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Article

Should Monetary Policy in South Africa Lean against the Wind by Targeting the Financial Cycle?

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Abstract: Recently, several studies have argued about the interactions of the real economy and financial system, as well as the importance of financial cycles in business cycle fluctuations. To date, there exists near consensus among central bankers, economists, and other scholars that the financial cycle is an important source of business cycle fluctuations. This has raised the question of whether monetary policy should respond to financial instability and/or imbalances. As a result, we asked the following questions: Should monetary policy lean against the wind by targeting the aggregate financial cycle in South Africa? And what is the role of monetary policy in minimizing financial imbalances and instabilities in South Africa? The present article aims to provide answers to the above-mentioned question. Through the adoption of a multiple-equation generalized method of moments and structural vector autoregressive approaches, this article simultaneously estimates and compares both the finance-augmented and the conventional Taylor rules. It is shown that the South African Reserve Bank has considered developments in the aggregate financial cycle in setting its policy rate. Overall, there is clear evidence to conclude that the South African Reserve Bank can lean against the wind by targeting the aggregate financial cycle, but only as a genuine augmentation not as a fully flagged objective. This article adds new evidence to the South African literature on the prevailing debate of whether monetary policy should respond to developments in the financial system.

Keywords: financial cycle index; monetary policy; business cycle; finance-augmented Taylor rule; structural vector autoregressive modelling; multiple-equation GMM



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JEL Classification: E44; E61; G21

1. Introduction

Prior to the 2007–2009 global financial crises (GFCs), business cycle (BC) studies were primarily based on real business cycle (RBC) models and new Keynesian models (NKM)s that disregarded financial factors (Kydlund and Prescott 1982; Long and Plosser 1983). The primary focus of these studies was on the dynamics of real indicators such as consumption, rates of unemployment and employment, aggregate prices, and gross domestic product (GDP), to name only a few. Important financial variables such as credit, house prices, equity, and spreads were overlooked in such studies (Ma and Zhang 2016). Furthermore, analyses of financial factors and financial shocks as sources of BC fluctuations also received less attention prior to the 2007–2009 GFCs. In reality, following the RBC literature (King and Rebelo 1999), the conventional view about sources of BC fluctuations has been primarily centered on technological shocks, and little or no role was found to be played by financial factors. This was especially the case in developed countries such as the United States, United Kingdom, and China, to name only a few.

In developing countries such as South Africa, the conventional view about sources of economic fluctuations has been centered on factors such as the lack of resource endowment, low levels of human capital, the administrative, legal, and institutional framework, the stance of the macroeconomic framework, and structural policies (Ndlela and Nkala 2003).

In the aftermath of the 2007–2009 GFCs, however, the view regarding sources of BC fluctuations expanded to include financial factors. For example, in [Jermann and Quadrini \(2012\)](#), a model with debt and equity financing was developed to explore the macroeconomic effects of financial shocks. Results revealed that financial shocks contributed significantly to the observed dynamics of financial and real variables. This was in line with the conclusions of other related studies ([Hirakata et al. 2011](#)).

From a general equilibrium model (DSGE) perspective, as estimated in [Iacoviello \(2015\)](#), it was found that financial shocks that affect leveraged sectors accounted for two-thirds of the output collapse during the great moderation. Recently, [Caldara et al. \(2016\)](#) found that financial shocks have significant adverse effects on economic outcomes and have been an important source of cyclical fluctuations since the 1980s. Similar conclusions are also found in recent contributions from [Ajello et al. \(2016, 2018\)](#), among others. Recently, several studies have argued about the interactions of the real economy and financial system, as well as the importance of financial cycles (FCs) in BC fluctuations. To date, there exists near consensus among central bankers, economists, and other scholars that the FC is an important source of BC fluctuations.

The above discussion has raised the question of whether monetary policy should respond to financial instability ([Justiniano et al. 2010](#)). This is one of the defining questions that shape modern macroeconomics, and while it has been explored in the literature, literature has not reached consensus on the answers ([Iacoviello 2015](#)). While some have argued that price stability is a necessary but insufficient condition for financial stability purposes, and central banks therefore need to utilize the interest rate to lean against financial imbalances ([Claessens et al. 2012](#); [White 2009](#); [Woodford 2012](#)), others have argued that trying to use MP for financial stability purposes is an ineffective way to achieve and maintain financial stability ([Smets 2014](#); [Svensson 2012](#)).

Accordingly, a natural way to address financial instability has been the augmentation of the Taylor rule with financial variables, so as to allow the interest rate to react to financial imbalances ([Issing 2011](#); [Nair and Anand 2020](#)). This has been supported by several scholars, noting that the standard Taylor rule increases financial risks through the risk-taking channel, and it only captures the impact of financial imbalances on individual financial institutions such as banks. Hence, the need for an augmented Taylor rule which captures the impact of financial imbalances on the entire financial system was emphasized ([Adrian and Shin 2009](#); [Agénor et al. 2013](#); [Mishkin 2011a](#); [Nair and Anand 2020](#)).

The abovementioned analyses hold valuable significance for South African policymakers as they embark on a journey to adopt macroprudential policy (MaPP) for finance system stability, as laid out on the Financial Sector Regulations Bill (FSR Bill). Prior to the 2007/09 GFCs, the SARB's objective was primarily to maintain price stability to ensure sustained economic growth in South Africa. This was mainly achieved through the adjustment of the repo rate, thus affecting borrowing costs and inflation, respectively. In the aftermath of the 2007/09 GFCs, the SARB's mandate seemingly was expanded to include financial system stability, over and above the objective of price stability. The SARB is now tasked with maintaining financial system stability through the implementation of macroprudential policy in South Africa. The SARB also plays a crucial role as a regulatory oversight, thus regulating and supervising financial institutions in South Africa ([Hollander and Van Lill 2019](#)). This means that the SARB is now an integrated monetary and supervisory authority, responsible for both the objectives of price and financial stability.

While this is new and different from the ordinary operations of the SARB or any other central bank, it presents a few challenges that need to be addressed. In South Africa, these challenges include identification of systemic risks, measuring of financial instability, policy coordination, a macro-financial approach, preventative and reactive measures, independence, and credibility, among others. Notwithstanding the above facts, only a few studies have dedicated efforts towards the analyses of the above issues (see [Hollander and Van Lill 2019](#); [Nyati et al. 2023](#), among others). Furthermore, according to authors' knowledge, no study has adopted a composite index to measure the FC and

its relationship with other macroeconomic variables within an augmented Taylor rule framework, to analyze whether MP in South Africa should respond to financial instabilities.

As a result, the present article aims to respond to the following question; what is the role of MP in minimizing financial instabilities in South Africa? This is achieved through the assessment of whether the SARB should lean against the wind by targeting the FC. Specifically, through the adoption of a multiple-equation generalized method of moments (MEGMM), this article simultaneously estimates and compares the finance-augmented and the conventional Taylor rules. The article provides analysis of the various shocks to the model's endogenous variables, through the estimation of an augmented Taylor rule model with a structural vector autoregressive methodology and impulse response functions.

2. Theoretical Framework

2.1. Monetary Policy with a Financial Stability Objective

One of the contributions of this article is its examination of the role of MP in minimizing financial instabilities/imbances in South Africa. To achieve this, this article assesses whether the central bank (SARB) should lean against the wind by targeting the aggregate FC. One of the key reasons for adopting an aggregate measure of the FC is that it contains more comprehensive information about the various sectors of the financial system. Furthermore, it provides a broader picture of the financial system's conditions. Hence, it acts as a true reflection of the dynamics of the financial system. While the normative issues of the appropriateness of MP responses to financial system indicators, such as asset prices, credit, and equity, have been of interest in the literature (Bernanke et al. 1999; Hafner and Lauwers 2017), the major innovation of this article is the incorporation of a composite financial cycle index (CFCI) measured through the amalgamation of eleven monthly financial time series indicators into the conventional Taylor rule, thus forming what is here referred as the finance-augmented Taylor rule.

2.1.1. The Original Taylor Rule Model

The conventional Taylor rule model (Taylor 1993) relates the setting of short-term nominal interest rates to the evolution of price inflation and the output gap as follows:

$$r_t = r^* + \pi^* + \phi_1(\pi_t - \pi^*) + \phi_2 y_t \quad (1)$$

where r_t is the short-term nominal interest rate assumed to adjust to the target rate each period; r^* denotes the equilibrium real interest rate; π^* is the central banks' inflation target; π_t is the present inflation rate given as the percentage change in the price level; y_t denotes the output gap, which is the difference between actual output and potential output; ϕ_1 and ϕ_2 denote the sensitivity of the interest rate towards deviations of inflation and output from their target and potential levels, respectively (Hafner and Lauwers 2017; Nair and Anand 2020).

In accordance with Hafner and Lauwers (2017), the wide applicability of the original Taylor rule model came from its simplicity, intuitiveness, and its realism. However, this original version became slightly outdated as it was based on the assumptions that the central bank is backward-looking and trails on the non-inertial policy rule. As a result, improvements were made to the original model; these are discussed below.

2.1.2. The Conventional Forward-Looking Taylor Rule Model

The forward-looking conventional Taylor rule of Clarida et al. (1999) is one of the improvements to the conventional Taylor rule model. Accordingly, instead of the incorporation of actual or past values of inflation, this rule uses the forward-looking or expected inflation rate, thus complying with the central banks' practices of using expected inflation to calculate the desired interest rate. This rule can be illustrated mathematically as follows:

$$r_t^* = r^* + \pi^* + \phi_1 [E(\pi_{t+k} | \Omega_t) - \pi^*] + \phi_2 [E(y_{t+p} | \Omega_t)] \quad (2)$$

$$r_t^* = \alpha + \varnothing_1 E(\pi_{t+k}|\Omega_t) + \varnothing_2 [E(y_{t+p})|\Omega_t] \quad (3)$$

where α is given by $r^* - (\varnothing_1 - 1) \pi^*$ and π_{t+k} and y_{t+p} denote the forecast values of inflation and the output gap conditioned upon a vector of all the information (Ω) in period t . Accordingly, if $\varnothing_1 > 0$ and $\varnothing_2 > 0$, the rule prescribes raising the target interest rate r_t^* if expected inflation within the time horizon is rising above target level, and the output gap is projected to be positive. Combining the target Equation (3) with the partial adjustment mechanism yields the final specification of the forward-looking conventional Taylor rule, for estimation purposes:

$$r_t = \left(1 - \sum_{i=1}^p \rho_i\right) (\alpha + \varnothing_1 E(\pi_{t+k}|\Omega_t) + \varnothing_2 [E(y_{t+p})|\Omega_t]) + \sum_{i=1}^p \rho_i r_{t-i} + v_t \quad (4)$$

where v_t is an exogenous white noise shock to the actual interest rate. For the model to be estimable, the unobserved expected values of inflation and the output gap need to be proxied. According to Clarida et al. (1999), this can be easily achieved through rewriting the reaction function in terms of actual or realised values while including the forecast errors in the new composite error term. In line with this, the following estimable equation is obtained:

$$r_t = \left(1 - \sum_{i=1}^p \rho_i\right) (\alpha + \varnothing_1 \pi_{t+k} + \varnothing_2 y_{t+p}) + \sum_{i=1}^p \rho_i r_{t-i} + \varepsilon_t \quad (5)$$

The new term ε_t in Equation (5), above, represents the linear combinations of the forecast errors of inflation and the output gap with exogenous disturbance v_t .

2.1.3. A Finance Augmented Taylor Rule Model

In accordance with its first objective, this article extends the forward-looking conventional Taylor rule model of MP (Equation (4)) through incorporating the CFCI, thus leading to what is here referred as a finance-augmented Taylor rule, given as follows:

$$r_t = \left(1 - \sum_{i=1}^p \rho_i\right) (\alpha + \varnothing_1 E(\pi_{t+k}|\Omega_t) + \varnothing_2 E(y_{t+p}|\Omega_t) + \varnothing_3 CFCI_t) + \sum_{i=1}^p \rho_i r_{t-i} + v_t \quad (6)$$

where $CFCI_t$ denotes the composite financial cycle index, which represents a common factor extracted from an amalgamation of eleven monthly financial time series variables. The parameter \varnothing_3 shows the central banks' response to financial cycle fluctuations or the interest rate sensitivity towards fluctuations in the financial cycle. It is assumed that the central bank focuses on actual or current values of the FC and responds to these accordingly.

The rule assumes that the short-term nominal interest rate that captures the MP stance of the SARB must be restrictive if the actual inflation rate is above the potential inflation rate and the actual real output is more than the potential real output. The former principle is satisfied if the coefficient on the inflation gap is higher than and significantly different from one. Hence, when $\varnothing_1 > 1$, this means that the SARB observes restrictive MP to curb inflation and stabilize the economy; on the other hand, $\varnothing_1 < 1$ is indicative of accommodative MP pursuance by the SARB.

The latter principle stipulates that the coefficient on the output gap must be positive ($\varnothing_2 > 0$) and significant. This indicates a lowering of the interest rate while actual output falls short of the potential level. On the other hand, the coefficient on the CFCI (\varnothing_3) is expected to be negative and significant. This is because an increase in the interest rate is associated with a downturn of the FC, thus signifying accommodative monetary policy. Consequently, the estimation analyses pay attention to the estimation of the reduced-form finance-augmented Taylor rule, given as follows:

$$r_t \varnothing_0 + \varnothing_1 \pi_{t+k} + \varnothing_2 y_{t+p} + \varnothing_3 CFCI_t + \sum_{i=1}^p \rho_i r_{t-i} + \varepsilon_t \quad (7)$$

The a priori expectation is a negative and significant coefficient with a value close 0.5 in the CFCI parameter, in accordance with the literature ([Hafner and Lauwers 2017](#); [Nair and Anand 2020](#)). The value of 0.5 implies that the SARB can lean against the wind by targeting the aggregate FC as a fully flagged objective, while lower values indicate targeting the FC only as a genuine augmentation. Furthermore, the expectation is for a positive value of the coefficient of the output gap and expected inflation and for the coefficient value of expected inflation to be larger than the value of the coefficient of the output gap, in line with the SARB mandates. Following the Taylor principle, the expectation is a value close to 1.5 for inflation and 0.5 for the output gap.

The present article compares the conversional Taylor rule and the finance-augmented Taylor rule to determine whether the SARB should lean against the wind by targeting the aggregate FC. The following section reviews the conceptual and empirical literature.

3. Theoretical and Empirical Literature

Presently, there exist three dominant strands of literature on the analyses of interactions between macroprudential and monetary policies. The first strand of the literature advocates for a clear separation of objectives, also referred to as the modified Jackson Hole consensus. Explicitly, advocates of this view are of the belief that central banks should focus their attention on achieving price stability while MaPP measures should be assigned to achieve financial stability. They believe the two objectives are independent of each other ([Malovaná et al. 2023](#)).

The second strand, which is by far the most popular in the recent literature, considers price stability and financial stability to be strongly intertwined and inseparable, suggesting that policy coordination is desirable to achieve the best economic outcomes. Macro-financial linkages creating feedback loops between the real economy and the financial system are at the core of this view ([Dunstan 2014](#); [Frait et al. 2014](#); [Hollander and Van Lill 2019](#); [Malovaná and Frait 2017](#)). The third and final strand of the literature focuses on taking risks to financial stability into account in MP conduct even if current forecasts indicate no risk to price stability, also referred as the “lean against the wind consensus”. Advocates of this view acknowledge that macroprudential policy cannot fully address the existing or potential systemic risks, while monetary policy can be effective in this pursuit ([Malovaná et al. 2023](#)).

In line with the above strands of the literature, many studies, both empirical and theoretical, have strongly argued about the interactions and linkages between business cycles and financial cycles and the role of financial factors in shaping macroeconomic fluctuations ([Ajello et al. 2018](#)). This has led to increasing consensus among economists, central bankers, and other scholars that the financial system plays a significant role as a source of macroeconomic fluctuations and that therefore, the FC is an important source of BC fluctuations (see [Ajello 2016](#); [Ajello et al. 2018](#); [Caldara et al. 2016](#); [Christensen and Dib 2008](#); [Christiano and Ikeda 2013](#); [Christiano et al. 2010](#); [Hafstead and Smith 2012](#); [Hirakata et al. 2011](#); [Iacoviello 2015](#); [Ma and Zhang 2016](#)).

In this context, a crucial question remains; should monetary policy respond to financial instabilities/imbalances? Theoretically, macroprudential policies (MaPPs) are viewed primarily as tools aimed at mitigating financial vulnerabilities and promoting financial stability ([Hollander 2017](#)). These regulatory and supervisory tools, viz., bank capital requirements and or sector-specific loan-to-value ratios may be used to lean against the wind through the tightening of financial conditions in a targeted way and to strengthen the resilience of the financial system against adverse shocks (see [Adrian and Liang 2016](#); [Hollander 2017](#)). Monetary policy (MP) works in a similar manner to lean against the wind; however, it is not targeted. Furthermore, it may not be as efficient as MaPP if the financial vulnerability is narrow. Additionally, it does not directly increase resilience in a similar manner that higher capital at banks can ([Adrian and Liang 2016](#)).

The abovementioned considerations support the clear separation of responsibilities, a view which has been supported by among others, i.e., [Svensson \(2010, 2012\)](#), [Smets \(2014\)](#),

[Ueda and Valencia \(2014\)](#). These advocates have noted, among other factors, ineffectiveness, reputation, credibility, and time inconsistency, as the main reasons why MP should not respond to financial instabilities. For instance, [Svensson \(2010\)](#) argued that MP should be conducted considering financial stability. As a result, it followed that financial stability as an objective of MP made little sense, while financial stability as a central bank objective made more sense. In another piece of work, [Svensson \(2012\)](#) added that trying to use MP for financial stability purposes is an ineffective way to achieve and maintain financial stability that could lead to poorer outcomes than otherwise without MP.

In a study by [Smets \(2014\)](#), it was maintained that the reputation and credibility of the central bank may suffer due to a double objective of price and financial stability. Moreover, in the absence of uniform rules being clearly established, MaPP is more exposed to the problem of time inconsistency, which could harm the credibility of central banks and, consequently, the effectiveness of MP ([Ueda and Valencia 2014](#)). This clean separation of views was further supported by the cost–benefit analysis of leaning against the wind found in [Svensson \(2016\)](#). Within this framework, the costs of MP leaning against the wind included higher unemployment rates in the current period, and benefits included reduced household borrowing, which led to a lower probability of financial crises. Based on the parameters from the Swedish economy on credit growth to MP, it was concluded that costs outweighed benefits ([Adrian and Liang 2016](#)).

Conversely, MP has effects on financial vulnerabilities in addition to financial conditions. Furthermore, as opposed to MaPP, MP also affect the costs of all borrowers and lenders; hence, it gets in all the cracks ([Stein 2014](#)). Furthermore, MP is less subject to the criticism that regulators are making non-market credit decisions. As a result, in light of the multidimensional interactions and similar channels of transmission to the real economy, through asset prices, credit, and financial intermediation, MP and MaPP should not be separate ([Adrian and Liang 2016](#)). Similar to the theoretical considerations mentioned above, advocates of this view have also pointed to the important effects MP has on financial stability, the interactions between BCs and FCs, and the similar channels of transmission as reasons why MP should respond to financial stability ([Claessens et al. 2012](#); [Erdem and Tsatsaronis 2013](#); [Gameiro et al. 2011](#); [Montes 2010](#); [White 2009](#); [Woodford 2012](#)).

In [Montes \(2010\)](#), it was argued that financial stability must not be considered as a simple goal of MP, but a precondition for central banks to operate their policies and reach their goals of inflation and output stability. Furthermore, [Gameiro et al. \(2011\)](#) argued that, given the importance of the financial system for MP transmission mechanisms, financial stability concerns need to be considered in setting MP. In line with this, [Woodford \(2012\)](#) also argued that price stability does not guarantee financial stability. As a result, it remains essential for other prudential policies to maintain close surveillance of the financial system and act to minimize the likelihood of financial imbalances, which pose threats to the economy.

Furthermore, in [Claessens et al. \(2012\)](#), the interactions between BCs and FCs were analyzed, utilizing an extensive database covering 44 countries. It was concluded that, considering the multidimensional interactions between BCs and FCs, close monitoring of the FC should be an integral part of macroeconomic surveillance and policy design. Moreover, in investigating the linkages between financial and real variables, [Erdem and Tsatsaronis \(2013\)](#) revealed that financial variables have a significant information content for future realization of real variables over the typical planning horizon of MP. Therefore, policy frameworks aiming at macroeconomic stability can benefit from the information captured through financial sector variables. In [Ma and Zhang \(2016\)](#), new evidence on the debate of whether or not MP should respond to financial instability was provided. The authors revealed that MP has an important role in safeguarding the financial system and as a result, financial stability should be adopted as a target for MP.

Currently, it is widely accepted that there are important lessons to be learned from the incorporation of financial factors in macroeconomic models. It is also accepted that addressing financial instability should form an integral part of a central banks' mandate.

Empirically, a natural way to address financial stability has been the augmentation of the conventional Taylor rule with financial targets, so as to allow the interest rate to react to financial imbalances (Christiano et al. 2010). This has been advocated by many authors (Adrian and Shin 2009; Ma and Zhang 2016; Mishkin 2011b), emphasizing the effectiveness of the augmented Taylor rule over the standard Taylor rule for financial stability purposes. For example, in Ma and Zhang (2016), the performance of a finance-augmented Taylor rule was compared with that of the conventional Taylor rule. It was found that both the financial system and the real economy would have been better stabilized under the finance-augmented Taylor rule.

Furthermore, Hafner and Lauwers (2017) investigated the limitations and opportunities of incorporating financial system variables into the standard forward-looking Taylor rule of the United States Federal Reserve. Utilizing house price and stock price data penning the period 1979–2011, ambiguous evidence for the role of house prices was found, while stock prices proved to represent an integral part of the Federal Reserve's monetary policy. Furthermore, in Nair and Anand (2020), the role of monetary policy as a tool to achieve financial stability was investigated. This was achieved through the comparison of the standard Taylor rule with an asset-price-augmented Taylor rule. It was concluded that targeting asset prices can be an effective way to alleviate financial instabilities.

In South Africa, like any in other central bank around the globe, there is currently a clear mandate for financial stability within the SARB. In accordance with the Financial Sector Regulations Bill (FSR Bill), it is the SARB's responsibility to protect and enhance financial stability in South Africa. If a systemic event is identified as imminent or has occurred, it is also the SARB's responsibility to maintain or restore stability (South African Reserve Bank 2016). Therefore, the SARB must take all necessary steps to thwart systemic events from stirring and to alleviate the hostile effects of events on financial stability, through the application of toolkits of MaPP instruments.

While these issues and many others currently form part of the SARB's research agenda, it is, however, important to note that, according to authors' knowledge, no study has adopted a composite index to measure the FC with the aim of providing evidence on the debate of whether MP should respond to financial instabilities. As a result, the present article contributes to the body of knowledge on the interactions between the financial system and the real economy in three ways. First, we show that there is better information content in targeting the aggregate FC than individual variables. Second, we show that the financial system and real economy of South Africa are better stabilized under the finance-augmented Taylor rule. Third, we show that the SARB can lean against the wind by targeting the aggregate financial cycle but only as a genuine augmentation and not as a fully flagged objective.

4. Database and Methodology

4.1. Data Description and Data Sources

The present article utilizes monthly data from South Africa penning the period 2000M1 to 2018M12. While the most important indicator used in this article is the composite financial cycle index put forward by Nyati et al. (2021, 2023), the chosen time frame was mostly influenced by this index and the data availability of the other indicators. The data used in this article were identified following in the footsteps of Drehmann et al. (2012), Ma and Zhang (2016), and other relevant studies (Krznar and Matheson 2017). These are all discussed below.

1. Composite financial cycle index (CFCI): the CFCI used in this article represents a common factor extracted from an amalgamation of eleven monthly financial time series indicators. This was adopted from Nyati et al. (2023); for details on this, the reader is referred to the above citation. The inclusion of this variable is in line with the theory of procyclicality of the financial system;
2. South African Reserve Bank proxy financial cycle Index: this index represents a common factor extracted from an amalgamation of three financial time series variables,

including credit, house prices, and equity prices. This was adopted from [Nyati et al. \(2021\)](#); for details on this, the reader is referred to the above citation;

3. Real gross domestic product (RGDP): RGDP used in this article represents a monthly measurement of economic output taking into consideration the effect of inflation. Real GDP is used as a measure of economic performance, while its gap is used to capture fluctuations in economic activity; hence, it has been used by past studies as a proxy for the BC ([Venter 2019](#)). In accordance with the procyclicality, this variable should possess a positive relationship with the FC; the main aim is therefore to gauge these interactions on a model-based basis. Data for this indicator were gathered from the South African Reserve Bank (SARB) database including selected monthly publications of indicators;
4. Short-term interest rates (STIRs): these are rates showing how short-term borrowings among financial institutions are affected. These can also be looked at based on the rates at which short-term government bonds are issued or traded in the market. It is believed the interest rate is associated with the downturn of both BCs and FCs; hence, it is expected that this indicator should have a negative sign in the regressions of FCs and BCs. Data for this indicator are available from the SARB database and the Federal Reserve Bank of St Louis (FRED), for both quarterly and monthly frequencies;
5. Inflation (INF): proxied through CPI inflation, this is defined as the change in the price of a basket of goods and services purchased by specific groups of households. This is measured in terms of annual growth rate and as an index, with 2010 being the base year with a breakdown for food, energy, and the total excluding food and energy. It is normative thinking that the SARB targets inflation in order to stabilize the South African economy. Hence, the inclusion of this indicator is empirically and theoretically justified. This indicator was gathered from the SARB database, and it is also available from the FRED database and the Organization for Economic Co-operation and Development (OECD) database;
6. Expected inflation (EINF): this represents survey-based inflation forecasts. It is assumed that the Central Bank stabilizes the economy based on rational expectations rather than adaptive expectations. This rules out the inclusion of past values of inflation but calls for inclusion of future values. Data for this were gathered from the FRED online database;
7. Long-term interest rates (LTIRs): these refer to Government bonds maturing in ten years, and can be determined by three things, namely, the price charged by the lender, the risk from the borrower, and the fall in capital value. Data for this indicator are available from the SARB database and are also available from the FRED and the International Monetary Fund's International Financial Statistics databases.

All these indicators were normalized and seasonally adjusted before being utilized in this article. This was done mainly to convert them into the same unit of measure, which eased interpretation.

4.2. Model Specification

4.2.1. A Multiple-Equation Generalized Method of Moments Technique

As a first step towards analyzing the FC as a source of BC fluctuations and whether MP should respond to financial imbalances, this article adopts a multiple-equation generalized method of moments (MEGMM) for the simultaneous estimation of the traditional and the finance-augmented Taylor rules. This method enables authors to handle a system of multiple equations, suitably specifying the matrices and the vectors comprising a single-equation generalized method of moments (SEGMM). This multiple equation model can be expressed as a single-equation GMM estimator ([Hansen 2010](#)). In the presence of heteroscedasticity, the multiple-equation GMM reduces to a full-information instrumental variable efficient (FIVE) estimator model. It further reduces to a 3-stage least squares model, where the set of instrumental variables is common through all the equations ([Hall 2005](#); [Hansen 1982, 2010](#)).

With the assumption that all the regressors are predetermined, the 3SLS reduces to what is called seemingly unrelated regression (SUR), which in turn gives what is called multivariate regression (MR) when all the equations have the same regressors. An MEGMM can be represented as a system of equations with its coefficients constrained to be the same across equations. In this case, the random effect estimator is a GMM estimator with all the regressors predetermined and errors conditionally homoscedastic. Thus, the SUR and MR are equivalent estimators (Hansen 2010).

Several assumptions are made to derive a MEGMM estimator. These include the assumption of linearity: assume there are M equations such that:

$$y_{im} = z'_{im}\delta_m + \varepsilon_{im} \quad (m = 1, 2, \dots, M; i = 1, 2, \dots, n) \quad (8)$$

where n = sample size, z'_{im} = L_m —dimensional vector of regressors, δ_m = the conformable coefficient vector, and ε_{im} = an unobservable error term in the m -th equation. The matrix representation of the linear multiple equation regression model can be represented as:

$$y = Z\delta + \varepsilon \quad (9)$$

where:

$$L = \sum_{m=1}^M L_m \quad (10)$$

The second assumption is that of Ergodic stationarity: let w_i be a unique and non-constant element of $(y_{i1}, \dots, y_{iM}, z_{i1}, \dots, z_{iM}, x_{i1}, \dots, x_{iM})$, then, $[w_i]$ is jointly stationary and ergodic.

The third assumption is that of orthogonality conditions, which stipulates that, for each equation m , the K_m variables in the instruments x_{im} are predetermined such that:

$$E(x_{im} \cdot \varepsilon_{im}) = 0 \quad (m = 1, 2, \dots, M) \quad (11)$$

There are in total $\sum_m K_m$ orthogonality conditions, which in turn define:

$$\left(\sum_{m=1}^M K_{mx1} \right)^{g_i} \equiv \begin{bmatrix} X_{i1} & \varepsilon_{i1} \\ X_{iM} & \varepsilon_{iM} \end{bmatrix} \quad (12)$$

The orthogonality conditions can be written compactly as $E(g_i) = 0$. Note: this is not assuming cross-equation orthogonality. Given the above orthogonality conditions, identification can be established in the same way as in the case of single-equation GMM:

$$g(w_i; \delta) \equiv \begin{bmatrix} X_{i1} & \cdots & (y_{i1} - Z'_{i1}\delta_1) \\ \vdots & \ddots & \vdots \\ X_{iM} & \cdots & (y_{iM} - Z'_{iM}\delta_M) \end{bmatrix} \quad (13)$$

The orthogonality conditions can be expressed as $E\left[g\left(w_i; \tilde{\delta}\right)\right] = 0$. The coefficient vector is identified if $\tilde{\delta} = \delta$ is the only solution to the system of the equations:

$$E\left[g\left(w_i; \tilde{\delta}\right)\right] = 0 \quad (14)$$

The moment conditions for each of the equations in the MEGMM are the same as the ones derived for the SEGMM model. In that sense, in the same way, a system of equations determining $\tilde{\delta}$ can also be derived as:

$$\sum_{xz} \tilde{\delta} = \sigma_{xy} \quad (15)$$

The MEGMM Σ_{xz} is block diagonal. Recall that a necessary and sufficient condition for identification of the SEGMM is that Σ_{xz} be of full column rank. If $K_m = L_M$ for $(m = 1, 2, \dots, M)$, then, δ is exactly identified and:

$$\begin{bmatrix} \delta_1 \\ \vdots \\ \delta_M \end{bmatrix} = \begin{bmatrix} \Sigma_{x_1 z_1}^{-1} \sigma_{x_1 y_1} \\ \vdots \\ \Sigma_{x_M z_M}^{-1} \sigma_{x_M z_M} \end{bmatrix} \quad (16)$$

If $K_m > L_M$ for some m , then solving:

$$E[g_i(\delta)] = \begin{pmatrix} \sigma_{xy} \\ (k \times 1) \end{pmatrix} - \begin{pmatrix} \Sigma_{xz} \\ (K \times L) \end{pmatrix} \begin{pmatrix} \tilde{\delta} \\ (L \times 1) \end{pmatrix} \quad (17)$$

requires the rank condition positing that for each $m (= 1, 2, \dots, M)$, $E(x_{im} z'_{im}) (K_m \times L_m)$ is of full rank. This means that all coefficient vectors $(\delta_1, \dots, \delta_M)$ can be determined uniquely if and only if each coefficient vector δ_M is uniquely determined. This is the case if the orthogonality assumption holds for each equation.

The last of these assumptions is that g_i is a martingale difference sequence with finite second moments, i.e., $[g_i]$ is a joint martingale difference sequence. $E(g_i g'_i)$ is non-singular.

If $K_m = L_M$ for $m = 1, \dots, M$ then $X'_m Z_m$ is a square matrix and so:

$$\tilde{\delta}_m = S_{x_m z_m}^{-1} S_{x_m y_m}, \quad m = 1, \dots, M \quad (18)$$

Therefore:

$$\tilde{\delta} = \left(\tilde{\delta}_1, \dots, \tilde{\delta}_M \right)' \quad (19)$$

Solves:

$$\begin{pmatrix} S_{xy} \\ (k \times 1) \end{pmatrix} - \begin{pmatrix} S_{xz} \\ (K \times L) \end{pmatrix} \begin{pmatrix} \tilde{\delta} \\ (L \times 1) \end{pmatrix} = 0$$

If the equation is identified and $K_m > L_M$ for some m , then it is impossible to discover $\tilde{\delta}$ that solves the moment conditions. Thus, for the overidentified model, we let \hat{W} be a $K \times K$ positive definite symmetric matrix, given below as:

$$\hat{W} = \begin{bmatrix} \hat{W}_{11} & \hat{W}_{12} & \cdots & \hat{W}_{1M} \\ \hat{W}'_{12} & \hat{W}_{22} & \cdots & \hat{W}_{2M} \\ \vdots & \vdots & \ddots & \vdots \\ \hat{W}'_{1M} & \hat{W}'_{2M} & \cdots & \hat{W}_{MM} \end{bmatrix} \quad (20)$$

such that $\hat{W} \xrightarrow[p]{} W$. The GMM estimator then solves:

$$\tilde{\delta}(\hat{W}) \underset{\tilde{\delta}}{\operatorname{argmin}} J(\tilde{\delta}, \hat{W}) = n g_n(\tilde{\delta})' \hat{W} g_n(\tilde{\delta}) \quad (21)$$

$$= \underset{\tilde{\delta}}{\operatorname{argmin}} n \left(S_{xy} - S_{xz} \tilde{\delta} \right)' \hat{W} \left(S_{xy} - S_{xz} \tilde{\delta} \right) \quad (22)$$

The definition of the MEGMM estimator is the same as in the case of an SEGMM, given that the weighing matrix \hat{W} is now $\sum_m K_m \times \sum_m K_m$. Thus, given the above features and assumptions, the multiple equation GMM estimator is given as:

$$\tilde{\delta}(\hat{W}) = (S'_{xz} \hat{W} S_{xz})^{-1} S'_{xz} \hat{W} S_{xy} \quad (23)$$

and its sampling error is given as:

$$\tilde{\delta}(\hat{W}) - \delta = (S'_{xz} \hat{W} S_{xz})^{-1} S'_{xz} \hat{W} \bar{g} \quad (24)$$

$$S'_{xz} \hat{W} \bar{g} \quad (25)$$

where S_{xy} is a stacked vector, S_{xz} is a block diagonal matrix, $\sum_m K_m \times \sum_m K_m$ is the size of the weighting matrix, and \bar{g} is the sample mean of g_i , the stacked vector given as:

$$\bar{g} \equiv \frac{1}{n} \sum_{i=1}^n g_i = \begin{bmatrix} \frac{1}{n} \sum_{j=1}^n x_{i1} & \cdots & \varepsilon_{i1} \\ \vdots & \vdots & \vdots \\ \frac{1}{n} \sum_{i=1}^n x_{iM} & \cdots & \varepsilon_{i1} \end{bmatrix} = g_n \delta \quad (26)$$

Given all the features as mentioned above, it would be necessary to write out the MEGMM estimator as shown in Equation (24) in full. To achieve this, it would be required that $\hat{W}_{mh}(K_m \times K_h)$ be the (m, h) block of $\hat{W}(m, h = 1, 2, \dots, M)$.

This method was utilised to facilitate the comparison of both the conventional and the finance-augmented Taylor rules. If z_1 and z_2 are instruments for the first and second equations, respectively, this gives us the following sets of moment conditions:

$$E_t \left\{ \begin{matrix} INT_t - [\varnothing_0 + \varnothing_1 INF_{t+k} + \varnothing_2 rGDP_{t+p}] | z_1 \\ INT_t - [\sigma_0 + \sigma_1 INF_{t+k} + \sigma_2 rGDP_{t+p} + \sigma_3 CFCI_t] | z_1 \end{matrix} \right\} = 0 \quad (27)$$

To test for the validity of these GMM methods, the present article describes various tests that were conducted, including the instrument orthogonality test, also referred to as the C-test, the regressor endogeneity test that was carried out through the application of the Durbin–Wu–Hausman test, and lastly, the weak instrument diagnostic test, which was carried out through moment selection criteria.

4.2.2. Structural Vector Autoregressive (SVAR) and Impulse Responses

Based on the estimation of the finance-augmented Taylor rule, this article further examines the impact of various shocks on the major endogenous variables of the model system. Specifically, this article investigates the effects of a positive supply shock, positive demand shock, positive FC shock, and positive interest rate shock on the interactions between FCs, output, inflation, and the interest rate. To this end, a structural VAR method was utilized together with impulse response analyses.

While economic theory often links variables contemporaneously, a simple VAR model cannot be used in this case, or may need to be modified to allow for these contemporaneous relationships (Lutkepohl 2017). A VAR model that caters for contemporaneous relationships among variables can be written as follows:

$$Ay_t = C_1 y_{t-1} + \cdots + C_k y_{t-k} + e_t \quad (28)$$

The introduction of the notation C_i is validated by the fact that when $A \neq I$, the C_i is different from A_i in the reduced-form VAR. The A matrix characterises the contemporaneous relationships among the variables in a VAR. Another identified problem with the simple-form VAR is that error terms in general are correlated, which poses difficulties when it comes to impulse response analyses, as there are assumptions posed which are violated

in the presence of correlated error terms (Lutkepohl 2017). A well-known remedy for this is to write the errors as a linear combination of structural shocks, as follows:

$$e_t = Bu_t \quad (29)$$

Without generality losses, the following is imposed: $E(u_t u_t') = I$.

Since the task is to estimate parameters of a VAR model extended to include correlation among endogenous variables and exclude correlation among error terms, Equations (28) and (29) are combined to produce what is referred to as a structural VAR model, given as follows:

$$Ay_t = C_1 y_{t-1} + \dots + C_k y_{t-k} + Bu_t \quad (30)$$

where the goal is to estimate A , B , and C_i . The identification problem is to move from population-level moments back to unique estimates of the parameters in the structural matrices. If it assumed that A is invertible, the structural VAR model can be written as:

$$Ay_t = A^{-1}C_1 y_{t-1} + \dots + A^{-1}C_k y_{t-k} + Bu_t \quad (31)$$

implying the following set of interactions:

$$A^{-1}C_i = A_i$$

for $i = 1, 2, \dots, k$ and

$$A^{-1}BB'A^{-1'} = \Sigma$$

Through the estimation of A and B , recovering C_i could be straightforward; however, there exist many several A and B matrices that are consistent with the same observed Σ . As a result, it is difficult to pin down A and B from Σ . A solution for this is to place the restriction $n^2 + n(n-1)/2$ on A and B to obtain unique estimates of A and B from Σ . The order conditions ensure only that there are enough restrictions while the rank condition ensures there are enough linearly independent restrictions. The most common method of identification is to set $A = I$ and require B to be a lower triangular matrix, thus placing zeroes on all entries above the diagonal. The resulting mapping from structure to reduced form is:

$$BB' = \Sigma \quad (32)$$

along with the requirement that B be lower triangular. The reverse is true when A is lower triangular and $B = I$. Both these methods may be seen as imposing a causal ordering on the variables in the VAR; hence, the causal ordering represents the beliefs of the researcher about the nature of the relationship between variables (Lutkepohl 2017).

Using this method, this article estimates the following augmented Taylor rule and uses impulse response analyses to determine the effect of the various shocks on the endogenous variables on the model:

$$INT_t = \sigma_0 + \sigma_1 INF_{t+k} + \sigma_2 rGDP_{t+p} + \sigma_3 CFCI_t + \varepsilon_t$$

where all the variables are the same as given above.

5. Estimation Results and Analysis

5.1. Monetary Policy with a Financial Cycle Target

The analysis in this section aim to provide empirical evidence on the role of MP in minimizing financial instabilities/ imbalances in South Africa. Specifically, the aim is to provide answers on whether the SARB can lean against the wind by targeting the aggregate FC. To this end, both the conventional and the finance-augmented Taylor rules were estimated jointly through the adoption of an MEGMM. The estimated output of this model is shown in Table 1, below, with the conventional Taylor rule first, followed by the

augmented Taylor rule. For the joint specification, the J-test of overidentifying restrictions was passed, thus providing confidence about the validity of the estimated model.

Table 1. MEGMM Output of the Taylor Rules.

Equation	Parameter	Description	Value	J-Statistic (p-Value)
A. Monetary policy	$r_t = \varnothing_0 + \varnothing_1\pi_{t+k} + \varnothing_2y_{t+p} + \sum_{i=1}^p \rho_i r_{t-i} + \varepsilon_t$			
	ρ_i	Interest rate smoothing	0.762 *** (0.017)	
	\varnothing_1	Inflation expectations	0.279 *** (0.022)	
	\varnothing_2	Forward-looking output gap	0.135 * (0.072)	
B. Monetary policy with FC	$r_t = \varnothing_0 + \varnothing_1\pi_{t+k} + \varnothing_2y_{t+p} + \varnothing_3CFCI_t + \sum_{i=1}^p \rho_i r_{t-i} + \varepsilon_t$			71,714 (0.2253)
	ρ_i	Interest rate smoothing	0.764 *** (0.017)	
	\varnothing_1	Inflation expectations	0.278 *** (0.022)	
	\varnothing_2	Forward-looking output gap	0.141 ** (0.072)	
	\varnothing_3	Financial cycle	−0.012 ** (0.000)	

Note: Significance at 10%, 5%, and 1% levels reported by *, **, and ***, respectively. Standard errors in parentheses. Source: Authors' own estimates (2021).

The estimation of the standard forward-looking Taylor rule and the finance-augmented Taylor rule, as shown in panels A and B of Table 1, indicated that all the estimated coefficients had the expected signs and were statistically significant over the full sample period. Specifically, in the standard and finance-augmented Taylor rules, the expected inflation was found to be positive and statistically significant at a 5 percent level of significance, though the values were smaller than the canonical value of 1.5 suggested by Taylor (1993). Furthermore, in both the specifications, the output gap was found to be positive and statistically significant at a 1 percent level of significance, again at a smaller value than the canonical value of 0.5. The CFCI in the augmented specification was negative and statistically significant at a 5 percent level of significance, as expected.

In relation to the rules in terms of the Taylor principles as discussed in the methodology section, since the coefficient on the inflation gap was less than one and the coefficient on the output gap was positive, the results of both the standard and the augmented Taylor rules indicate that during the period 2000M1 to 2018M12, the SARB predominantly pursued accommodative MP. Furthermore, the results of both the standard and the augmented Taylor rules indicated that the monetary authorities in South Africa considered inflation expectations in the configuration of MP during the period under examination.

Furthermore, these results also indicated that during the period under examination, the SARB's behaviour was dominated by a preference for interest rate smoothing rather than for inflation or price stability and output gap stability. This was indicated through a larger value of the interest rate smoothing parameter of around 0.76, suggesting gradualism in interest rate setting while responding sluggishly to inflation and output, a situation referred to as monetary policy inertia. Despite the slower speed of adjustment of the interest rate to its fundamentals, the SARB still considered inflation expectations ahead of output gap when setting its policy rate, as the coefficient on the inflation rate parameter was larger than the coefficient on the output gap.

These results find support in the works of Söderström et al. (2005) and Nair and Anand (2020), where the authors found evidence of central banks' behaviour being predominantly dominated by a preference for interest rate smoothing over and above inflation and output

stability. These results are, however, in contrast to the works of [Ellyne and Veller \(2011\)](#) in which the SARB's behaviour was found to be most influenced by output stability rather than inflation. The differences in these results may be due to modelling strategy; while this article estimated the equations simultaneously, the other studies reported the results of equation-by-equation models.

In the results of the augmented Taylor rule, as shown in panel B of Table 1 the article explores the role of MP in stabilizing the financial system through the incorporation of CFCI in the reaction function. The priori expectation is a negative and significant coefficient with a value close to 0.5 in the CFCI parameter, in accordance with the literature ([Hafner and Lauwers 2017](#); [Nair and Anand 2020](#)). The value of 0.5 means that the SARB can lean against the wind by targeting the aggregate FC (CFCI) as a fully flagged objective, while lower values indicate targeting the aggregate FC (CFCI) only as a genuine augmentation.

The null hypothesis is that the SARB did not respond to CFCI developments during the period under examination, against the alternative that the SARB responded to CFCI developments during the period under examination. The estimated reaction coefficient of the monetary policy rate to the CFCI was -0.012 for the full sample, statistically significant at a 5% level of significance. As a result, the null hypotheses of no response by the SARB to CFCI developments is rejected and it is concluded that the SARB responded to CFCI developments during the period under examination.

The magnitude and negative sign of the CFCI mean that an appreciation of the CFCI led the SARB to decrease the target interest rate in the following month by 0.12 basis points, when all else held constant. This is evidence that monetary authorities were stabilizing the FC during the period under examination, though with a slightly moderate but highly significant magnitude. Contrary to [Bernanke et al. \(1999\)](#) and in line with [Nair and Anand \(2020\)](#) these results suggest that the SARB considered CFCI developments in setting interest rate targets.

Furthermore, these results point to accommodative MP during the period under examination, and this accommodative MP is also apparent in the positive and significant coefficient of the output gap. These results indicate that the SARB responded pro-cyclically to the FC developments, a result in line with the analyses by [Erler et al. \(2013\)](#). Regarding the rules in terms of the value of the coefficient of CFCI, the value of the coefficient was way below 0.5 (0.012); hence, it is deduced that the SARB can lean against the wind by the targeting the aggregate FC, only as a genuine augmentation, but not as a fully flagged objective.

Holistically, these results suggest that concerns of financial stability have been significantly reflected in MP configuration during the period under examination. The SARB pursued accommodative MP, thus responding pro-cyclically to the developments in the FC. Hence, there is evidence of a procyclical leaning against the wind during the period under examination. Therefore, contrary to [Hafner and Lauwers \(2017\)](#), these results suggests that the SARB considered CFCI developments in setting its interest rate targets, however, not as a fully-flagged objective, but as a genuine augmentation for informational purposes only. This is in line with the inferences made in [Bernanke et al. \(1999\)](#).

5.2. The Augmented Taylor Rule and the Analyses of Shocks

Through the adoption of the finance-augmented Taylor rule, this article investigates the impact of positive supply, demand, financial cycle, and interest rate shocks on the models' endogenous variables. The aim is to determine the role played by the FC in macroeconomic fluctuations. Accordingly, panels A–D in Figure 1 summarise the impulse responses of inflation, output, interest rate, and CFCI to positive demand, supply, interest rate, and FC shocks.

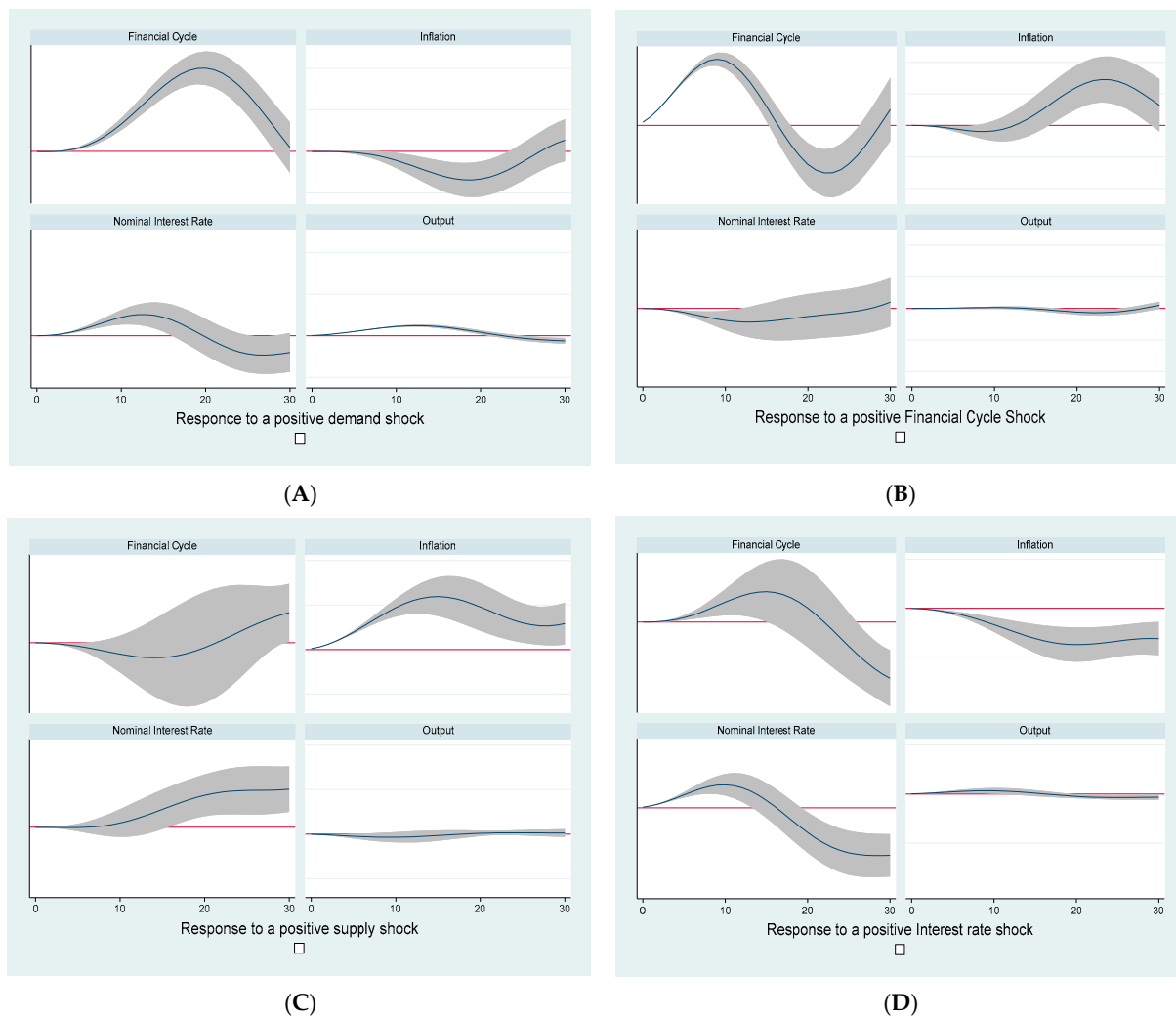


Figure 1. SVAR impulse response functions. Source: Author's own estimates. (A): Response to a positive demand shock, (B): Response to a positive financial cycle shock, (C): Response to a positive supply shock, (D): Response to a positive interest rate shock.

Figure 1A shows the response of the model's endogenous variables to a positive demand shock. In accordance with the above analysis of the augmented Taylor rule, a positive demand shock leads to an increase in the aggregate FC, output, and inflation while it also leads to a slight increase in the nominal interest rate. All indicators return to equilibrium after 24 months on average. Notably, a positive demand shock has a greater effect on the FC compared with other variables. This confirms the procyclicality of the financial system with the real economy, as observed in the model-based analysis above. This is in line with priori expectations and conforms to the relationships between these variables observed in the model system above.

Looking at Figure 1B, which shows the response of the models' endogenous variables to a positive interest rate shock, the nominal interest rate shock accordingly has the effect of decreasing the FC, thus confirming its association with the downward phase of the cycle. It also leads to a decrease in the inflation rate and nominal interest while leading to an increase in output, which returns to equilibrium after a year. The positive interest rate shock has greater significance since it leaves these variables in a state of disequilibrium for a very long time, except for output. While some quickly revert back to equilibrium, they remain volatile in the opposite direction.

A positive supply shock has the effect of increasing both the FC and output, with both the indicators reverting to a state of equilibrium in about a year after the shock. The shock

also has the effect of slightly increasing the nominal interest rate, which quickly adjusts back to equilibrium and remains in a state of disequilibrium in the opposite direction. In line with economic theory, a positive supply shock increases overall output and leads to a decrease in prices in the economy; hence, the decrease in inflation is well substantiated. Specifically, a positive supply shock shifts the AS curve to the right, yielding more real GDP at a lower price. This is associated with the downward shift of the Phillips curve towards the origin. The resulting effect is an economy that has lower unemployment and a lower rate of inflation.

The notion of a positive FC shock remains an issue of interest and has been relatively unstudied in the literature. Previous results have shown that fluctuations in the FC can themselves contribute to a shock (Ma and Zhang 2016). The analysis in the current article provides support for these results, with a positive financial cycle shock leading to a larger fluctuation in the FC around equilibrium, with no clear evidence of remaining in equilibrium. FC shock also leads to a decrease in the interest rate while it increases the inflation rate, with both variables returning to equilibrium about 28 months later. The effect of the shock on output fluctuations appears to follow the shock to the FC.

5.3. Robustness Test for the Finance Augmented Taylor Rule

To examine the robustness of the findings in Table 1, above, this study simultaneously re-estimated the standard and the finance-augmented Taylor rules utilizing an alternative measure of the FC. To this end, the study adopted the SARB FC proxy index representing a common factor extracted from an amalgamation of three financial time series indicators, namely, house prices, total credit, and equity prices. This proxy index was measured following the approach of the SARB, which was similar to the one proposed by Drehmann et al. (2012), but utilizing a different measurement methodology.

One reason for adopting this specification of the FC is that the current South African FC is measured based on the abovementioned procedure. Therefore, it should give a clear indication of the behaviour of the SARB with regards to financial system stability and the setting of its policy rate. Furthermore, it helps validate the proposed extension of the scope of financial variables used to measure FCs in South Africa. Results from this are shown in Table 2, below.

Table 2. MEGMM Output for the robustness testing of the Taylor Rules.

Equation	Parameter	Description	Value	J-Statistic (p-Value)
A. Monetary policy	$r_t = \varnothing_0 + \varnothing_1 \pi_{t+k} + \varnothing_2 y_{t+p} + \sum_{i=1}^p \rho_i r_{t-i} + \varepsilon_t$			71,714 (0.2253)
	ρ_i	Interest rate smoothing	0.762 *** (0.017)	
	\varnothing_1	Inflation expectations	0.279 *** (0.022)	
	\varnothing_2	Output gap	0.135 * (0.072)	
B. Monetary policy with FC	$r_t = \varnothing_0 + \varnothing_1 \pi_{t+k} + \varnothing_2 y_{t+p} + \varnothing_3 FC_t + \sum_{i=1}^p \rho_i r_{t-i} + \varepsilon_t$			71,714 (0.2253)
	ρ_i	Interest rate smoothing	0.764 *** (0.017)	
	\varnothing_1	Inflation gap	0.278 *** (0.022)	
	\varnothing_2	Output gap	0.140 ** (0.072)	
	\varnothing_3	FC proxy index	−0.002 ** (0.000)	

Note: Significance at 10%, 5%, and 1% levels indicated with *, **, and ***, respectively. Standard errors in parentheses Source: Authors' own estimates (2021).

Table 2 shows that the inclusion of the FC proxy instead of the CFCI in the simultaneous model did not have an effect on the output of the standard forward-looking Taylor rule,

as the estimated output was still the same as that in Table 1 panel A. Compared with the standard Taylor rule output, the inclusion of the FC proxy in the reaction function of the finance-augmented Taylor rule also left the parameters of the inflation gap and the output gap unchanged, and their significance levels were also maintained.

As shown in panel B of the table, this article examines the possibility that the SARB responded to the SARB FC developments by including a FC proxy index in the reaction function of the finance-augmented Taylor rule. The predictable response to the FC proxy was -0.002 for the whole sample; therefore, the null hypotheses of no response by the SARB to the FC proxy is rejected at a 5% level of significance. Hence, this finding suggests that the SARB considered developments in the FC proxy only as a genuine augmentation than a fully flagged objective. The magnitude and sign of the coefficient followed economic reasoning and were in line with the analyses in the previous section, although the magnitude was smaller than that of the CFCI.

Holistically, these results reasonably suggest that the SARB pursued accommodative MP during the period under examination and responded in a procyclical manner to the developments of the FC, a result in line with macroeconomic theories and the findings above. These results further stress the behaviour of the SARB during the period under examination being highly dominated by inflation stability and the presence of monetary inertia. The difference in the magnitudes of the FC proxy (0.002) and the CFCI (0.012) points to evidence that there is greater information content in the CFCI than in the FC proxy.

Therefore, in line with Nyati et al. (2021), there exists room for extending the scope of time series indicators used to measure FCs beyond the indicators of credit, house prices, and equity, the failure of which may allow vulnerabilities to accumulate unnoticed and pose threats to both the financial system and the real economy. Therefore, the SARB can lean against the wind by targeting the CFCI, but only as a genuine augmentation and not as a fully flagged objective.

6. Conclusions and Policy Recommendations

The main aim of this article is to provide answers to the questions of whether monetary policy in South Africa should respond to financial imbalances, and what is the role of monetary policy in minimizing financial instabilities/imbances in South Africa? Our contribution is threefold: First, we show that there is better information content to be gained in targeting the aggregate FC than individual variables. Second, we show that the financial system and real economy of South Africa are better stabilized under the finance-augmented Taylor rule. Third, we show that the SARB can lean against the wind by targeting the aggregate financial cycle, but only as a genuine augmentation and not as a fully flagged objective. An MEGMM and SVAR methods were adopted for the analysis of these objectives. Specifically, through the adoption of the MEGMM, this article simultaneously estimates and compares both the finance-augmented and the conventional Taylor rules.

The analyses of the standard and finance-augmented Taylor rules revealed several important points about MP during the period under examination. Among other aspects, South African MP had a forward-looking inflation target during the period under examination and the SARB behaviour was dominated by a preference for inflation stability over output, which is in line with the Taylor principle and the price stability mandate of the SARB. The presence of monetary policy inertia was prevalent in all four specifications, indicating a slower speed of adjustment of the policy rate to its fundamentals, and hence, a gradual adjustment of the interest rate while responding sluggishly to inflation and output stability.

Furthermore, the SARB pursued accommodative MP during the period under examination, to stabilize the South African economy, and it considered developments in the FC when setting its policy rate. Generally, there is evidence of a pro-cyclic leaning against the wind by the SARB in targeting the FC in South Africa. Overall, while literature is still inconclusive on the effect of the FC on BC fluctuations, and whether MP should respond to financial instabilities, the analysis presented in this article suggests that there is clear evidence to conclude that developments in the financial system lead developments in the

real economy and vice versa. This means that to stabilize the economy, the SARB needs to consider developments in the financial system, and in cases of financial system stability, the SARB should consider real economic developments.

Furthermore, there is clear evidence to conclude that the SARB should consider extending the scope of financial time series variables used to measure FCs in South Africa. There is clear evidence to conclude that MP in South Africa can lean against the wind by targeting the FC in the country, but only as a genuine augment and not as a fully flagged objective. This adds new evidence to the South African literature on the prevailing debate of whether MP should respond to financial system developments.

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