Gain	Low
Increas	Moder
Rise	Soften
Risen	Subdu
Stable	Worsen

Note: All words are stemmed.

Figure 1A. Estimated number of topics for Egypt.

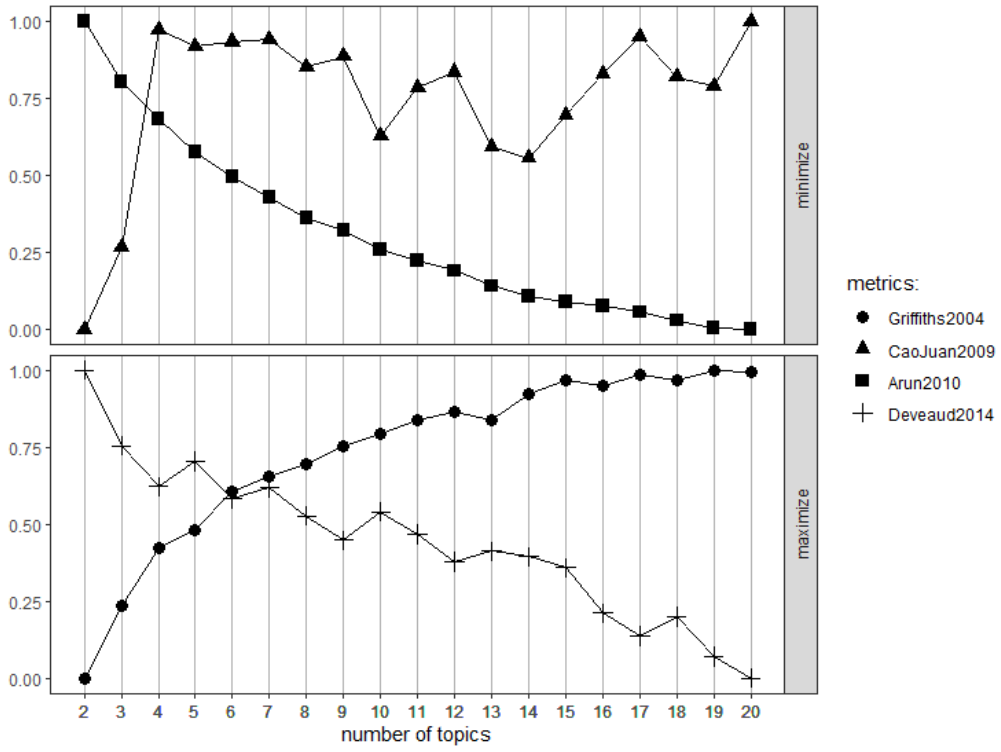


Figure 2A. Evolution of the index of the economic situation in Egypt.

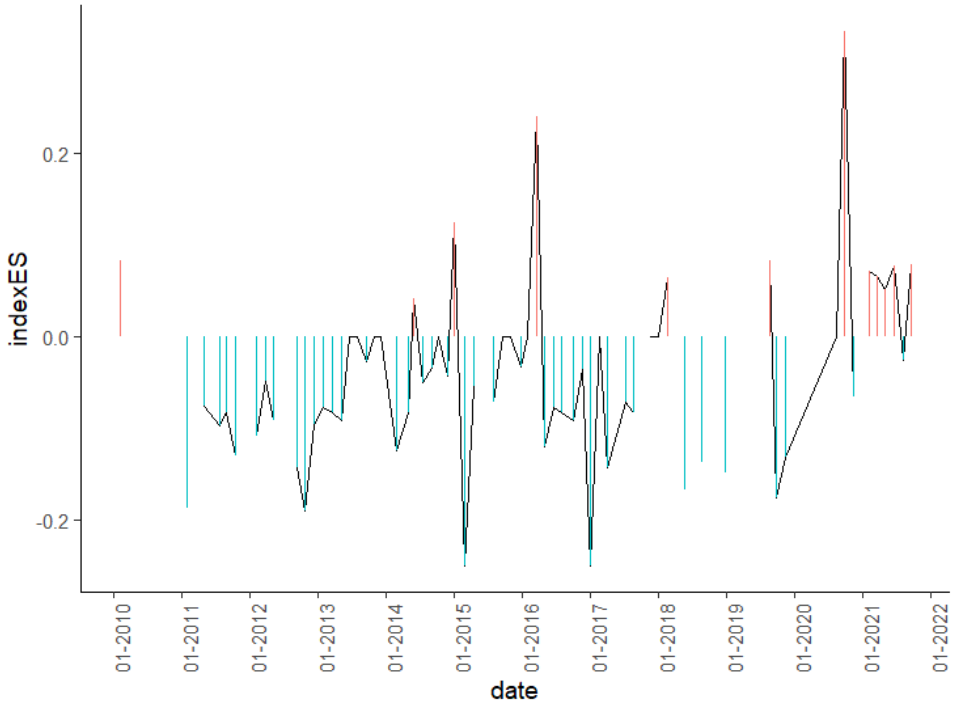

indexES
0.2
0.0
-0.2
01-2010
01-2011
01-2012
01-2013
01-2014
01-2015
01-2016
01-2017
01-2018
01-2019
01-2020
01-2021
01-2022
date

Table 2A. Correlation: key independent and robustness check variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Log of FX volat 10d	1.00													
(2) Log of FX volat 5d	0.90	1.00												
(3) Log of FX volat 3d	0.83	0.92	1.00											
(4) Log of Treasury bill rate volat 3m	-0.04	-0.07	-0.04	1.00										
(5) Log of Money market rate volat 3m	-0.10	-0.09	-0.10	0.38	1.00									
(6) Log of Lending rate volat 3m	-0.09	-0.10	-0.11	0.30	0.36	1.00								
(7) Log of mean sentence lenght	-0.12	-0.15	-0.17	0.14	0.09	0.09	1.00							
(8) Log of mean_word_syllables	-0.11	-0.10	-0.06	0.05	0.19	0.11	0.01	1.00						
(9) Log of number of sentences	-0.07	-0.05	-0.05	-0.08	0.12	-0.06	-0.30	-0.01	1.00					
(10) Log of FK	-0.16	-0.18	-0.19	0.15	0.16	0.14	0.89	0.45	-0.28	1.00				
(11) Log of FL	0.08	0.09	0.08	-0.12	-0.21	-0.14	-0.62	-0.73	0.23	-0.88	1.00			
(12) Log of ARI	-0.16	-0.19	-0.19	0.16	0.17	0.14	0.92	0.37	-0.31	0.98	-0.83	1.00		
(13) Log of FOG	-0.14	-0.16	-0.16	0.15	0.15	0.17	0.85	0.48	-0.27	0.98	-0.88	0.95	1.00	
(14) Log of SMOG	-0.14	-0.16	-0.15	0.15	0.16	0.17	0.83	0.52	-0.25	0.97	-0.89	0.93	1.00	1.00

Table 3A. Correlation: control variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) Log of FX volat 10d	1.00															
(2) Log of FX volat 5d	0.88	1.00														
(3) Log of FX volat 3d	0.84	0.94	1.00													
(4) Log of Treasury bill rate volat 3m	0.04	-0.01	-0.00	1.00												
(5) Log of Money market rate volat 3m	0.02	0.03	0.03	0.36	1.00											
(6) Log of Lending rate volat 3m	0.12	0.11	0.09	0.22	0.09	1.00										
(7) Policy rate change	0.27	0.26	0.23	0.12	0.08	0.17	1.00									
(8) Economic situation index	0.05	0.06	0.07	-0.07	0.04	-0.05	0.00	1.00								
(9) Log of international reserves	-0.29	-0.22	-0.20	-0.05	-0.08	-0.09	-0.09	0.01	1.00							
(10) Log of consumer price index	0.03	0.04	0.02	0.16	0.31	0.24	0.12	-0.01	0.11	1.00						
(11) Log of risk for inflation	-0.00	-0.02	-0.01	-0.02	-0.03	-0.07	-0.06	0.12	-0.05	-0.07	1.00					
(12) Log of risk for budget balance	-0.03	-0.03	-0.05	0.11	0.35	0.10	0.01	-0.03	-0.09	0.60	0.02	1.00				
(13) Log of risk for per capita GDP	-0.08	-0.07	-0.08	-0.03	-0.24	0.04	-0.12	0.01	0.29	-0.01	0.13	-0.11	1.00			
(14) Log of war risk	-0.28	-0.29	-0.30	-0.01	0.11	-0.23	-0.20	-0.07	-0.27	-0.44	0.15	-0.03	-0.15	1.00		
(15) Log of risk for international liquidity	0.03	0.02	-0.01	0.06	0.21	0.04	0.03	-0.13	0.02	0.18	0.09	0.28	-0.05	-0.01	1.00	
(16) Log of M1 money supply	-0.23	-0.18	-0.15	0.02	-0.06	0.00	-0.06	-0.02	0.69	0.21	0.02	0.06	0.21	-0.12	-0.20	1.00

Table 4A: Augmented Dickey Fuller Panel Unit Root Test results

Variables	chi2	p-value
Log of FX volat 10d	380.969	0.000
D. Log of FX volat 10d	696.058	0.000
Log of FX volat 5d	443.801	0.000
D. Log of FX volat 5d	703.255	0.000
Log of FX volat 3d	483.492	0.000
D. Log of FX volat 3d	736.430	0.000
Log of Lending rate volat 3m	290.690	0.000
D. Log of Lending rate volat 3m	589.256	0.000
Log of Money market rate volat 3m	206.298	0.000
D. Log of Money market rate volat 3m	559.078	0.000
Log of Treasury bill rate volat 3m	214.579	0.000
D. Log of Treasury bill rate volat 3m	507.852	0.000
Log of average sentence length	320.100	0.000
D. Log of average sentence length	701.928	0.000
Log of mean word syllables	299.087	0.000
D. Log of mean word syllables	769.081	0.000
Log of Flesch-Kincaid readability score	300.415	0.000
D. Log of Flesch-Kincaid readability score	726.588	0.000
Log of Automated Readability Index	297.506	0.000
D. Log of Automated Readability Index	691.696	0.000
Log of Gunning Fog index	315.823	0.000
D. Log of Gunning Fog index	730.176	0.000
Log of Simple Measure of Gobbledygook	310.088	0.000
D. Log of Simple Measure of Gobbledygook	724.443	0.000
Log of number of sentences	191.578	0.000
D. Log of number of sentences	729.141	0.000
Economic situation index	444.778	0.000
D. Economic situation index	629.325	0.000
Log of international reserves	40.010	0.470
D. Log of international reserves	394.061	0.000
Log of consumer price index	103.227	0.000
D. Log of consumer price index	283.682	0.000
Log of risk for inflation	61.544	0.001
D. Log of risk for inflation	429.829	0.000
Log of risk for budget balance	49.344	0.026
D. Log of risk for budget balance	384.547	0.000
Log of risk for per capita GDP	40.780	0.137
D. Log of risk for per capita GDP	253.131	0.000
Dummy for a monetary policy stance change	505.910	0.000
D. Dummy for a monetary policy stance change	797.172	0.000
Log of war risk	3.991	1.000
D. Log of war risk	105.544	0.000
Log of risk for international liquidity	46.500	0.047
D. Log of risk for international liquidity	410.850	0.000
Log of M1 money supply	43.319	0.018
D. Log of M1 money supply	281.843	0.000

Table 5A: Kao panel-data cointegration test results for Log of international reserves, Log of risk for per capita GDP, and Log of war risk

	Statistic	**p-value**
Modified Dickey–Fuller t	-9.7899	0.0000
Dickey–Fuller t	-9.3155	0.0000
Augmented Dickey-Fuller t	-4.1724	0.0000
Unadjusted modified Dickey-Fuller t	-31.2263	0.0000
Unadjusted Dickey-Fuller t	-14.3997	0.0000

Table 6A. Summary statistics of original (non-transformed) variables

Variable	N	Mean	Std. Dev.	Min	Max	Short definition
			Dependent variables			
FX volat 10d	874	0.04	0.09	0.00	1.40	the 10 days foreign exchange rates volatility annualized
FX volat 5d	874	0.04	0.11	0.00	1.96	the 5 days foreign exchange rates volatility annualized
FX volat 3d	874	0.04	0.11	0.00	2.37	the 3 days foreign exchange rates volatility annualized
Lending rate volat 3m	819	0.08	0.09	0.00	0.97	the 3 months lending rates volatility annualized
Money market rate volat 3m	707	0.40	1.47	0.00	35.60	the 3 months money market rates volatility annualized
Treasury bill rate volat 3m	732	0.22	1.17	0.00	30.97	the 3 months treasury bill rates volatility annualized
			Independent variables			
FL	872	29.47	7.68	3.26	60.05	Flesch reading ease score
Sentence length	874	25.21	4.63	15.20	45.33	average sentence length
			Robustness check variables			
Sentence count	874	36.21	26.87	3.00	138.00	number of sentences
Syllable count	874	1.79	0.07	1.55	2.10	mean word syllables
FK	874	15.42	2.04	8.66	23.13	Flesch-Kincaid readability score
ARI	874	15.99	2.48	8.42	25.34	Automated Readability Index
FOG	874	19.36	2.34	12.92	29.19	Gunning Fog index
SMOG	874	16.87	1.63	12.34	23.86	Simple Measure of Gobbledygook
			Controls			
Policy rate change	874	0.35	0.48	0.00	1.00	Dummy for a monetary policy stance change
Economic situation	798	-0.02	0.07	-0.33	0.40	Economic situation index
Reserves	831	10437.89	12204.39	0.00	50395.86	international reserves BoP
CPI	848	141.41	60.83	33.97	395.98	consumer price index
Inflation risk	784	7.58	1.24	3.00	10.00	risk for inflation
Budget risk	784	4.79	1.25	1.50	8.00	risk for budget balance
War risk	784	3.79	0.41	2.50	4.00	war risk
International liquidity risk	784	1.90	1.29	0.00	5.00	risk for international liquidity
Money supply M1	698	2130000.00	4000000.00	0.00	20100000.00	M1 money supply
GDP pp risk	784	0.38	0.35	0.00	1.00	risk for per capita GDP

Note: Control variables and Exchange rate data is sourced from IHS Markit, Treasury Bills and interest rates from IHS Markit, IFS of International Monetary Fund, and central banks websites, complexity and readability indicators are computed by the authors using the algorithm in R. Interest rates are used in terms as in IFS of IMF: Lending rate is the rate used by other depository corporations to satisfy the private sector's short- and medium-term financial needs; Money market rate - the rate at which short-term loans are made between financial institutions; Treasury bill rate - short-term government debt is issued and sold on the market. Volatility calculated based on standard deviation of rates either with daily or monthly frequency and further annualized.

" Press release of the National Bank of Moldova, 29 September 2016

During the meeting of 29 September 2016, the Executive Board of the National Bank of Moldova adopted the following decision by unanimous vote:

1. to decrease the base rate applied on main short-term monetary policy operations by 0.5 percentage points from 10.0 to 9.5 percent annually;

2. to decrease the interest rates:

- on overnight loans by 0.5 percentage points from 13.0 to 12.5 percent annually;

- on overnight deposits by 0.5 percentage points from 7.0 to 6.5 percent annually;

3. to maintain the required reserves ratio from financial means attracted in freely convertible currency at the level of 14.0 percent of the base.

4. to maintain the required reserves ratio from financial means attracted in MDL and non-convertible currency at the current level of 35.0 percent of the base;

The analysis of the most recent statistical data shows the downward trend of the annual inflation rate for the eighth consecutive month and its return within the range of ± 1.5 percentage points from the 5.0 percent target.

The annual inflation rate was 3.6 percent in August 2016 or by 3.4 percentage points less compared to the previous month.

The deceleration of the annual inflation rate in August is in line with the latest forecast of the NBM (published in August 2016) and validates the correctness of monetary policy decisions taken in 2015 and at the beginning of the year.

The annual rate of core inflation was 7.5 percent in August 2016, decreasing by 1.3 percentage points compared to the previous month.

In the second quarter of 2016, the economic activity recorded an increase of 1.8 percent compared to the same period in 2015. In terms of uses, this dynamic is determined by the increase in household final consumption and changes in inventories, generating a contribution of 1.9 percentage points and 4.0 percentage points, respectively. By categories of resources, the positive dynamics of GDP were determined by the increase of gross value added in all sectors, except for that of the subcomponent "construction" and "public administration". Thus, the gross value added recorded increases in “agriculture” (4.1 percent), "trade" (4.1 percent), "transport and storage" (7.0 percent), and "industry" (0.6 percent).

The dynamics of macroeconomic indicators in July and August 2016 show moderate signs of further economic activity recovery in the third quarter. In July 2016, exports increased by 0.5 percent compared to the same period in 2015, while imports decreased by 7.9 percent. At the same time, the industrial output recorded a decrease of 5.2 percent, the turnover of trade in services by 5.6 percent, and the turnover of retail trade increased by 1.2 percent. In August 2016, the annual growth rate of transported goods recorded a pronounced increase up to the level of 19.0 percent.

In terms of consumer demand, the annual average real wage growth in the economy was 0.9 percent in July 2016, 0.8 percentage points lower than in June 2016. Money transfers to individuals through the banks of the Republic of Moldova fell by 6.0 percent in January-August 2016, while in August 2016, these transfers increased, in nominal terms, by 18.4 percent compared with the same periods of 2015.

In August 2016, lending and saving processes recorded similar developments. The volume of new loans granted during the reporting period increased by 17.3 percent, while new attracted deposits increased by 19.9 percent compared to the same period of last year. The total balance of credits at the end of August decreased by 13.7 percent compared to the same period of last year, while the total balance of deposits recorded an increase of 4.0 percent compared to August 2015.

The average rate of new loans granted in national currency decreased by 0.30 percent compared to the level recorded in July 2016, accounting for 13.70 percent. The rate of new deposits attracted in MDL decreased in August 2016 by 1.62 percentage points, reaching the level of 8.24 percent.

The monetary policy continues to be affected by the complexity of risks and uncertainties associated with the development of internal and external environments. The external disinflationary risks associated with the weak economic activity in the Euro area countries and the recession of the Russian Federation - the main trading partners of the Republic of Moldova, with repercussions on the short-term decrease in foreign currency income of the households and domestic exporters through the remittances and foreign trade channel. Potential risks to inflation arise from the increased volatility of the international financial foreign exchange markets, along with the uncertainties relating to oil prices, and international prices for raw materials and food products. The main internal risks and uncertainties arise from postponing the adjustment of regulated tariffs, and the modification of excise duties, in terms of fiscal policy conduct for 2017 and of harvest in 2016, respectively. Thus, the disinflationary risks are prevailing significantly and a fast decrease process of the annual growth rate of prices is anticipated, also due to the high base of comparison in 2015.

In assessing the inflation outlook in the short and medium term, within the meeting held on 29 September 2016, the members of the Executive Board of the NBM decided by unanimous vote to decrease the policy rate by 0.5 percentage points from 10.0 to 9.5 percent annually.

The decision is aimed at maintaining the inflation rate close to the target of 5.0 percent over the medium term, with a possible deviation of ± 1.5 percentage points. The gradual calibration of monetary policy conduct aims to ensure adequate real monetary conditions for supporting lending and savings and for boosting domestic demand, along with the further adaptation of the domestic economic environment to the volatility and uncertainty related to the external environment.

NBM will continue to manage firmly the liquidity excess through sterilization operations, according to the announced schedule.

At the same time, National Bank will continue to offer banks liquidity, according to the schedule announced for 2016, through REPO operations with the term of 14 days, at a fixed rate equal to the base rate of the National Bank plus a margin of 0.25 points percentage.

NBM will further monitor and anticipate the domestic and international economic environment developments so that the flexibility of the operational framework is specific to the inflation targeting strategy to ensure price stability in the medium term.

The next meeting of the Executive Board of the NBM on monetary policy will take place on 27 October 2016, according to the announced schedule. "[16]

[16] Taken form the National Bank of Moldova website.

" CENTRAL BANK OF THE GAMBIA

PRESS RELEASE

MONETARY POLICY COMMITTEE

The Monetary Policy Committee (MPC) of the Central Bank of the Gambia met on Wednesday, November 28, 2018, to review recent economic developments and decide on the monetary policy rate. The following summarizes the deliberations on key economic indicators that informed the Committee's decision.

Global Economic Outlook.

1. Global economic growth remains on track, although risks to the outlook have shifted to the downside. In its October release of the World Economic Outlook, the International Monetary Fund (IMF) has revised downwards its growth projection for 2018 to 3.7 percent (the same level as in 2017) from 3.9 percent reported in its July update, as trade and investment moderate and financial conditions tighten.

2. In advanced economies, growth is projected at 2.4 percent in 2018, compared to 2.3 percent in 2017. The rising global interest rates combined with the strengthening of the U.S. dollar, have contributed to tighter financial conditions and moderated capital flows to emerging and developing economies. Growth in emerging markets and developing economies is projected to remain unchanged at 6.5 percent in 2018 compared to 2017 before declining to 6.3 percent in 2019. In sub-Sahara Africa, the economic recovery continues, supported by stronger external demand, higher commodity prices, and improved access to capital. Economic growth in the region is projected at 3.1 percent in 2018, higher than 2.7 percent in 2017.

3. Global inflation is projected to accelerate to an average of 3.5 percent in 2018, higher than 3.1 percent in 2017, driven largely by rising energy prices. Inflation pressures in sub-Saharan Africa have broadly softened, with annual inflation projected to ease to 8.6 percent in 2018, from 11 percent in 2017.

Domestic Economic Outlook.

Real Sector.

4. Economic recovery in the Gambia continues to gather strength evidenced by the rebound in tourism, construction activities, finance and insurance, trade, and telecommunication. The strong business confidence and prudent macroeconomic policies were also important contributors to growth during the period. The Gambia Bureau of Statistics (GBoS) estimated real GDP to have grown by 4.6 percent in 2017, higher than 0.4 percent in 2016. Growth is expected to remain robust in 2018 and the medium-term outlook is positive on the back of the continued implementation of sound macroeconomic policies and structural reforms.

External Sector.

5. Preliminary balance of payments estimates for the first nine months of 2018 indicate a wider current account deficit compared to the corresponding period of 2017, attributed largely to the sharp increase in imports which reflects increased economic activity.

6. The current account deficit is estimated to have widened to US$55.58 million in the first nine months of 2018 from a deficit of US$ 28.11 million a year ago. The services account balance surged to a surplus of US$52.23 million or 43.50 percent in the first nine months of 2018 from US$36.40 million in the same period last year. Performance in the services account is attributed, in the main, to the increase in travel income reflecting a robust start to the tourism season. Similarly, current transfers rose to US$136.68 million or by 20.46 percent.

7. The deficit in the goods account widened to US$252.64 million or 16.47 percent of GDP in the first nine months of 2018 from US$ 205.51 million in the corresponding period of 2017, due to the increase in imports.

8. The surplus in the capital and financial account improved to US$ 40.15 million in the first nine months of 2018 from a deficit of US$ 13.55 million in the same period a year ago. Gross international reserves are projected at 4 months of next year's imports of goods and services.

Exchange rate developments.

9. Activity in the foreign exchange market, measured by aggregate sales and purchases of foreign currency has picked up rapidly. In the year to End-October 2018, the volume of transactions in the domestic foreign exchange market totaled US$1.9 billion, higher than US$1.2 billion in the same period last year. The strong performance reflects improved supply conditions.

10. Purchases of foreign currency increased markedly by 50.7 percent to US$965.4 million as of End-October 2018 from US$640.4 million in the corresponding period in 2017. Similarly, sales of foreign currency, which indicates demand, increased significantly by 68.4 percent to US$963.3 million in the review period from US$572.2 million in the same period of 2017.

11. The exchange rate of the dalasi remains stable. From December 2017 to October 2018, the dalasi appreciated against the pound sterling by 0.2 percent but depreciated against the U.S. dollar and Euro by 3.7 percent and 0.3 percent respectively. In real effective exchange rate terms, however, the dalasi has appreciated. The exchange rate is expected to remain stable in the near to medium term, predicated on the continued implementation of sound macroeconomic policies, improved supply conditions, and confidence.

Government Fiscal Operations.

12. Preliminary government fiscal operations for the nine months to the end of September 2018 indicate total revenue and grants of D7.8 billion compared to D10.9 billion in the same period last year. Domestic revenue, comprising tax and non-tax revenues, rose by 16.0 percent to D6.7 billion.

13. Total expenditure and net lending declined to D10.7 billion or 19.1 percent reflecting mainly the marked drop in interest payments by 20.4 percent.

14. The budget balance (excluding grants) narrowed to a deficit of D4.0 billion in the nine months to End-September 2018 compared to a deficit of D7.5 billion in the corresponding period a year ago.

Domestic Debt.

15. The stock of domestic debt increased slightly to D29.66 billion (42.7 percent of GDP) as of End-October 2018 from D29.14 billion (42.0 percent of GDP) in the corresponding period a year ago. The stock of Treasury and Sukuk-Al Salaam bills increased by 0.96 percent to D17.14 billion during the period under review.

16. Yields on all Treasury bills increased. The 91- day, 182-day, and 364-day Treasury bills rates increased from 3.68 percent, 4.77 percent, and 6.34 percent in October 2017 to 4.97 percent, 6.83 percent, and 9.25 percent, respectively in October 2018.

17. As part of broader reforms of the monetary policy framework of the Bank, the Central Bank has started issuing its own bills for liquidity management beginning in October 2018. In addition, the Bank has also introduced the interest rate corridor comprising overnight lending and deposit facilities.

Banking Sector.

18. The banking sector remains fundamentally sound. The industry remains highly capitalized, liquid and profitable. The industry registered asset growth of 15.8 percent in the year to End-September 2018. The asset quality has also improved. Non-performing loan ratio stood at 4.7 percent, lower than the 5.9 percent reported at the previous MPC and 10.2 percent in the same period last year.

19. The risk-weighted capital adequacy ratio stood at 33.6 percent, significantly higher than the statutory requirement of 10 percent. The liquidity ratio was 98.48 percent in September 2018 and also remains well above the requirement of 30 percent.

Development in Monetary Aggregates.

20. As of End-September 2018, the money supply grew by 22.4 percent, higher than the 20.0 percent recorded a year earlier. The net foreign assets of the banking system expanded to D9.4 billion or by 33.1 percent during the period. The net foreign assets of the Central Bank and commercial banks increased to D3.8 billion and D5.6 billion or by 4.0 percent and 64.4 percent respectively.

21. The banking system's net domestic assets increased to D22.7 billion or 18.4 percent following a contraction of 6.7 percent at the end of September 2017. Claims on government, net, grew by 14.5 percent relative to a growth rate of 3.2 percent a year ago.

22. Private sector credit expanded by a robust 28.2 percent at the end of September 2018 compared to a contraction of 12.3 percent a year ago.

23. Reserve money growth slowed largely reflecting a decline in the Bank's net claims on the government. As of End-September 2018, reserve money grew by 11.8 percent, lower than the

29.3 percent recorded last year. Central Bank financing of fiscal deficit remains zero in November 2018.

Price Movements.

24. Inflation as measured by the National Consumer Price Index (NCPI) remained largely subdued. According to the latest release from the Gambia Bureau of Statistics (GBOS), inflation decelerated to 6.5 percent in October 2018 from 7.4 percent a year ago, thanks to the decline in consumer food inflation.

25. Food inflation, which is the main driver of headline inflation, decelerated to 6.5 percent in October 2018 from 7.9 percent last year. Price indices of all the components of the food basket declined with the exception of fruits and nuts. Non-food inflation, on the other hand, edged up slightly to 6.8 percent from 6.7 percent during the review period. The marginal increase in non-food inflation is attributed largely to the rise in price indices of housing, fuel and lighting, hotels and restaurants, transportation, health, furniture, and education.

Inflation Outlook.

26. The outlook for inflation is a further deceleration towards the Bank's medium-term target of 5 percent. This is premised on the following:

o The exchange rate of the dalasi is projected to remain broadly stable supported by improved confidence and supply conditions in the foreign exchange market.

o The Bank's Business Sentiment Survey indicated that inflation expectations are well anchored with the majority of respondents projecting a subdued inflationary environment.

o Pressures from global food prices are expected to remain mild.

o Monetary and fiscal policies will remain prudent and well-coordinated.

27. However, there are risks to the outlook:

o Global inflation is accelerating which may put upward pressure on the prices of imported goods.

o The rising interest rates in advanced economies and stronger U.S. dollar in the international market.

o Increase in domestic energy prices may affect inflation expectations.

Decision.

Taking the above factors into consideration, the Monetary Policy Committee has decided to keep the monetary policy rate unchanged at 13.5 percent.

The Committee also decided to maintain the overnight deposit rate at 2.0 percent.

Information Note

The next Monetary Policy Committee (MPC) meeting is scheduled for February 27, 2019. The meeting will be followed by the announcement of the policy decision on February 28, 2019."[17]

[17] Taken form the Central Bank of the Gambia website

3.0 Chapter Three: Does Monetary Policy Transparency Matter for Banking System Stability?

Abstract

Monetary policy transparency and its association with banking industry stability have not been comprehensively investigated in the literature, particularly now that most central banks are joining the bandwagon of being transparent and that more methodical central bank transparency datasets are becoming available. This study sets out to test this relationship decisively using newly constructed datasets from over 100 economies. I find robust evidence suggesting that monetary policy-related transparency is linked with stable banking systems. The evidence of this relationship is found to exist in both advanced and emerging countries. Further investigations, however, reveal that this relationship depends on how the banking system interprets each type of disclosure within the monetary policy transparency framework, to the effect that misinterpreted news from the central bank would yield unintended outcomes.

Keywords: Central bank transparency, banking system stability, monetary policy

3.1 Introduction

The recent two decades have seen a growing consensus among monetary policymakers that monetary policy transparency is essential for restraining uncertainty and anchoring inflation. Indeed, most studies support this idea. Sterne et al. (2002) argue that greater transparency is linked to restrained average inflation. Liu et al. (2008) conclude that more transparency enhances monetary policy effectiveness, and Dincer and Eichengreen (2014) show that transparency eases the volatility of inflation but has no effect on the persistence of inflation. Further, it is reported by De Mendonça and Galveas, (2013) that the transparency of central bank information is a key tool to guide public expectations and helps to keep inflation controlled. More recently, Weber (2018) found that transparency lowers inflation expectations and actual inflation, even after controlling for other factors and that the impact on inflation is mainly due to lowered inflation expectations and that central bank transparency seems to reduce inflation uncertainty. Moreover, Oikonomou (2021) reports that monetary policy transparency statistically and significantly affects inflation persistence. This notwithstanding, van der Cruijsen and Demertzis (2007) claim that monetary policy is more effective for central banks with minimal transparency and further show that openness benefits in correcting private sector inflation expectations whilst Hwang et al. (2020) demonstrate that the benefits of transparency in terms of private forecast accuracy are limited.

Is monetary policy transparency all about inflation and inflation expectations? How do banks get affected by the information acquired through the transparency of monetary policy in terms of their broader stability? While literature is in abundance examining the monetary policy transparency-inflation nexus, hitherto, little is known about how monetary policy transparency is associated with bank stability.

Clearer central bank decision guidelines would reduce market volatility and increase the predictability of future financial asset movements. Rafferty and Tomljanovich (2002) provide evidence to suggest that greater openness between US Federal Reserve policymakers and the public is associated with lower volatility in financial markets. This research expands on that great insight by utilizing newly constructed central bank transparency datasets from over 100 economies to examine how transparency of monetary policy is specifically associated with bank industry stability.

3.1.1 Research objectives

This study, therefore, intends to answer the following questions:

1. How monetary policy transparency is associated with bank industry stability?
2. To what extent do the effects of monetary policy transparency on banking system stability between advanced economies and emerging and developing economies differ?
3. To what extent do the type of information being divulged about monetary policy matter for the stability of the banking system?

3.1.2 Contribution to the existing literature

This is one of the early studies to comprehensively explore whether there could be some association between monetary policy transparency and banking industry stability using cross-country datasets from over 100 countries. Certainly, the studies previously have dwelled much on the link between transparency and inflation because central banks are more focused on inflation dynamics with little regard to how transparency is associated with soundness of banking industry. After the global financial crisis, central banks became more interested in financial system stability alongside price stability. Further, the central banks emphasized the need for transparent by enhancing communication to anchor inflation expectations. However,

it has not been well investigated how the enhanced availability of information following the improved transparency might have affected the stability of financial systems. The studies that have attempted to examine related relationships have neither looked at monetary policy transparency and stability relationship nor the effects of specific types of news being released by the central bank. This study attempts to fill this lacuna.

3.2 Literature Review

3.2.1 The Notion of Central Bank Transparency

Central banks' transparency is aimed at enhancing their accountability to earn credibility. Central banks must openly communicate their strategies and policy decisions to the public. Over the last two decades, transparency and accountability have become essential components of central bank operations worldwide. The majority of existing literature advocates for transparency in monetary policy and financial stability issues to benefit the economy (Jenkins, 2004; Horváth & Vaško, 2016; Blinder et al., 2017; Lustenberger & Rossi, 2018; Assenmacher et al., 2021; Dincer et al., 2022). According to Powell (2018), transparency helps restore and maintain public trust in the financial system. Other studies, on the other hand, find evidence that suggests that greater transparency may harm economic performance (Walsh, 2018; Dale et al., 2018; Neuenkirch, 2013; Chahrour, 2014) and they demonstrate that an abundance of information is detrimental as economic agents fail to coordinate signals effectively. This revelation in the literature suggests that transparency should perhaps be limited.

Monetary Policy Transparency

Monetary policy transparency is the degree to which the central bank discloses monetary policy-making processes to the public (Eijffinger & Geraats, 2006) . This type of transparency is the flawless flow of information between the central bank and the public

regarding monetary policy choices (Geraats, 2009). Dincer et al. (2022) find a wide range of levels of transparency based on economic development status. They find the gap in transparency between low-income and middle-income countries to be substantial. However, the discrepancy between countries within the middle-income bracket and those within the high-income bracket is trivial. Horváth and Vaško (2016) likewise find that high-income countries are more transparent than low-income countries.

Fry et al. (2000) employ a composite index of monetary policy explanations in their analysis of monetary policy transparency. The index is made up of three distinct types of explanations: (i) policy decision explanations, (ii) forecasts and forward-looking analysis explanations, and (iii) published assessments and research explanations. Geraats (2002) and Eijffinger and Geraats (2006) further present a comprehensive framework with five transparency dimensions corresponding to the degree of transparency at each stage of the policy-making process. They highlight the following key aspects and their ingredients: (i) Political transparency that includes a clear understanding of policy objectives such as policy goals, quantitative targets, and policy institutions, (ii) Economic transparency is concerned with the timely provision of economic information (iii) Procedural transparency is concerned with the process of making monetary policy decisions, including strategies (iv) Policy transparency assesses the stance of monetary policy announcements, including policy adjustments, explanations, and inclinations, and (v) Operational transparency examines policy execution, including control failures, shocks, and monetary policy outcomes. Ehrmann et al. (2010) commend the Eijffinger-Geraats Index as the most widely used measure of the transparency of central banks in the literature.

Computation of the index is by aggregating the subindices of the five transparency dimensions, each of which has three components. A subindex ranks from 0 to 3 based on responses to three equally weighted questions, each with a maximum score of 1 (Eijffinger &

Geraats, 2006). As a result, the total transparency index ranges from 0 to 15. Political, economic, and operational transparency reduces inflationary biases (Faust & Svensson, 2001); Geraats, 2005; Eijffinger & Geraats, 2006). Similarly, procedural transparency improves decision-making efficiency, and policy transparency influences effective interest rate-setting (Eijffinger & Geraats, 2006). Other studies criticize the Eijffinger-Geraats Index for being misleading because it is an equally weighted measure (Claussen, 2008).

Financial Stability Transparency (FST)

This is simply how transparent the authorities are, pertaining to financial stability issues in an economy. Most studies identify financial stability-related statements including financial stability reports as widely used channels for communicating information about financial stability policy (Sotomska-Krzysztofik & Szczepanska, 2006). Most FSRs are published in developed economies. For example, Horváth and Vaško (2016) show how the Swedish Riksbank as well as the Bank of England use FSRs as an early warning system to identify prospective threats in the financial system and communicate coping strategies. According to Born et al., (2014), high-quality FSRs have long-term effects on stock market yields and lessen financial market volatility.

Horváth and Vaško (2016) demonstrate the FST index by adapting Eijffinger and Geraats' five-dimension methodology. The FST index is a weighted average of 11 components: (i) clarity of financial stability goals, (ii) publication of FSRs, (iii) frequency of publication, (iv) forward-looking nature of FSRs, (v) coverage of FSRs, (vi) publication of stress test, (vii) financial soundness indicators, (viii) macro-prudential policy transparency, (ix) existence of financial stability committee, (x) existence of a financial stability webpage on the central banks' website, and (xi) existence of a financial stability speeches database.

Supervisory Transparency

Transparency of banking supervisory policies, like financial stability transparency, has long been less of an issue. However, Liedorp et al. (2013) demonstrate that central banks' communications about banking supervision are critical because (i) they increase the legitimacy of responsible authorities, (ii) they promote accountability of autonomous supervisors, (iii) they increase supervisor predictability, and (iv) they promote effective decision-making. Transparency of banking supervisors is now one of the core principles of most central banks worldwide. At the same time, there are strict limits on the amount of information that banking supervisors can reveal to the public when it involves individual financial institutions. For example, the European Banking Authority (EBA) has guidelines for supervisory transparency and regulations for European Union member countries (EBA, 2010). According to Liedorp et al., (2013), exposing the information of an independent financial institution Northern Rock Bank triggered a bank run in 2007.

Following the framework of Eijffinger and Geraats (2006) an index of supervision transparency was developed by Liedorp et al. (2013), to assess supervision transparency. The framework distinguishes policy, economic, political, procedural, and operational aspects of transparency as each corresponds to information disclosure at various stages of the supervisory process. The political aspect includes the objectives of banking supervision, goal prioritization, and institutional arrangements. Regular off-site financial reports of banks, risk scoring, and risk assessment are all part of the economic dimension. Procedural transparency includes the supervisory strategy, intervention strategy, and policy deliberations. Sanctions, prompt disclosure of sanctions, and non-sanction interventions are all part of policy transparency. Finally, operational transparency includes target reports, internal evaluation, and external evaluation.

3.2.2 The Effects of Central Bank Transparency

In the study by Van Duuren et al. (2020), a fixed-effects panel model is utilized to analyze FST in 110 countries where the dependent variable is the non-performing loan ratio representing the measure of financial stability. The Horváth and Vako (2016) index of FST is used as a measure of financial stability transparency index. The model accounted for GDP per capita, inflation , real interest rate, domestic debt to GDP ratio, exchange rate versus the US dollar, financial openness, and stock market capitalization to GDP. Corruption Perception Index (CPI) and Government Effectiveness Index (GE) were included as proxies for institutional quality. The results show that transparency and institutional quality promote financial stability.

Muñoz et al. (2012) investigate the effects of publishing FSRs on financial stability using the Heckman selection model. The selection equation simulates the central banks' decision to publish FSRs. The primary outcome equation assesses the empirical relationship between FSR publication and financial stability. They find that the publication of FSRs alone, has no direct impact on financial stability but higher-quality FSRs, on the other hand, were linked to financial stability. The clarity, coverage, and consistency of the FSRs were all evaluated to assess the quality of the reports. Similarly, the study shows that the publication of FSRs significantly impacts stock market volatility. The findings are consistent with those of Born et al. (2014), who investigate a related problem using an event study methodology.

In a similar study, Spyromitros and Tuysuz (2008) employ both fixed and random effects models to examine the effects of central bank transparency on a selection of macroeconomic indicators. They discover that higher central bank transparency reduces inflation rates and inflation expectations. These findings are consistent with those discovered by other researchers, such as Dincer and Eichengreen (2014). In addition, they show a negative correlation between the degree of transparency and the 5- and 10-year bond yields. Rafferty

and Tomljanovich (2002) examined the response of interest rates on short-term and long-term bonds to increased Federal Reserve transparency in the United States using the Vector-Autoregressive Method (VAR). According to the study, increased central bank transparency is associated with increased financial market efficiency and lower volatility. Higher levels of transparency were associated with lower interest rate volatility and high market certainty.

In a cross-country study, Weber (2018) examines the effects of the transparency of the central bank on the volatility of exchange rates using fixed effects regression. The study found that increased central bank transparency has a positive effect on exchange rate fluctuations in developed countries but a negative effect in developing countries. According to the findings, increased transparency has little effect on exchange rate volatility.

3.2.3 Summary of the literature and the Basis for this Study

Few conclusions can be formed from the literature presented. First, there are three flavors of central bank transparency: monetary policy transparency, financial stability transparency, and supervisory/regulatory transparency. Second, there is evidence in the literature that transparency is linked to exchange rate volatility, financial stability, interest rate volatility, inflation, and inflation expectations. Thirdly, the relationship between central bank transparency—particularly monetary policy transparency—and banking stability has not been widely examined. Moreover, and most significantly, past research has not demonstrated how various central bank monetary policy information disclosures influence the stability of the banking systems. In the literature, we found that there are various types of transparency, including political transparency, economic transparency, procedural transparency, policy transparency, and operational openness. It is crucial to investigate how the banking system interprets such disclosures. Lastly, past research has not investigated the effect of transparency on bank stability in developed, emerging, and developing economies. In addition to examining the relationship between monetary policy transparency and banking system stability, this study will also investigate if the impacts vary across different economic sizes and types of monetary policy transparency subcomponents.

3.3 Data and methodology

3.3.1 Data

The analysis includes cross-country data from 2000 to 2019 for developed, emerging, and developing economies. This study's dependent variables are two bank stability indicators: the bank-z-score and the ratio of nonperforming loans. The World Bank defines the Bank-z-score as a measure of a country's banking system's chance of default. The non-performing loans ratio is the ratio of non-performing loans to the total amount of loans extended over a given time. This information originates from the World Bank database. The study utilizes the recently developed monetary policy transparency index by Dincer et al. (2019) as a key independent variable. The index is composed of five equally weighted sub-components comprising political, economic, procedural, policy, and operational transparency. The overall index is equal to the sum of the scores obtained for each element. The index is available for the period 1998 to 2019. The benefit of this transparency index is that it focuses on monetary policy, as opposed to other central bank objectives. This allows this study to establish a clear link between the formulation of monetary policy, the transparency surrounding the formulation processes and its association with banking system stability.

The disaggregation of the transparency index reveals a broader spectrum of information disclosures. Since there is varying nature of disclosures within a monetary policy transparency framework, this study is interested in examining how each type of disclosure in this framework will be associated with the banking system stability. Therefore, the study sequentially uses each subcomponent of the index in the regression equations to examine the separate effects of each type of monetary policy disclosure on bank stability. Indeed, this approach also addresses concerns raised by Claussen (2008) who argued that the overall equally weighted monetary policy transparency index could be misleading.

Moreover, there is also an impression in the literature that suggests too much transparency could be detrimental to the economy to an extent that van der Cruijsen and Demertzis (2007) claim that monetary policy is more effective for central banks with minimal transparency and further evidence that suggests that greater transparency may harm economic performance. It is indeed demonstrated by Walsh (2018), Dale et al. (2018), Neuenkirch, 2013 and Chahrour (2014) that an abundance of information is detrimental as economic agents fail to coordinate signals effectively. This revelation in the literature suggests that transparency should perhaps be limited, after all. Well, these findings are interesting in theory but hard to implement in practice. For instance, how should a central bank know such optimal threshold level of transparency beyond which it becomes problematic to the economy? Moreover, the monetary policy transparency index is multifaceted: how does a central bank arrive at that "golden" optimal level of transparency? To extend the works of the previous studies and hopefully improve the practicality of implementation of the optimal level of transparency, this study hypothesizes that the monetary policy transparency index must have some components that have positive, negative and zero association with the banking system stability. While it is beneficial to know that "too much" of transparency could be problematic, it will be equally useful to know elements of transparency that could be problematic and the ones that are beneficial. This is the reason this study attempts to estimate how each of the components of monetary policy transparency index described in table 3.1 is associated with banking system stability.

Table 3. 1 : Components of Monetary Policy Transparency Index

Component	Description
Political transparency	Whether the central bank discloses explicitly monetary policy objectives or not. Scoring is based on whether there is: (a) Formal disclosure of monetary policy objectives with clear prioritization of the policy goals. (b) Quantification of the key monetary policy goal. (c) Explicit institutional contracts for monetary policy.
Economic Transparency	Scoring is based on whether there is: (a) Release of current economic data for the conduct of monetary policy such as money supply, inflation, GDP growth, output gap, and interest rates. (b) A published macro-economic model for use in monetary policy. (c) Regular publication of macroeconomic forecasts.
Procedural Transparency	Scoring is based on whether there is: (a) Explicit announcement of policy rules. (b) Provision of a comprehensive account of monetary policy deliberations. (c) Disclosure of how each decision was reached/voting records.
Policy Transparency	Scoring is based on whether there is: (a) A prompt announcement of policy instruments/target adjustment. (b) An explanation of when policy decisions are announced. (c) Disclosure of forward guidance.
Operational Transparency	It is about the implementation of monetary policy actions by the central bank (a) Whether the central bank considers the degree to which monetary policy operating objectives have been met. (b) Whether the central bank provides information about risks to the achievement of the objectives. (c) Whether the central bank is accountable and evaluates the policy outcomes benchmarked on the set objectives.

Notes. Summarized by the author from Dincer, Eichengreen, and Geraats (2019). When a component is completely not achieved, it is assigned a score of 0, the partial achievement is assigned 1/2, and the full and satisfactory achievement of a component is assigned 1. A total index is simply the sum of all the scores from the 15 subcomponents with possible minimum score=0 and possible maximum score=15.

Control Variables

The control variables used in the study include real GDP, inflation, exchange rates measured by domestic currency per US dollar, money supply-GDP ratio, policy rate, level of

democratization and political stability. The use of these variables as control variables is well documented in the literature, for example, Horváth and Vaško (2016).

3.3.2 Methodology

The study utilizes the fixed effects models following Spyromitros and Tuysuz (2008); Weber (2018) and Van Duuren et al. (2020). The following model is estimated:

$$y_{it} = \vartheta_i + \tau_t + \varphi_2 x_{it} + \sum_{j=1}^{k} \beta_i \, Control_{it} + \varepsilon_{it}$$

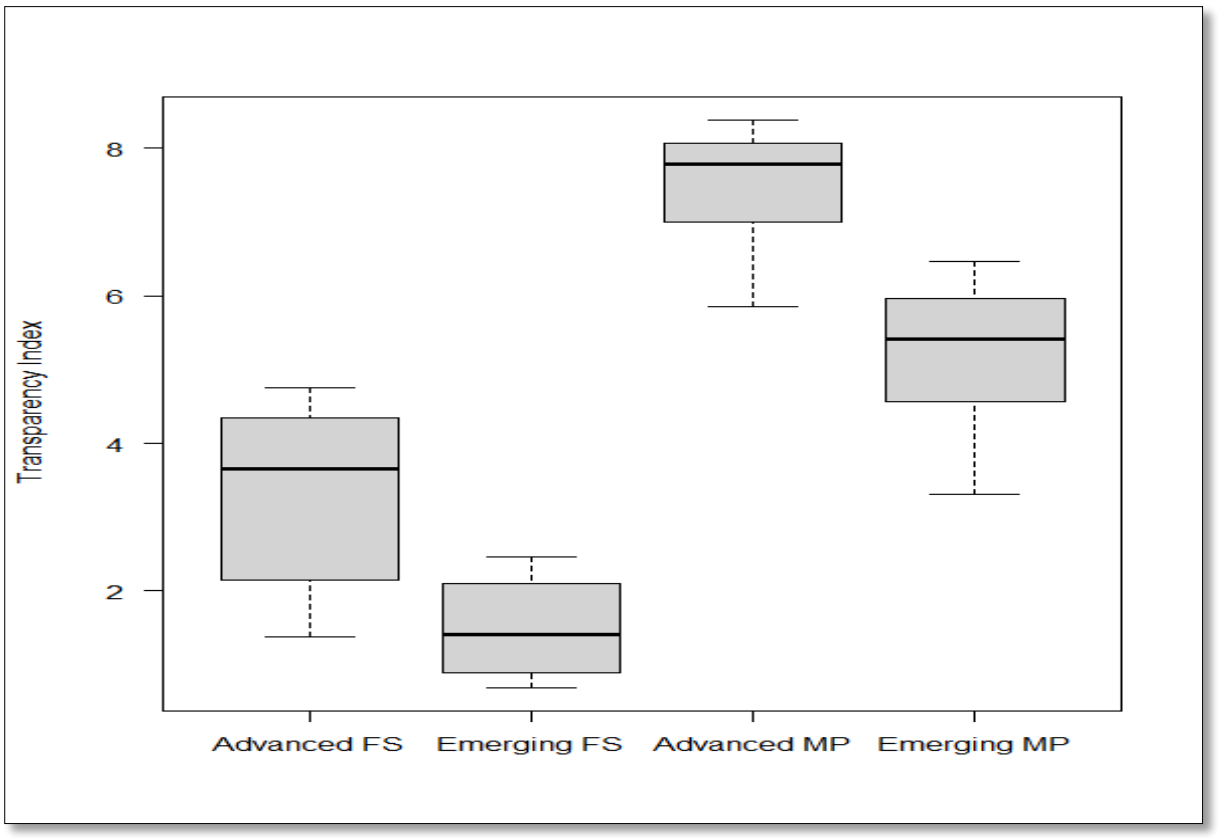
Where y_{it} is a dependent variable which is the banking industry stability indicator for economy i and time t; x_{it} is the central bank transparency index, either the monetary policy transparency index or its subcomponents, for country i and time t. $Control_{it}$ is a set of k macroeconomic variables such as real GDP, inflation, exchange rates measured by domestic currency per US dollar, money supply-GDP ratio, policy rate, level of democratization and political stability. The $\vartheta_i \; and \; \tau_t$ are fixed and trend effects variables respectively while ε_{it} is the error term. As a way of robustness checks, the study employs central bank independence and level of authoritarianism as instruments for monetary policy transparency in an economy.

3.4 Results

3.4.1 Descriptive Statistics

From the boxplots in figure 3.1, the advanced economies as classified by the World Bank have higher median of both monetary policy and financial stability index suggesting that advanced countries are on average more transparent, in terms of their monetary policy and financial stability processes, than emerging economies. It is not surprising therefore that Figure A3 in the appendix is suggesting that advanced economies have a more stable banking sector compared to emerging and developing economies based on both NPL-ratio and Bank-z-score. This provides some anecdotal evidence to suggest that transparency could be associated with banking system stability.

Figure 3. 1: Central Bank Transparency Boxplots

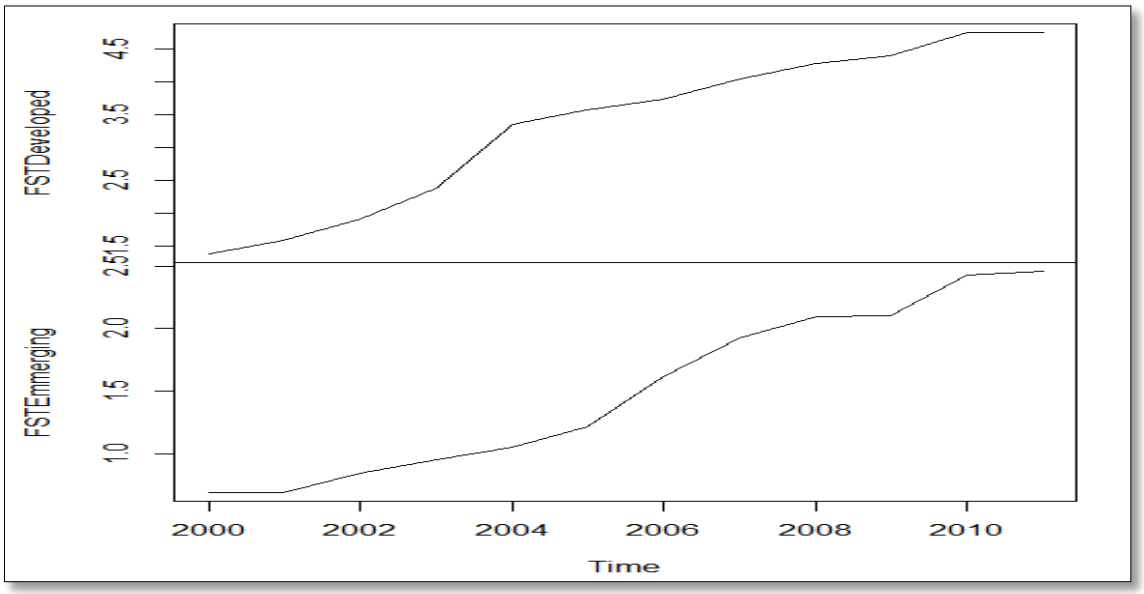


Notes. FS=Financial stability, MP=Monetary Policy, Advanced=Advanced Economies, Emerging=Emerging and developing countries

Figure 3.2 suggests that over time, both monetary policy and financial stability indices have been rising both for developed and emerging economies. This may suggest that on average, central banks have improved their transparency levels. This could be due to the realization by the central banks of the importance of being transparent vis-à-vis monetary policy and financial stability. Moreover, figure 3.2 also suggests that the trend was not seriously impaired by the 2008-2009 global financial crisis. Figure A4 in the appendix also show that, over time, the banking sectors have on average become stable based on both bank z-scores and NPLs-loans ratio.

Figure 3. 2: Central Bank Transparency Index Trends

(a) Financial Stability Transparency Index



(b) Monetary Policy Transparency Index

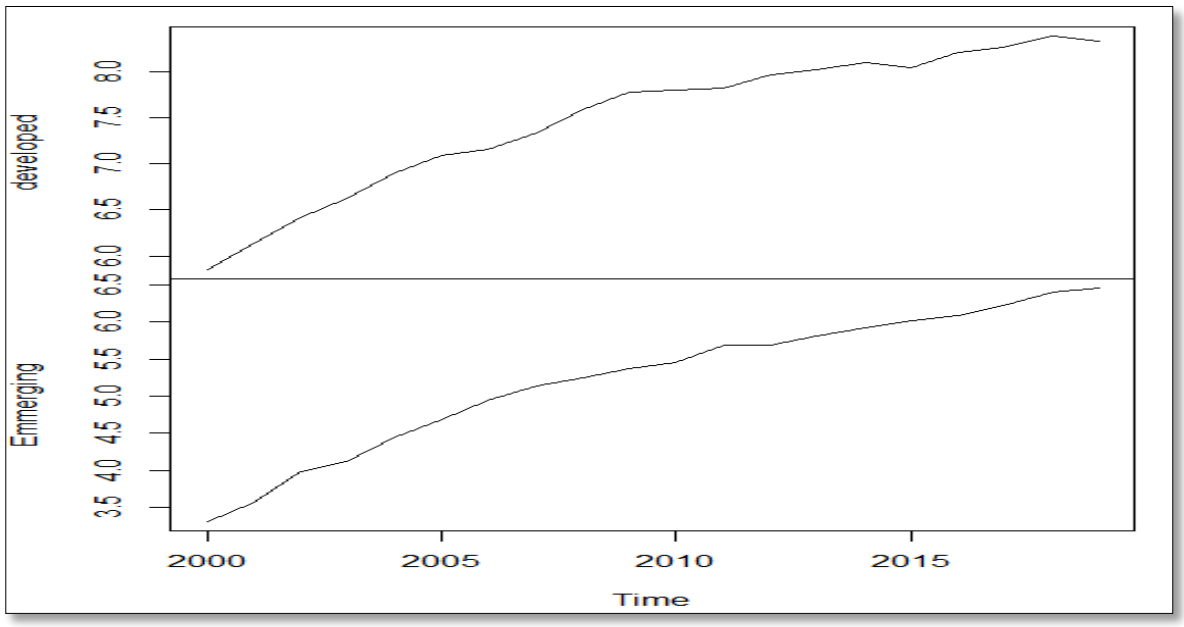


Table 3.2 presents the summary statistics of all key variables used in this study. Since the data is from various sources, the number of observations varies per variable. Nevertheless, the overlapping periods across the variables provide large enough datasets for this analysis. Moreover, this analysis covers over 100 countries from which data is sourced. The summary statistics for advanced and emerging economies are also compiled in separate tables and are deposited in the appendix table A2 and A3.

Table 3. 2 : Summary Statistics

Variable Name	Observations	Mean	Std. Dev	Min	Max
Bank-z-score	3103	16.30	9.84	-1.84	142.60
NPLs ratio	2347	7.15	7.62	0.00	74.10
MP Transparency Index	2376	5.75	3.17	1.00	14.50
Political transparency	2376	2.16	0.72	1.00	3.00
Economic Transparency	2376	0.70	0.86	0.00	3.00
Procedural Transparency	2376	0.92	0.75	0.00	3.00
Policy Transparency	2376	0.80	0.98	0.00	3.00
Operational Transparency	2376	1.18	0.73	0.00	3.00
Log GDP	3817	22.10	3.43	12.70	32.32
Log CPI	6292	3.82	2.16	-25.92	8.12
Log FX rate	6771	2.57	3.40	-24.68	15.40
Log M2	5731	3.70	0.69	1.05	6.11
Policy rate	1844	8.37	10.45	-0.75	183.20
Democracy Index	5629	4.92	4.07	0.00	10.00
CB Independence	5051	0.56	0.18	0.10	0.93
Political Stability Index	4371	-0.03	1.00	-3.31	1.97

Notes. Computed using data sources from different sources. Bank Z-score and NPLs, are sourced from World Bank Financial Development Database; Democracy is sourced from the Polity IV database, CB Independence Index is from Romelli,(2022), Political Stability is from World Bank's Governance indicators database and Monetary policy transparency index is from Dincer et al. (2022).

3.4.2 Estimations

This section summarizes the econometric findings of the study about the effects of monetary policy transparency on banking stability. As noted previously, the stability of the banking industry is determined by bank-z-score and non-performing loan-to-asset ratios. The bank-z-score is represented as a logarithm.

Monetary Policy Transparency and Financial Stability: Bank-Z-Score

The use of bank-z-score as a measure of banking stability is commonly used in the literature (for example, Karim et al. 2018; Zhou & Tewari, 2019, Nguyen & Du, 2022; Agoraki et al. 2022). A larger value implies lower overall bank risk. To ease interpretation, the score is multiplied by -1. Table 3.3 populates results for monetary policy transparency and financial stability as measured by the bank-z-score. The results suggest that a higher level of monetary policy transparency is associated with better stability outcomes. Specifically, table 3.3 suggest that a 1 unit change in monetary policy transparency index is associated with [1.8 - 3.6] percent decline in the default probability of the banking system. The outcome is consistent with Horváth & Vaško (2016) who found that central banks that have clear guidelines for their monetary policy also have clear guidelines for how they will ensure the stability of the financial system.

Table 3. 3 : Monetary Policy Transparency and Financial Stability

VARIABLES	(1) bank z-score	(2) bank z-score	(3) bank z-score
MP Transparency	-0.0176**	-0.0359***	-0.0317***
	(0.0076)	(0.0098)	(0.0104)
Log GDP	0.0797*	-0.0516	-0.0122
	(0.0464)	(0.0625)	(0.0679)
Log CPI	-0.1621***	-0.1130	-0.0195
	(0.0575)	(0.0831)	(0.0869)
Log FX rate	0.0675	0.1037*	0.0648
	(0.0433)	(0.0573)	(0.0600)
M2/GDP	0.0953**	0.3154***	0.1864**
	(0.0461)	(0.0794)	(0.0856)
Policy Rate		-0.0005	-0.0018
		(0.0014)	(0.0013)
Democracy			0.0364***
			(0.0088)
Political Stability			-0.0704*
			(0.0400)
Constant	-4.2092***	-2.1068*	-3.1073**
	(0.9488)	(1.2626)	(1.3877)
Observations	1,175	770	658
R-squared	0.0223	0.0454	0.0533
Number of count_num	72	50	47
Country FE	YES	YES	YES
Year FE	YES	YES	YES

Notes: The dependent variable is Bank z score. It measures a country's financial system's default likelihood. Z-score contrasts a country's banking buffer (capitalization and returns) with return volatility. It's calculated as (ROA+(equity/assets))/sd(ROA) for country-years with at least 5 bank-level observations. a larger value implies lower overall bank risk. ROA, equity, and assets are national averages. Calculated from Bankscope and Orbis data. A country-year with fewer than 3 bank-level observations is not reported. Control variables include GDP, exchange rate, inflation, monetary policy rate and quality of institutions. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The study further explored whether the relationship between the monetary policy transparency and banking system stability vary depending on whether environment is in advanced markets or emerging markets[18]. The sample was therefore split between advanced economies and emerging economies. The assumption underlying this approach is that the speed at which banking system in developing markets process information made available by the transparent central bank would differ from advanced markets. The results summarized in table

[18] In this analysis, "Emerging market" is used in loose sense here, it also includes developing economies for simplicity.

3.4 suggest that the relationship is robust for advanced economies and weaker for emerging economies when more factors are considered in the analysis. Specifically, a unit change in the monetary policy transparency index is associated with about 5 percent reduction in default risk of the banking system in advanced economies and about 3 percent for emerging economies. The association between monetary policy transparency and banking stability is however not robust for emerging economies sample particularly when more control variables are considered.

Table 3. 4: Monetary Policy Transparency and Stability: Advanced and Emerging Economies

	Advanced Economies		Emerging & Developing Economies	
	(1)	(2)	(3)	(4)
VARIABLES	bank z-score	bank z-score	bank z-score	bank z-score
MP Transparency	-0.0581***	-0.0510**	-0.0309**	-0.0139
	(0.0134)	(0.0248)	(0.0136)	(0.0128)
Log GDP	0.1529	-0.7377**	-0.0419	0.0565
	(0.1232)	(0.2928)	(0.07)	(0.0693)
Log CPI	-0.0237	0.8806**	-0.2457***	-0.1615*
	(0.1987)	(0.4015)	(0.0938)	(0.0891)
Log FX rate	-0.1678*	-0.1585	0.1679**	0.1092
	(0.0965)	(0.137)	(0.0702)	(0.0667)
M2/GDP	-0.1961**	0.2132	0.5152***	0.3043***
	(0.0981)	(0.1808)	(0.1038)	(0.1034)
Policy Rate		0.0175	-0.0012	-0.0022*
		(0.0124)	(0.0014)	(0.0013)
Democracy		0.0396		0.0391***
		(0.0604)		(0.0083)
Political Stability		0.1564		-0.1229***
		(0.1096)		(0.0417)
Observations	430	222	446	407
R-squared	0.112	0.1287	0.0722	0.1074
Countries	26	16	30	30
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Notes: The dependent variable is Bank-z-score. It measures a country's financial system's default likelihood. Z-score contrasts a country's banking buffer (capitalization and returns) with return volatility. It's calculated as (ROA+(equity/assets))/sd(ROA) for country-years with at least 5 bank-level observations. A larger value implies lower overall bank risk. ROA, equity, and assets are national averages. Calculated from Bankscope and Orbis data. A country-year with fewer than 3 bank-level observations is not reported. Control variables include GDP, exchange rate, inflation, monetary policy rate and quality of institutions. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

When the central banks are generally transparent about their monetary policy, they may reduce the uncertainty about the economic performance, for example about inflation, exchange rate and output. Since most central banks' monetary policy communication are dominated by positive news, usually accompanied by minimal remarks about downside risks to the positive narratives, there is higher likelihood for the transparent central banks (central banks that communicate more) to instill confidence in the economy in general.

Table 3. 5: Transparency and Stability by type of transparency-Full sample

VARIABLES	(1) bank z-score	(2) bank z-score	(3) bank z-score	(4) bank z-score	(5) bank z-score
Political transparency	0.1319**				
	(0.0641)				
Economic Transparency		0.022			
		(0.0314)			
Procedural Transparency			-0.0753***		
			(0.029)		
Policy Transparency				-0.0203	
				(0.0225)	
Operational Transparency					0.0475
					(0.0369)
Controls	YES	YES	YES	YES	YES
Observations	585	585	585	585	585
R-squared	0.1956	0.1898	0.1995	0.1903	0.1916
Countries	44	44	44	44	44
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Notes: The dependent variable is bank z-score. The key explanatory variables are forms of central bank monetary policy disclosures (transparency) as defined in table 3.1. Control variables include GDP, exchange rate, inflation, monetary policy rate and quality of institutions *** p<0.01, ** p<0.05, * p<0.1.

Table 3.5 summarizes the results for the effects of each type of monetary policy disclosure in the monetary policy transparency index. It is found that the increase in procedural transparency is associated with a reduction in the default risk of the banking system. This is not surprising. The procedural transparency entails the explicit announcement of the policy rule, a

comprehensive account of monetary policy deliberations and disclosure of how each decision was arrived at. The announcement about these items by the central bank prepares the market on what to expect each time the monetary policy committee is meeting since the market is clear about the decision rules. The policy transparency that entails the announcement of policy guidance has the correct sign but is not significant. Economic transparency and operational transparency are not significant. The political transparency coefficient has, however, a positive sign.

Table 3. 6 : Transparency and Stability in Advanced Economies by Disclosure Type

	Advanced Economies					Emerging and Developing Economies				
VARIABLES	(1) bank z-score	(2) bank z-score	(3) bank z-score	(4) bank z-score	(5) bank z-score	(6) bank z-score	(7) bank z-score	(8) bank z-score	(9) bank z-score	(10) bank z-score
Political transparency	0.053					0.1111				
	(0.177)					(0.069)				
Economic Transparency		-0.172**					0.082**			
		(0.066)					(0.037)			
Procedural Transparency			-0.068					-0.106**		
			(0.049)					(0.042)		
Policy Transparency				-0.084*					-0.016	
				(0.045)					(0.027	
Operational Transparency					-0.051					0.078**
					(0.099)					(0.038)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	222	222	222	222	222	363	363	363	363	363
R-squared	0.2024	0.2311	0.2104	0.2175	0.2032	0.2691	0.2745	0.278	0.2638	0.2728
Countries	16	16	16	16	16	28	28	28	28	28
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: The dependent variable is bank z-score. The key explanatory variables are forms of central bank monetary policy disclosures as defined in table 1. Control variables include GDP, exchange rate, inflation, monetary policy rate and quality of institutions *** p<0.01, ** p<0.05, * p<0.1

The sample is then split into two groups: advanced and emerging economies and the results are reported in table 3.6 to examine the relationships according to income groups of countries. Policy transparency and economic transparency have expected negative signs and significant while procedural transparency has the expected sign but insignificant for advanced economies. Procedural transparency has again an expected sign and significant for emerging markets. It is timely to mention that the relationship might be positive or negative depending on how the

market (economic agents) processes and interprets the information. The same signal might be interpreted differently by the banking system and yield different results. In pursuit of being transparent, monetary policy authorities need to be clear in their communication to avoid being misinterpreted and getting unintended outcomes.

Monetary Policy Transparency and Financial Stability: NPL-Asset Ratios

Horváth and Vaško (2016) used NPLs-loan ratios as a measure of financial (in)stability in a similar study. This study uses this measure as well for three reasons. Firstly, their study examined the relationship between financial stability transparency and financial stability and therefore it will be interesting to know how monetary policy transparency feeds into the stability of the banking system. Secondly, this analysis will be a robustness check to the preceding results in this study when bank-z-score is used. Thirdly, this study will conduct an analysis by income groups as well as disclosure type of monetary policy. The results based on the split sample for advanced and emerging economies are populated in table 3.7 and results for different disclosures within the monetary policy transparency framework are summarized in tables 3.8 and 3.9.

Table 3. 7: Transparency and Stability-Advanced and Emerging Economies

Advanced Economies				Emerging Economies		
	(1)	(2)	(3)	(5)	(6)	(8)
VARIABLES	NPLs-ratio	NPLs-ratio	NPLs-ratio	NPLs-ratio	NPLs-ratio	NPLs-ratio
MP Transparency Index	-0.003**	-0.005**	-0.007***	-0.007***	-0.001	-0.006**
	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Log GDP	-0.145***	-0.150***	-0.166***	-0.115***	-0.117***	-0.213***
	(0.014)	(0.016)	(0.022)	(0.019)	(0.022)	(0.031)
Log CPI	0.131***	0.191***	0.232***	-0.024	-0.021	-0.009
	(0.017)	(0.025)	(0.031)	(0.017)	(0.020)	(0.025)
Log FX rate	0.023**	0.025**	0.021*	0.061***	0.049***	0.046**
	(0.009)	(0.010)	(0.012)	(0.013)	(0.015)	(0.020)
M2/GDP	0.0117	0.0047	-0.008	0.0427**	0.0355	0.014
	(0.010)	(0.012)	(0.013)	(0.017)	(0.024)	(0.025)
Policy Rate		0.0022***	0.0018*		0.000	-0.0009***
		(0.0008)	(0.0009)		(0.0003)	(0.0003)
Democracy			0.0172***			0.0015
			(0.0049)			(0.002)
Political Stability			-0.0263***			0.0292***
			(0.010)			(0.010)
Observations	435	330	266	638	372	342
R-squared	0.3227	0.3562	0.432	0.2455	0.2038	0.3781
Countries	25	19	17	44	26	26
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Notes: The dependent variable is the ratio of non-performing loans to total loans. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Again, consistent with results above, monetary policy transparency is associated with decline in the banking stability for both advanced and emerging economies even when different measure of stability (NPLs-loans ratio) is used. The results are robust when more control variables are considered. Furthermore, table 3.8 shows that procedural transparency has stability-improving effects on the banking system. The positive coefficients for policy transparency are shown in both table 3.8 and 3.9.

Table 3. 8 : Monetary Policy Transparency and Financial Stability-Full sample by Transparency type

VARIABLES	(1) NPLs-ratio	(2) NPLs-ratio	(3) NPLs-ratio	(4) NPLs-ratio	(5) NPLs-ratio
Political transparency	0.0168				
	(0.0106)				
Economic Transparency		-0.0031			
		(0.0048)			
Procedural Transparency			-0.0144***		
			(0.0047)		
Policy Transparency				0.0067*	
				(0.0037)	
Operational Transparency					-0.0054
					(0.006)
Controls	YES	YES	YES	YES	YES
Observations	551	551	551	551	551
R-squared	0.2553	0.2521	0.266	0.2565	0.2527
Countries	41	41	41	41	41
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Notes: The dependent variable is the ratio of non-performing loans to total loans. The key explanatory variables are forms of central bank monetary policy disclosures as defined in table 1. Control variables include GDP, exchange rate, inflation, monetary policy rate and quality of institutions *** p<0.01, ** p<0.05, * p<0.1

Table 3. 9: Transparency and Stability-Advanced and Emerging Economies by Monetary Policy Disclosures

	Advanced Economies					Emerging & Developing Economies				
VARIABLES	(1) NPLs-ratio	(2) NPLs-ratio	(3) NPLs-ratio	(4) NPLs-ratio	(5) NPLs-ratio	(1) NPLs-ratio	(2) NPLs-ratio	(3) NPLs-ratio	(4) NPLs-ratio	(5) NPLs-ratio
Political transparency	0.024**					0.0021				
	(0.012)					(0.016)				
Economic Transparency		-0.031***					-0.0039			
		(0.005)					(0.0076)			
Procedural Transparency			-0.006					-0.038***		
			(0.004)					(0.0082)		
Policy Transparency				0.002					0.012*	
				(0.004)					(0.006)	
Operational Transparency					-0.002					-0.008
					(0.007)					(0.0083)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	238	238	238	238	238	313	313	313	313	313
R-squared	0.589	0.653	0.5846	0.5805	0.5801	0.275	0.2757	0.3303	0.2848	0.2772
Countries	16	16	16	16	16	25	25	25	25	25
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: The dependent variable is the ratio of non-performing loans to total loans. The key explanatory variables are forms of central bank monetary policy disclosures as defined in table 1. Control variables include GDP, exchange rate, inflation, monetary policy rate and quality of institutions *** p<0.01, ** p<0.05, * p<0.1.

3.4.3 Robustness Checks

While the literature suggests that fixed effects estimations may handle some endogeneity issues in panel estimations, this study further employs the instrumental variables techniques to ascertain the results presented above. I use the central bank independence and level of authoritarianism as instruments for monetary policy transparency variable. The justification for using these instrumental variables emanates from the assumption that a central bank's level of transparency is highly associated with whether it is independent or not. This study assumes that an independent central bank will not face interference from any other authority and hence it is expected to be open about its policy objectives, information about the procedures in the conduct of monetary policy, how a monetary policy decision is arrived at and prompt announcements of the decisions regardless of its taste. Indeed, the independence of a central bank alone—without the manifestation of such independence through transparency and other channels—would not be useful enough. I also assume that less authoritarian political regimes will allow central banks to exercise better autonomy in making all the important announcements than otherwise. Table 3.10 presents results for instrumental variables regressions.

Table 3.10 presents results for the bank-z-score regressions for bank stability. The results are qualitatively the same as found above, when fixed effects regressions were used with expected signs of the coefficients and significance at least at 5%. The Cragg-Donald Wald F statistic suggests a minimal bias of less than 10% for all the models. However, the Sargan test suggests a plausible choice of instruments only in model (5) when all the control variables are used.

Table 3. 10: Instrumental Variables for Bank Z-Score Regressions

	(1)	(2)	(3)	(4)	(5)
VARIABLES	bank z-score	bank z-score	bank z-score	bank z-score	bank z-score
MP Transparency	-0.646***	-0.610***	-0.939***	-1.580***	-1.548***
	(0.189)	(0.186)	(0.223)	(0.229)	(0.309)
Log of Real GDP	-0.581***	-0.663***	-0.328	-0.793***	-1.424***
	(0.128)	(0.126)	(0.267)	(0.263)	(0.306)
Inflation		3.897***	4.729***	2.719**	2.216
		(1.167)	(1.208)	(1.186)	(1.524)
Exchange rate			-0.364	0.243	0.486
			(0.280)	(0.277)	(0.338)
M2/GDP				6.446***	7.900***
				(0.626)	(0.929)
Policy rate					0.00400
					(0.0452)
Constant	34.24***	18.43***	10.17	7.711	19.18**
	(2.826)	(5.497)	(7.659)	(7.472)	(9.666)
Sargan statistic	0.0000	0.0000	0.0000	0.0120	0.1604
Cragg-Donald Wald					
F statistic	198.222	234.643	218.448	194.877	131.001
Observations	900	879	879	867	603
R-squared	0.036	0.062	0.045	0.100	0.180

Notes: Null hypothesis for Sargan test is that the over-identifying restrictions are valid. The null hypothesis for Cragg-Donald Wald F statistic is that the maximum relative bias due to weak instruments is greater than 10%. This test is conducted against the Stock-Yogo weak ID test critical values. The critical value for 10% relative bias is 19.93. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

3.5 Conclusion

Four important findings are drawn from this study. Firstly, the study establishes that monetary policy transparency is not only beneficial for inflation and inflation expectations management, but it finds that it has generally stability-enhancing effects in the banking sector. Secondly, the study finds that monetary policy transparency has such effects regardless of whether the transparent central bank is in an advanced or emerging economy. Thirdly the market is not able to consistently interpret the monetary policy information laid bare by the central bank or the central banks give confusing messages in their quest for transparency. This is evident in the conflicting signs of coefficients sign of different central bank disclosures in the transparency spectrum. Finally, the results show that overtime, the banking sectors have, on average become stable based on both Bank-z-score and NPLs-loans ratio which coincides with the improvement in monetary policy transparency overtime. Nevertheless, the overall effect of transparency is still stability-enhancing. The results are robust when the monetary policy transparency index is instrumented with central bank independence and level of authoritarianism.

The implications of these findings are twofold: Firstly, while monetary policy transparency has primarily been viewed as a tool for achieving effective monetary policy, this study provides an avenue to consider transparency as having spillover effects on the banking sector particularly in enhancing banking stability. Secondly, the importance of central bank transparency on banking stability is not absolute: it depends on how the markets interpret the information available. This suggests that while the central banks might be transparent in various aspects of monetary policy operations, the monetary authorities have little influence on how the banking system will interpret the information available.

What should central banks do? In their pursuit of being transparent, monetary

authorities need to be careful with the information they are disseminating to avoid being misinterpreted and causing unnecessary volatility in the market. This study argues that apart from the findings of Horváth and Vaško (2016) which argue that too much transparency could be detrimental to the stability of the banking system, the type of information made available and how such information is processed and interpreted by the market matter for the stability of the financial system.

Further research would consider introducing this monetary policy index into a country-level DSGE-type model, to simulate how monetary policy transparency changes would affect different macroeconomic variables and forecasts. Now that the data is available for most countries, implementing this in such a framework, would be a feasible exercise.

References

Agoraki, M.-E. K., Aslanidis, N., & Kouretas, G. P. (2022). U.S. banks' lending, financial stability, and text-based sentiment analysis. *Journal of Economic Behavior & Organization*, *197*, 73–90. https://doi.org/10.1016/j.jebo.2022.02.025

Arnone, M., Darbar, S. M., & Gambini, A. (2007). *Banking Supervision: Quality and Governance*.

Assenmacher, K., Glöckler, G., Holton, S., Trautmann, P., Ioannou, D., Mee, S., Bakk-Simon, K., Bergbauer, S., Catenaro, M., & Charalampakis, E. (2021). *Clear, consistent and engaging: ECB monetary policy communication in a changing world*.

Blinder, A., Ehrmann, M., De Haan, J., & Jansen, D.-J. (2017). Necessity as the mother of invention: Monetary policy after the crisis. *Economic Policy*, *32*(92), 707–755.

Born, B., Ehrmann, M., & Fratzscher, M. (2014). Central Bank Communication on Financial Stability. *The Economic Journal*, *124*(577), 701–734. https://doi.org/10.1111/ecoj.12039

Chahrour, R. (2014). Public communication and information acquisition. *American Economic Journal: Macroeconomics*, *6*(3), 73–101.

Claussen, C. A. (2008). *Comparing monetary policy transparency. The Eijffinger and Geraats index-a comment* (No. 8275534712). Staff Memo.

Dale, S., Orphanides, A., & Österholm, P. (2018). Imperfect central bank communication: Information versus distraction. *25th Issue (June 2011) of the International Journal of Central Banking*.

de Mendonça, H. F., & de Siqueira Galveas, K. A. (2013). Transparency and inflation: What is the effect on the Brazilian economy? *Economic Systems*, *37*(1), 69–80. https://doi.org/10.1016/j.ecosys.2012.06.003

Dincer, N., Eichengreen, B., & Geraats, P. (2022). Trends in Monetary Policy Transparency: Further Updates. *International Journal of Central Banking*, *18*(1), 18.

Dincer, N. N., & Eichengreen, B. (2014). Central bank transparency and independence: Updates and new measures. *Int J Cent Bank*, *10*.

Ehrmann, M., Fratzscher, M., & Born, B. (2010). *Macroprudential policy and central bank communication*.

Eijffinger, S. C., & Geraats, P. M. (2006). How transparent are central banks? *European Journal of Political Economy*, *22*(1), 1–21.

Faust, J., & Svensson, L. E. (2001). Transparency and credibility: Monetary policy with unobservable goals. *International Economic Review*, *42*(2), 369–397.

Geraats, P. M. (2002). Central bank transparency. *The Economic Journal*, *112*(483), F532–F565.

Geraats, P. M. (2005). Transparency and reputation: The publication of central bank forecasts. *Topics in Macroeconomics*, *5*(1).

Geraats, P. M. (2009). Trends in Monetary Policy Transparency. *International Finance*, *12*(2), 235–268. https://doi.org/10.1111/j.1468-2362.2009.01239.x

Horváth, R., & Vaško, D. (2016). Central bank transparency and financial stability. *Journal of Financial Stability*, *22*, 45–56. https://doi.org/10.1016/j.jfs.2015.12.003

Hwang, I. D., Lustenberger, T., & Rossi, E. (2020). *Does Communication Influence Executives' Opinion of Central Bank Policy?*

Jenkins, P. (2004). *Communication: A vital tool in the implementation of monetary policy*. Remarks to the FMAC/FMA-USA Joint Conference.

Karim, N. A., Alhabshi, S. M. S. J., Kassim, S., & Haron, R. (2018). Measuring Bank Stability: A Comparative Analysis Between Islamic and Conventional Banks in Malaysia. In F. Noordin, A. K. Othman, & E. S. Kassim (Eds.), *Proceedings of the 2nd Advances in Business Research International Conference* (pp. 169–177). Springer. https://doi.org/10.1007/978-981-10-6053-3_16

Kohn, D. (1 C.E., November 30). Enhancing Financial Stability: The Role of Transparency. *Brookings*. https://www.brookings.edu/on-the-record/enhancing-financial-stability-the-role-of-transparency/

Liedorp, F., Mosch, R., van der Cruijsen, C., & de Haan, J. (2013). Transparency of Banking Supervisors. *IMF Economic Review*, *61*(2), 310–335. https://doi.org/10.1057/imfer.2013.11

Liu, M.-H., Margaritis, D., & Tourani-Rad, A. (2008). Monetary policy transparency and pass-through of retail interest rates. *Journal of Banking & Finance*, *32*(4), 501–511. https://doi.org/10.1016/j.jbankfin.2007.06.012

Lustenberger, T., & Rossi, E. (2018). *Does central bank transparency and communication affect financial and macroeconomic forecasts?* WWZ Working Paper.

Maxwell Fry, D. J., Lavan Mahadeva, S. R., & Sterne, G. (2000). Key issues in the choice of monetary policy framework. *Monetary Policy Frameworks in a Global Context*, *2*.

Muñoz, M. S., Jahjah, M. S., Cihak, M. M., Sharifuddin, M. S. T., & Tintchev, M. K. (2012). *Financial Stability Reports: What Are They Good For?* International Monetary Fund.

Neuenkirch, M. (2013). Central bank transparency and financial market expectations: The case of emerging markets. *Economic Systems*, *37*(4), 598–609.

Nguyen, T. D., & Du, Q. L. T. (2022). The effect of financial inclusion on bank stability: Evidence from ASEAN. *Cogent Economics & Finance*, *10*(1), 2040126. https://doi.org/10.1080/23322039.2022.2040126

Oikonomou, G. (2021). The effect of central bank transparency on inflation persistence. *739898418*.

Papadamou, S., Sidiropoulos, M., & Spyromitros, E. (2015). Central bank transparency and the interest rate channel: Evidence from emerging economies. *Economic Modelling*, *48*, 167–174.

Rafferty, M., & Tomljanovich, M. (2002). Central bank transparency and market efficiency: An econometric analysis. *Journal of Economics and Finance*, *26*(2), 150–161. https://doi.org/10.1007/BF02755982

Sotomska-Krzysztofik, P., & Szczepanska, O. (2006). *Transparency of central banks in supporting financial stability*.

Spyromitros, E., & Tuysuz, S. (2008). Do monetary policy transparency, independence and credibility enhance macro-financial stability? *Available at SSRN 1309737*.

Sterne, G., Stasavage, D., & Chortareas, G. (2002). Does It Pay to be Transparent? International Evidence Form Central Bank Forecasts. *Review*, *84*(4). https://doi.org/10.20955/r.84.99-118

van der Cruijsen, C., & Demertzis, M. (2007). The impact of central bank transparency on inflation expectations. *European Journal of Political Economy*, *23*(1), 51–66. https://doi.org/10.1016/j.ejpoleco.2006.09.009

van Duuren, T., de Haan, J., & van Kerkhoff, H. (2020). Does institutional quality condition the impact of financial stability transparency on financial stability? *Applied Economics Letters*, *27*(20), 1635–1638.

Walsh, C. E. (2018). Optimal economic transparency. *Eighth Issue (March 2007) of the International Journal of Central Banking*.

Weber, C. S. (2018). Central bank transparency and inflation (volatility) – new evidence. *International Economics and Economic Policy*, *15*(1), 21–67. https://doi.org/10.1007/s10368-016-0365-z

Zhou, S., & Tewari, D. D. (2019). Shadow banking, risk-taking and monetary policy in emerging economies: A panel cointegration approach. *Cogent Economics & Finance*, *7*(1), 1636508. https://doi.org/10.1080/23322039.2019.1636508

Appendix

Table A1: Unit root Test: Augmented Dickey Fuller and Phillips-Perron Test

	Augmented Dickey-Fuller		Phillips-Perron	
Variables	chi2	p-value	chi2	p-value
MP Transparency Index	316.219	0.000	316.219	0.000
D. Transparency Index	1097.543	0.000	1760.948	0.000
Bank-z-score	820.873	0.000	820.873	0.000
D.bank-z-score	1553.634	0.000	3220.403	0.000
NPLs	565.974	0.000	565.974	0.000
D.NPLs	1361.546	0.000	1270.475	0.000
Democracy	376.034	0.014	376.034	0.014
D.democ	1604.713	0.000	3333.971	0.000
pol_stability	986.419	0.000	986.419	0.000
D.pol_stability	2140.218	0.000	4227.988	0.000
Policy rate	541.647	0.000	541.647	0.000
D. policy rate	1256.991	0.000	1799.024	0.000

Notes: p-value of less than 0.05 suggest that the variable is stationary. Both Augmented Dickey-Fuller and Phillips-Perron were used to achieve robust results.

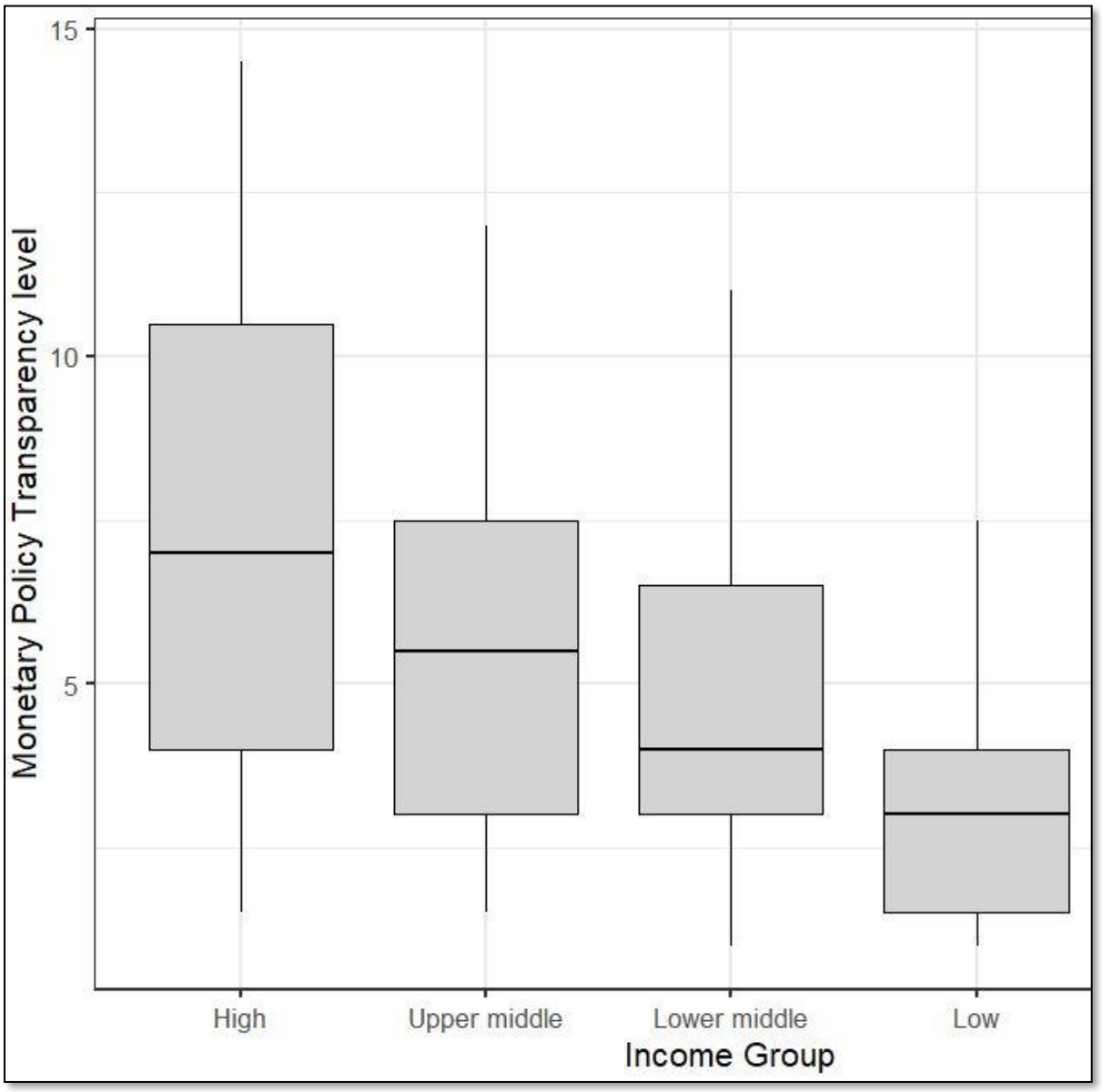
Table A2: Summary statistics: Advanced Economies

Variable Name	Observations	Mean	Std.Dev	Min	Max
Bank-z-score	1097	16.50	10.58	-1.84	142.60
NPLs	956	4.72	5.98	0.09	47.75
MP Transparency	770	7.29	3.60	1.50	14.50
Log GDP	1389	21.83	3.25	12.81	30.47
Log CPI	2114	4.16	1.19	-9.02	5.41
Log FX rate	2084	1.65	2.13	-4.75	7.57
Log M2	1306	4.22	0.51	2.78	6.11
Policy Rate	592	4.52	4.36	-0.75	28.00
Democracy	1621	7.67	3.90	0.00	10.00
CB Independence	1691	0.59	0.21	0.15	0.93
Political stability	1451	0.82	0.52	-1.63	1.97

Table A3: Summary statistics: Emerging Economies

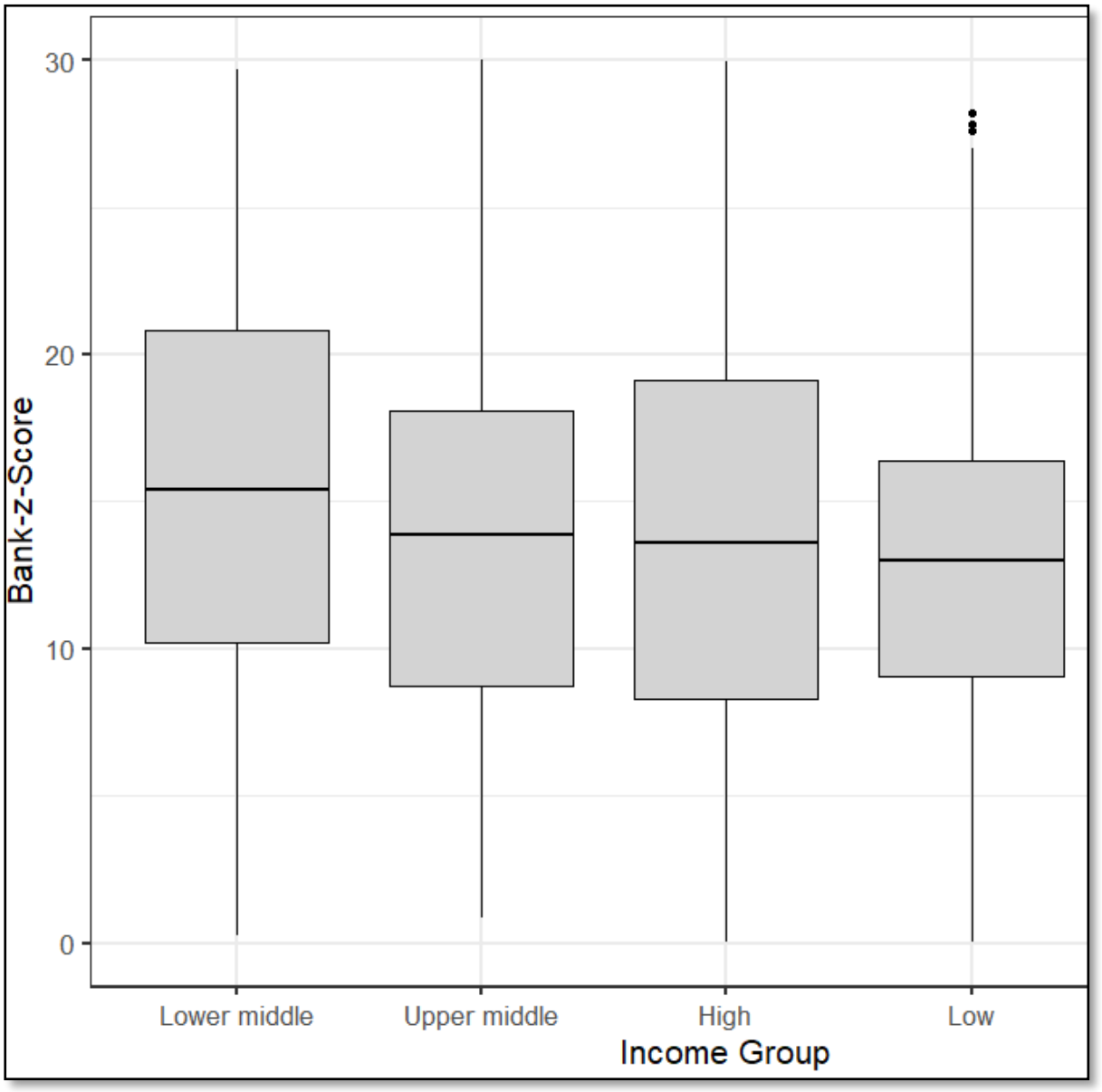
Variable Name	Observations	Mean	Std.Dev	Min	Max
Bank-z-score	2006	16.19	9.42	-0.02	70.97
NPLs	1391	8.82	8.16	0.00	74.10
MP Transparency	1606	5.02	2.64	1.00	12.00
Log GDP	2428	22.25	3.52	12.70	32.32
Log CPI	4178	3.64	2.50	-25.92	8.12
Log FX Rate	4687	2.97	3.76	-24.68	15.40
Log M2	4425	3.54	0.66	1.05	5.82
Policy Rate	1252	10.20	11.89	0.00	183.20
Democracy	4008	3.80	3.57	0.00	10.00
CB Independence	3360	0.55	0.16	0.10	0.90
Political stability	2920	-0.45	0.91	-3.31	1.42

Figure A1: Monetary Policy Transparency by Economy Size



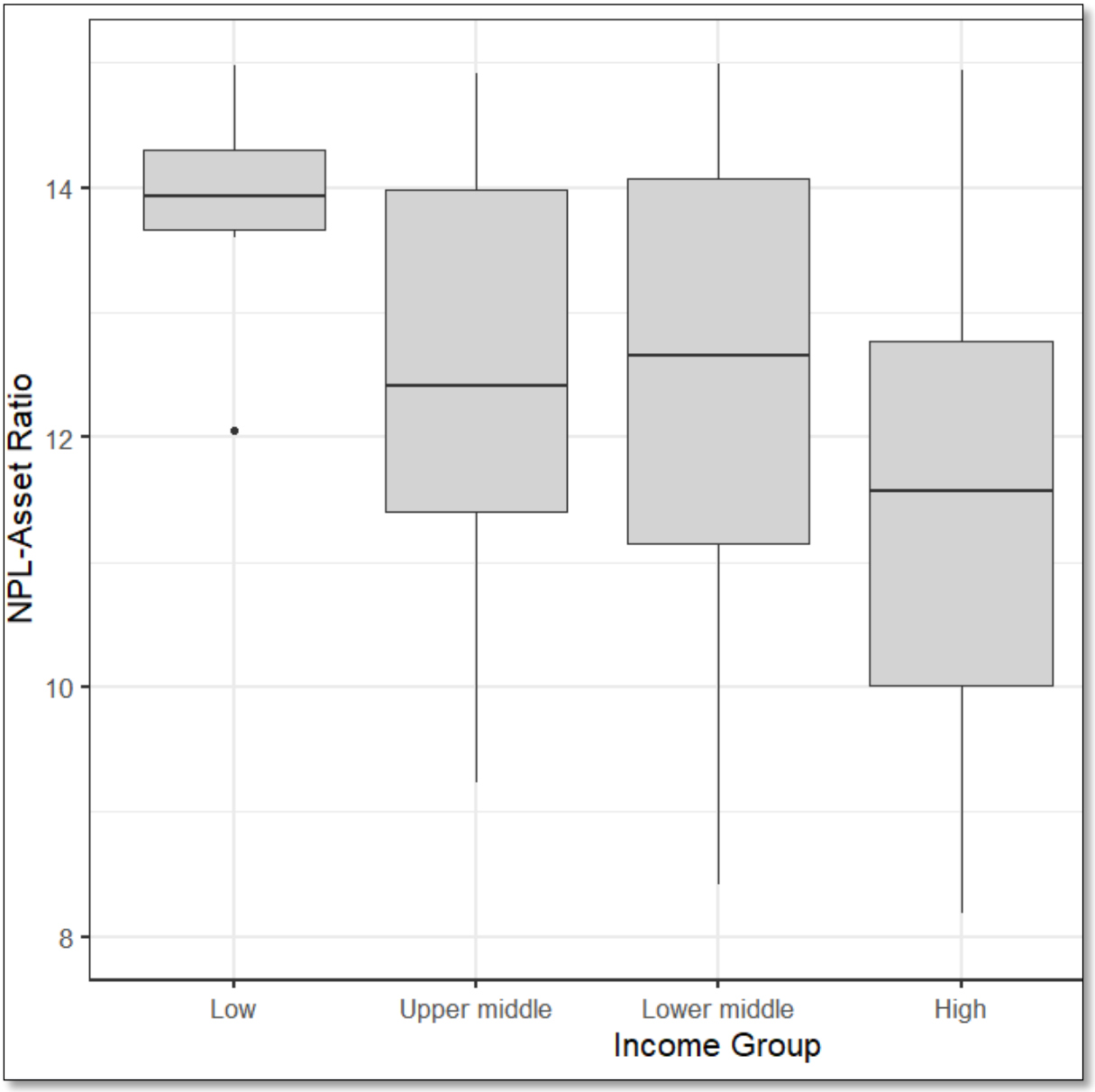
Notes: High=High income countries, Upper middle= Upper middle-income countries, lower middle= lower middle-income countries, low= low income countries

Table A2: Average Banking Industry Stability by Economy Size



Notes: High=High income countries, Upper middle= Upper middle-income countries, lower middle= lower middle-income countries, low= low income countries

Table A3: Average Banking Industry Stability by Economy Size



Notes: High=High income countries, Upper middle= Upper middle-income countries, lower middle= lower middle-income countries, low= low income countries

Table A4: Bank Stability Improving over the Years