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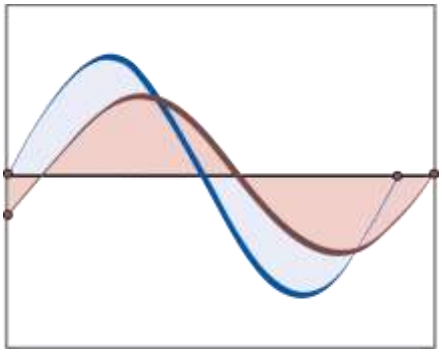

Monetary and Financial Stability Policies: Complementary or Conflicting?

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The paper examines the interaction between monetary and financial stability policies. While the two policies are separate, they can impact mutual channels of credit, capital flows and asset prices. Therefore, the research examines some country experiences to identify potential frictions and possible solutions. In these cases, macro-prudential policy is seen as an effective tool especially where monetary policy is constrained. To examine the interaction of these two policies in the domestic context, a Factor Augmented Vector Autoregressive (FAVAR) model is applied. In the absence of explicit macro-prudential policy, a generalized Macro-prudential Policy Index (MPI) proxy represents cross-sectional and pro-cyclical adjustments. The model estimates interactions of the MPI with monetary policy (the repo rate) over the period September 2002 to June 2016. Results indicated that the MPI occasioned a more substantial impact on credit and lending spreads with less reliance on the repo rate. This suggests that the introduction of macro-prudential policy can positively support the monetary transmission mechanism and improve overall financial stability. This paper makes a case for a macro-prudential policy framework in Trinidad and Tobago and the potential benefits that can be gained from co-ordination with monetary policy.

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1. Introduction

Prior to 2008 Global Financial Crisis, the prevailing regulatory paradigm was that monetary policy would ensure price stability, while financial stability risks would be contained using micro-prudential regulation. In this context, financial crises were seen as the result of exogenous shocks and were addressed on an ex-post basis. However, the increasing size and complexity of the global financial system escalates the potential significant costs to economic growth through financial crises. Regulators in some jurisdictions have used macro-prudential policy to explicitly address systemic risks to financial stability. Thus, the interest in financial stability as a categorical objective has surged. Empirical research is still however in nascent stages, especially regarding the assessment of interactions with more traditional measures such as monetary policy. This paper attempts to detail the interactions between financial stability policy and monetary policy and identify the potential impact for Trinidad and Tobago.

Research into monetary policy and financial stability interactions became more prevalent as many jurisdictions introduced explicit financial stability objectives, new macro-prudential policy and expanded monetary policy tools after the 2008 Crisis. However, policy makers were also concerned about the impact these modifications would have on short and long term macroeconomic performance. Although the policy objectives are distinct, shared policy space and mutually affected variables imply that monetary policy and macro-prudential policies are bound to coincide.

Conventional monetary policy has used policy rates and open market operations to influence the cost of borrowing and by extension credit growth. This notion accepted that the economy and financial system were subject to cyclical behaviour, and policy instruments were utilised to stabilize the economy and support growth. However, recent research (Adrian and Lang 2016) has found that in some cases monetary policy action has the potential to amplify the pro-cyclicality of leverage and asset prices. Low interest rates and relaxed lending standards, concurrent with easy monetary conditions can lead to credit booms. As monetary policy corrects for resultant rising inflation, higher debt levels and rapidly increasing interest rates can trigger systemic defaults and compromise financial stability. The reverse is also true. Financial stability goals often include higher capital reserves and lower credit growth which may counteract monetary policies seeking to boost inflation and output.

The Trinidad and Tobago (TT) monetary policy framework consisted mainly of open market operations and reserve requirements in the 1990's. However, since 2002, monetary policy has relied on the 'repo rate' instrument to influence the structure of interest rates in the financial system. In contrast, while financial institution stability has always been the responsibility of the Central Bank, an explicit macro-prudential framework is currently under development. Currently, Trinidad and Tobago does not have a comprehensive financial stability approach but the

mandate is split among regulators In TT. Monetary policy is the primary objective of the Central Bank and the study focuses on the response of the macro-prudential policy proxy to adjustments in monetary policy. The potential policy interactions for TT are estimated using a Factor Augmented Vector Auto-regression (FAVAR) model where financial stability policy is proxied by a Macro-prudential Policy Index (MPI).

The first section of the paper provides the research objectives, the second presents the review of the literature, the third includes a background and stylized facts, the fourth section outlines and examines the empirical model as well as discusses the results. The last section concludes and offers policy recommendations.

2. Literature Review

Empirical literature in the field of macro-prudential policy interactions is dominated by dynamic stochastic general equilibrium (DSGE) models with a minority using structural approaches. Researchers often augment the DSGE by one of two methods to compensate for the absence of a financial sector in the original models. The first approach models financial frictions between agents. It incorporates the financial accelerator mechanism theory and often adjusts collateral constraints or lending spreads to accommodate macro-prudential policy (Suh 2012, Antipa and Matheron 2014). The latter amendment to the standard DSGE model is the inclusion of a financial intermediary or sector (Kiley and Sim 2015, International Monetary Fund 2012, Ozkan and Unsal 2014, Medina and Roldós 2014).

Ultimately, the results from macroeconomic models suggest an optimal policy mix will maximise welfare by maximising output in the long run. In the event that there are distortions which potentially reduce welfare, regulators will issue policy which addresses short to medium term goals (price or financial stability) without sacrificing long run objectives. Many of the papers caution that results are dependent on the economy's position in the business and financial cycles, the level of co-ordination and the amount of leverage. However, the general consensus remains that macro-prudential policy is largely supportive of monetary policy in the long run especially in stable economic conditions by reducing accelerator effects. Conflicts did manifest in some experiments which resulted in the deviation from short term inflation targets, especially where shocks were financial in nature (Beau, Clerc and Mojon 2012, Angelini and Neri 2012). Although, it is important to note that there is an improvement in welfare gains when there was policy co-ordination.

Although the common choice for modelling monetary and macro-prudential policy, DSGE models are subject to some limitations. For instance, DSGE models are still not generally considered to be able to consistently outperform traditional VAR analysis (Tovar, 2008). Recent assessments (Domit, Monti and Sokol, 2016) have shown that medium-scale Bayesian VAR's in particular have generally exceeded the forecast performances of DSGE models. Additionally, standard DSGE model setups inadequately model financial sectors and frictions (Brazdik, 2012), which limits conclusions that may be drawn from them.

Kim and Mehrotra (2015) opted for a structural vector autoregressive (SVAR) model to examine macro-prudential and monetary policy interactions. A panel VAR and individual VARs were applied to four inflation targeting countries. Macro-prudential policy was represented by means of an index and financial stability objectives were proxied by private sector credit. Results indicated that a one standard deviation shock to monetary policy and macro-prudential policies respectively did have an impact on credit and inflation. The change in output from macro-prudential measures depended on the intensity and type of policy tool implemented. The research concluded that macro-prudential policy has a propensity to reduce inflation which could present policy challenges in periods with low inflation and credit booms. This is especially a concern for countries following inflation targeting frameworks. Nevertheless, standard VARs and SVARs have a limited number of parameters and using total credit as the sole objective of macro-prudential policy is an oversimplified assumption.

As monetary policy research expands to focus on the impact decisions may have on financial stability, the factors which influence policy have expanded beyond inflation and output (Bailliu, Meh and Zhang 2015, Federal Reserve Board 2016). Equally, macro-prudential policy is not set in isolation of financial variables and may consider aggregate demand as well (Committee on the Global Financial System 2010). Developments into research on transmission mechanism channels evolved to include non-traditional aspects which could impact the distortion of policy (Boivin, Kiley, & Mishkin, 2010).

Research based on monetary policy and financial stability in Trinidad and Tobago has largely been confined to their respective topic areas. Monetary policy research focused on the macroeconomic impact, while financial stability research was limited to examining for the presence of macroeconomic shocks on International Monetary Fund (IMF) Financial Stability Indicators (FSIs) such as, capital adequacy and non-performing loans (Rahaman, Mahabir, & Baksh, 2015). For Trinidad and Tobago, a noteworthy precursor is Rahaman, Mahabir and Majid (2015), who utilised correlation analysis and a vector autoregressive model to establish that price stability and financial stability were closely related. No conclusions were drawn, however, regarding the impact of policy on these objectives. Accordingly, policy interactions and the corresponding impact on price stability, financial stability and output are still largely unexplored in the domestic context. This paper seeks to augment existing domestic financial stability literature by examining international experience in context with current financial stability structures for Trinidad and Tobago[1].

3. Background and Stylised Facts

Due to the relative novelty of macro-prudential policy, the scope and frameworks for financial stability are heterogeneous across jurisdictions. This section attempts to clarify some of the fundamental concepts which

[1] A careful review of the economic literature in the Caribbean suggests that this paper is the first in the region to employ a FAVAR framework to model interactions between financial stability and monetary policy.

underpin the interaction of the two policies and identify conditions where conflicts can arise. Additionally, some cases of importance to the domestic context are briefly related.

Firstly, defining and measuring financial stability is not as straightforward as price stability. Financial stability can be defined as a condition in which contractual obligations can be met without external assistance, and that asset prices do not exhibit substantial volatility (Central Bank of Trinidad and Tobago, 2008). Macro-prudential policy has focused on financial stability objectives and has been defined as the use of primarily prudential tools to limit systemic risk (International Monetary Fund, 2013). While inflation is the indicator of price stability there is no similar explicit financial stability indicator[2]. Total credit is often used as a measure of financial stability (Kim and Mehrotra 2015). Some research argues however that composite measures of financial stability better reflect a multifaceted concept (Gadanecz and Jayaram 2009, Albulescu 2013).

a) International Policy Interactions in Practice

The outcome of policy interactions can be diverse in practice. Macro-prudential policy spans a wide range of instruments and objectives, some of which influence similar channels as those of monetary policy. Additionally, the diversity in supervisory and regulatory structures across regions can also impact the successful interactions between policies and subsequent policy outcomes. The case studies selected for this research paper provide an illustration of policy interactions in practice and drivers of the respective outcomes, especially as policy interactions in models are often subject to the Lucas critique.

i. Brazil: Policy interactions and Liquidity

Open, commodity-based economies often struggle with monetary policy since there is the potential for increased capital flow volatility which can intensify financial sector fragility (International Monetary Fund, 2012). If policymakers respond to credit booms by tightening financial conditions or there are capital flow reversals, this can increase financial fragility. The economy faces liquidity shortages which can increase systemic risk.

Brazil has used macro-prudential policies to support monetary policy and limit financial stability risks since the introduction of the tools in the post 2008 period (International Monetary Fund 2013). The Reserve Requirement (RR) is generally used as a direct monetary policy tool. However, the Central Bank of Brazil has implemented it as a macro-prudential policy tool to limit financial sector risk in periods of declining liquidity.

Counter-cyclical adjustment of the RR over the periods of the 2008 Financial Crisis, the 2013 Taper Tantrum and the 2014 collapse in global commodity prices, allowed policy makers to support financial sector liquidity conditions

[2] There are four broad categories of monetary policy regimes: inflation targeting; exchange-rate targeting; monetary targeting; and policy with an implicit but not an explicit nominal anchor (Mishkin 1998). Popularity among policy makers, as well as coordination efficiencies with macro-prudential policy objectives, contributes to dominance of the inflation targeting regimes in both theoretical and empirical research. Nevertheless, all regimes have as the ultimate goal low inflation and a stable economy.

without compromising the execution of monetary policy. The Central Bank of Brazil was able to tighten the SELIC (Sistema Especial de Liquidação e Custodia) rate, the overnight policy rate, to address rising inflation over the 2010-2011 and 2014-2015 periods without significant liquidity shortages.

ii. Sweden: A Tale of Two Mandates

Generally, monetary and financial stability policy interactions result in welfare gains when adequately co-ordinated. In practice, macro-prudential policy needs to be calibrated to mitigate systemic risk. The unconventional monetary policy measures adopted by European countries can prompt unsustainable credit growth and debt levels. Sweden's experience demonstrates that the appropriate choice of policy instruments is essential in addressing financial stability risks.

Owing to the size, interconnectedness and concentration levels in the Swedish financial system, beginning in 2010, the Financial Stability Council (FSC) implemented a Countercyclical Capital Buffer (CCB) and a Loan to Value (LTV) limit on mortgages with the aim of strengthening the buffers of the banks and protecting depositors. However, the Sveriges Riksbank, to mitigate the risk of deflation, introduced a negative policy rate in March 2015. The ultra-low interest rate environment coincided with a boom in residential property prices (International Monetary Fund 2016b).

Household debt continued to accumulate despite the introduction of LTV measures. LTV caps are often combined with Debt-to-Income (DTI) caps since LTV only manages the financial institution exposure and not the household debt exposure. Debt levels can then continue to accumulate unsustainably which increases financial system vulnerability. In such a case, macro-prudential policy had not addressed the imminent risks and had limited success in curbing the financial stability risks of unconventional monetary policy.

iii. Korea: Sectoral applications of financial stability policies

Korea has been one of the pioneers of financial stability policies owing to the impact of the Asian Financial Crisis in the late 1990's. To address the pro-cyclicality of asset prices and credit, Korean authorities introduced limits on loan-to-value (LTV) and debt-to-income (DTI) ratios in 2002 and 2005 respectively.

Like Sweden, Korea has high household debt because of the level of property prices, especially in areas where speculative demand is high. However, macro-prudential measures have curbed the systemic risk in the real estate and mortgage market (International Monetary Fund 2016a.). Default rates are low and the credit-to-GDP gap held at a moderate level of 3.1 per cent as at March 2016. This has been accomplished by the frequent and targeted adjustment of sectoral financial stability policies (Igan and Kang 2011).

The Bank of Korea (BOK) has adopted an inflation targeting framework in order to meet price stability objectives. Financial stability policies also allowed the BOK to pursue expansionary monetary policy after the 2008 financial crisis and again in 2011/ 2012 while limiting systemic risk.

iv. Hungary: Policy Interactions and Foreign Currency Debt

The Central Bank of Hungary, Maygar Nemzeti Bank (MNB), responds to macroeconomic downturns with accommodative monetary policy to stimulate lending and aggregate demand. However, lower policy rates have an adverse impact on capital flows and results in exchange rate depreciation. As an emerging European economy, Hungary applied macro-prudential policy to limit systemic risk from a declining Hungarian Forint and high levels of foreign currency borrowing, which monetary policy alone could not address.

In the run up to the 2008 Global Financial Crisis, a significant number of households engaged in 'carry trades' which increased foreign currency risk. They borrowed in euro currency to take advantage of lower interest rates. The borrower would accept the risk that the debt could balloon if the domestic currency devalued. Credit intermediaries funded this borrowing with the expectation that the MNB would offer support in the event of foreign exchange liquidity pressures. By the end of 2009, external debt was at a record high and coincided with the economic decline of the crisis. This put the central bank in a difficult position to stimulate lending which could increase default risk and negatively impact financial stability.

Systemic liquidity risk and maturity mismatches were addressed with the introduction of the Foreign Exchange Funding Adequacy (FFAR). The FFAR improved the resilience of foreign currency lending and supported MNB accommodative monetary policy. These monetary measures appear to have had some success since inflation moved closer to its target range by December 2015. These case studies underscore the important features of policy interaction. Firstly, the organisational frameworks for both policies should be firmly established. This ensures clarity in meeting respective policy objectives. A popular choice for co-ordination is housing the responsibility for both policies with the central bank or an executive committee. Antipa and Matheron (2014) explain that central banks are the most appropriate choice for macro-prudential supervision due to economies of scope, co-ordination benefits and strong incentives to avert financial crises due to their 'lender of last resort' function.

Secondly, minimising the negative effects of policy interaction requires that macro-prudential instruments directly address financial system risks. This entails guided research on the impact of specific policy tools and effective combinations. Furthermore, frequent surveillance and calibration of tools are required to mitigate risk while ensuring that credit growth and economic expansion are not unduly restricted.

b) Financial Stability and Monetary policy interactions in Trinidad & Tobago (TT)

Monetary policy and price stability objectives are the primary focus of the Central Bank of Trinidad and Tobago (CBTT). The legislation defining the CBTT's governance framework, the Central Bank Act, specifically mentions monetary stability with only inferred reference to financial stability through the regulation of the credit supply for the best interests of the country. The CBTT conducts monetary policy through the use of open market operations and the

'repo rate'. The repo rate was introduced in 2002 as the CBTT's primary policy instrument. The rate is the overnight lending rate for commercial banks and constitutes a signal for the direction of monetary policy. Changes in the repo rate are used to guide credit expansion and by extension price stability and output. The CBTT does not solely adhere to an inflation targeting framework. Other objectives include stable foreign exchange markets and reserves. This adds a layer of complexity to the conduct of domestic monetary policy and increases the channels through which policies can potentially interact.

The CBTT's financial stability mandate is guided by the Financial Institutions Act (FIA) 2008. The FIA describes the primary objectives with respect to licenced financial institutions which are to i) maintain confidence and stability in the financial system, ii) to oversee the payments systems, iii) to address the mitigation of systemic risk and, iv) preservation of confidence in these transfer mechanisms. Currently, no specific provisions for macro-prudential polices are described in the FIA and financial stability regulation is largely micro prudential in nature. Communication with the public on financial stability developments takes place on an annual basis through the Financial Stability Report. As mentioned previously, macro-prudential policy can coincide with monetary policy with possible feedback effects. Thus, the development of a macro-prudential framework for Trinidad and Tobago should include insights into policy interactions. The empirical section of the paper that follows will explore whether these interactions are present in Trinidad and Tobago.

4. Model, Data and Results

a) The Model

The factor augmented autoregressive (FAVAR) approach has been adopted by some researchers in isolating the policy transmission mechanism. Bernanke (2004) as well as Stock and Watson (2005) recognized that many time series can interact across dimensions which is critical to developing more robust monetary policy recommendations. They conclude that the use of FAVAR models offer a more comprehensive means of assessing policy measures than standard VAR models over a large set of variables. This is particularly useful for countries which do not pursue inflation targeting frameworks.

The procedure followed in this paper follows mainly from Bernanke (2004). If we begin with an *M x 1* vector of observable economic variables called Y_t, we may use the vector autoregressive (VAR) approach to determine the structural relationships between the variables. The VAR approach would take the following form:

$$Y_t = \Phi L Y_{t-1} + \varepsilon_t \qquad \text{(eq.1)}$$

In the above equation, ΦL is a lag polynomial of order *d* and ε_t is the mean-zero error term. All information relevant to the estimation of the model may not, however, be captured in the Y_t variable. We assume therefore, that there exists a *K x 1* vector of unobserved factors called F_t that can capture additional information relevant to the elements of Y_t.

The factors in F_t can be thought of as broader economic concepts than the definitions of time series variables. While the time series of private sector credit data, for instance, will only reflect the private credit aggregate in an economy, a factor based on different credit variables can be thought of as 'credit conditions'. Thus, the ideal factor is one which can be reflected across a broad range of variables, but difficult to capture in a small number of series.

Equation 1 can therefore be rewritten to include F_t as follows:

$$\begin{bmatrix} F_t \\ Y_t \end{bmatrix} = \theta L \begin{bmatrix} F_{t-1} \\ Y_{t-1} \end{bmatrix} + \mu_t \qquad \text{(eq.2)}$$

In this equation θL is a lag polynomial of order *f* and μ_t is the mean zero error term with a covariance matrix Q. The inclusion of the vector of factors F_t allows us to describe the equation system as a factor-augmented vector auto regression (FAVAR). A FAVAR setup was chosen given several limitations on conducting DSGE models.

The FAVAR setup is thus able to incorporate information from a large number of variables. Applying the FAVAR model to Trinidad and Tobago's data serves the purpose of accounting for the potential effect of broad, unobserved factors on empirical outcomes. As macro-prudential policy often depends on risk surveillance from a multitude of variables and depends heavily on broad economic concepts such as 'contagion' and 'interconnectedness', application of a FAVAR model to a proxy of macro-prudential policy can be appropriately used to model policy interactions in the context of domestic data.

b) Data

A dataset of 54 variables is used in populating Y_t, reflecting the major sectors of the economy of Trinidad and Tobago. They can be generally subdivided into representing the domestic, external, government, financial and regulatory sectors of the economy, with standard macroeconomic and policy variables included. In the model, the impact of macro-prudential policy is approximated by formulating a countercyclical response to an index of relevant conditions[3]. The period spanned by the data is September 2002 – June 2016, a total of 56 observations per series[4].

[3] A comprehensive list of variables can be found in Appendix A.

[4] In the derivation it is shown that in a FAVAR, the number of informational time series may be large relative to the time period i.e., the factor augmentation relaxes the limit on the instability introduced by adding variables.

As per the requirements of the 'Bernanke Two-Step' FAVAR setup, 31 of these variables were considered to be 'slow moving'. A variable was considered to be slow moving if it reflected an economic aggregate or balance, as opposed to a variable that represented a rate or index. These variables were assumed not to respond contemporaneously to the variable at the head of the vector Y_t. The data were subject to the Z-score standardisation as per Mizen et al, (2015), where the transformed variable $Z_{it} = (Y_{it} – \mu_i)/\sigma_i$, where i = 1,2… N and t = 1,2,…, T. Y_{it} is the unstandardized variable, and μ_i and σ_i are the respective means and variances of the variables in Y_t.

c) The Macro-Prudential Index (MPI)

As there are currently no explicit macro-prudential tools operated by Trinidad and Tobago authorities, a hypothetical macro-prudential policy variable is formulated for the model. In the model, the operational target of the macro-prudential tool is taken to be a composite index consisting of the sum of the growth rates of i) total credit, ii) capital to assets and iii) non-performing loans in the banking system of Trinidad and Tobago. These components are consistent with operational targets examined in the literature, as well as from the previously mentioned case studies, and can serve to construct an appropriate 'multifaceted' indicator. The effect of the macro-prudential tool itself is based on a reaction function of the form $M_t = \lambda T_t \mid \forall\ M_t \neq 0 : [\mid T_t - \bar{T}_t \mid > \mid \Psi_t - \bar{T}_t \mid]$ which states that the macro-prudential intervention M_t is mapped through a coefficient λ, associated with its target variable T_t, such that all interventions ($M_t \neq 0$) occur when the divergence of the target variable from some steady state proxy exceeds some acceptable degree.

In this case, the composite index described previously was weighted by the growth rate of output, to derive an index of macro-prudential indicators (MPI). The steady state proxy is in this case the average value of the MPI, (which becomes $\bar{T}_t$). Macro-prudential policy intervenes when $\bar{T}_t$ exceeds some degree of acceptable divergence ($\mid \Psi t - \bar{T}_t \mid$), and in this formulation and the threshold variable Ψ_t is taken to represent a limit of one standard deviation (approximated to the nearest whole number) away from the mean $\bar{T}_t$. To reflect the countercyclical nature of macro-prudential interventions, the sign of the parameter λ should be negative, while the level of the threshold variable Ψ_t is at the discretion of the policymaker[5].

The profile of interventions can therefore be denoted in the same terms as the target, and the formulation is subtracted from the MPI to derive a secondary series displaying the hypothetical effects of this intervention. The secondary variable represents the resulting value of the MPI subject to a macro-prudential intervention that is activated when this index exceeds a particular threshold of one standard deviation above or below its mean. The tool automatically represents a 'no-miss' policy, meaning that all deviations of the variable outside predetermined thresholds of stability cause an intervention. No coordination with monetary policy is assumed.

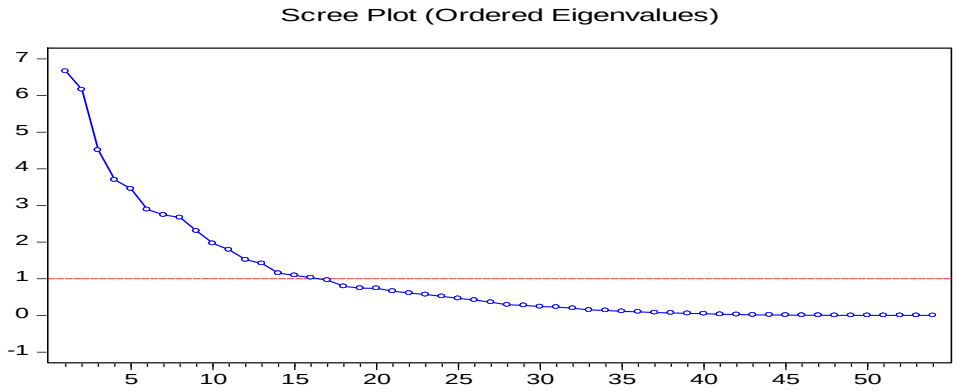
[5] The parameter λ is taken as -1.0 in this formulation.

The counterfactual MPI is ordered at the head of the system to represent the origin of the source of disturbances[6]. The effects of this macro-prudential policy intervention on the sub-sectors of credit i.e., business and consumer credit, on monetary policy vis-a-vis the reaction of the repo rate, and on the macro economy via output and inflation will be the focus of the model[7]. In order to provide a basis for benchmarking, the estimation was performed on the variables of interest for the 'policy-on' and 'policy-off' scenarios, i.e., the scenarios where the macro-prudential tool was engaged and disengaged respectively.

d) Results

The estimated models for the policy on and policy off scenarios returned acceptable results when checked for serial correlation, stationarity and heteroscedasticity[8]. The model was identified via the approach of Bernanke (2004) in imposing the factor restriction, to derive $\hat{F} = \sqrt{T}\hat{V}$, with $\hat{V}$ equal to the K largest eigenvalues associated with the informational time series. The scree plot of eigenvalues in Figure 1 below associated with Y_t suggested a large 'K', but the size of K was ultimately limited by minimum stability requirements for the model[9].

Figure 1
Scree Plot of Factors

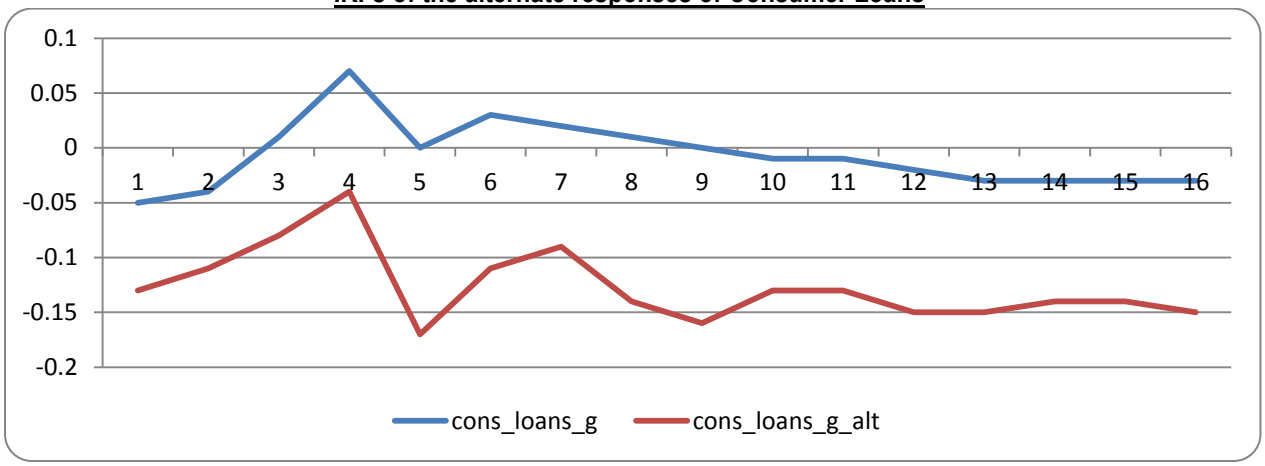


Source: Authors' derivations in EViews.

[6] A Cholesky ordering system is used in the FAVAR algorithm.
[7] The subsectors of credit and the Repo rate are transformed versions of their raw data. To minimize the effect of stochastic drift on headline inflation, a Christiano-Fitzgerald Filter of six lags was applied. The output data was the first differenced logarithm of the Quarterly Index of Economic Activity of the Central Bank of Trinidad and Tobago.
[8] Tested via the LM test for serial correlation, finding the inverse roots of the characteristic polynomial for stationarity, and the White test for heterokedasticity. Results can be supplied per request.
[9] The FAVAR was ultimately estimated with 2 lags and 8 factors included.

The impulse response functions (IRFs) associated with the policy-on and policy-off scenarios are presented in the Figures below. Difference testing showed that the means of the pairs of IRFs were significantly different from each other in the policy-on and policy-off scenarios, supporting the notion that the application of the macro-prudential intervention was effective in 'shifting' the subsequent variables[10] :

Figure 1
IRFs of the alternate responses of Consumer Loans

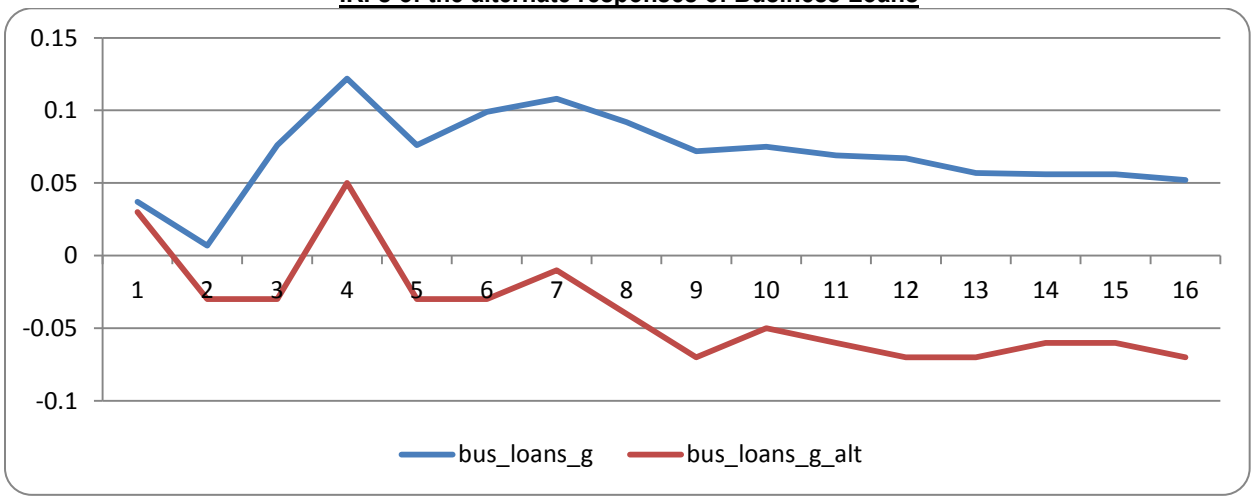


Source: Authors' derivations in EViews.

Figure 2 above shows the response of the consumer loans variable to the MPI under both scenarios. It should be remembered that private sector credit growth is considered in the MPI. However the response to the shock from the policy-off MPI (CONS_LOANS_G), shows that consumer loans initially declines, but recovers before declining again over the full extent of the reference period. In the policy-on scenario (CONS_LOANS_G_ALT) the entire IRF is in negative territory. Mitigating the movement of the MPI to remain within one standard deviation of its mean therefore results in cumulatively lowered consumer credit.

[10] Difference test results can be supplied on request.

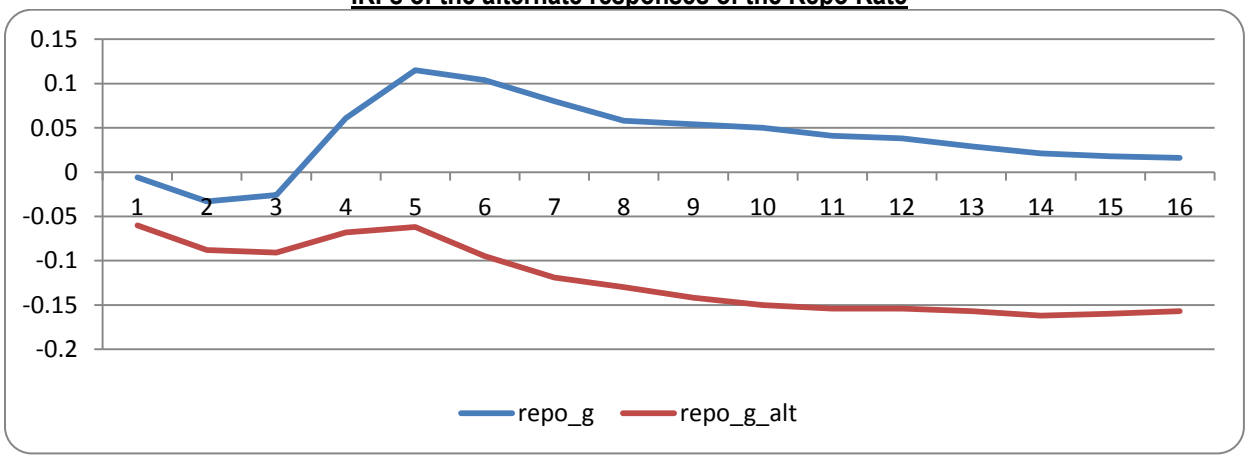
Figure 2
IRFs of the alternate responses of Business Loans



Source: Authors' derivations in EViews.

To investigate potential cross-sectional effects, a second component of credit was included in the form of business loans. In Figure 3 above, the policy-off scenario IRF (BUS_LOANS_G) responds to an MPI shock with minimal movement in the initial periods but an increase thereafter, until tapering off slowly to the end of the reference period. The IRF for the policy on scenario (BUS_LOANS_G_ALT) however ends up in a cumulatively negative position after some cyclicality in the initial periods, implying again that keeping the MPI in-band would cumulatively lower business credit in this case.

Figure 3
IRFs of the alternate responses of the Repo Rate

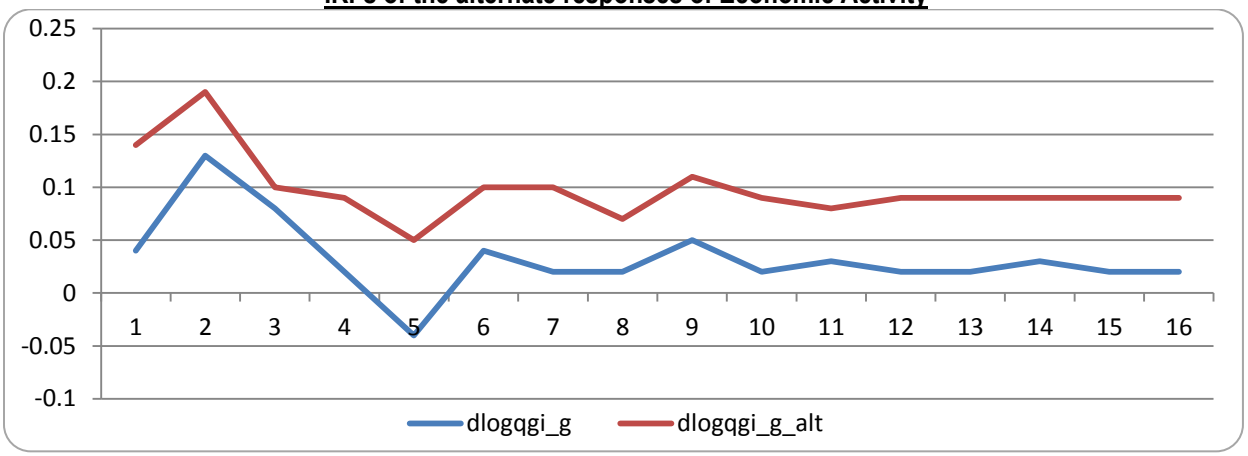


Source: Authors' derivations in EViews.

Figure 4 relates the interactions between the MPI scenarios and the Repo Rate. The policy-off scenario (REPO_G) initially shows accommodation, then shows tightening after the fourth period, before gradually tapering off to the end of the reference window. The initial accommodation is not surprising if we interpret the initial shocks to the MPI

scenarios to proxy financial instability improvements. These in turn slow the respective subsectors of credit. In both the cases of policy-off consumer and business loans however, a recovery was staged in the fourth period, likely prompting the observed tightening of the repo rate. The policy-on scenario (REPO_G_ALT) relates an entirely negative IRF, signalling accommodative monetary policy for the entire period. This response does not necessarily originate to deal with financial instability however, but as a response to lowered consumer and business loans in the policy-on scenario. In this case, keeping the MPI 'within-band' through macro-prudential interventions seems to elicit an accommodative response from monetary policy.

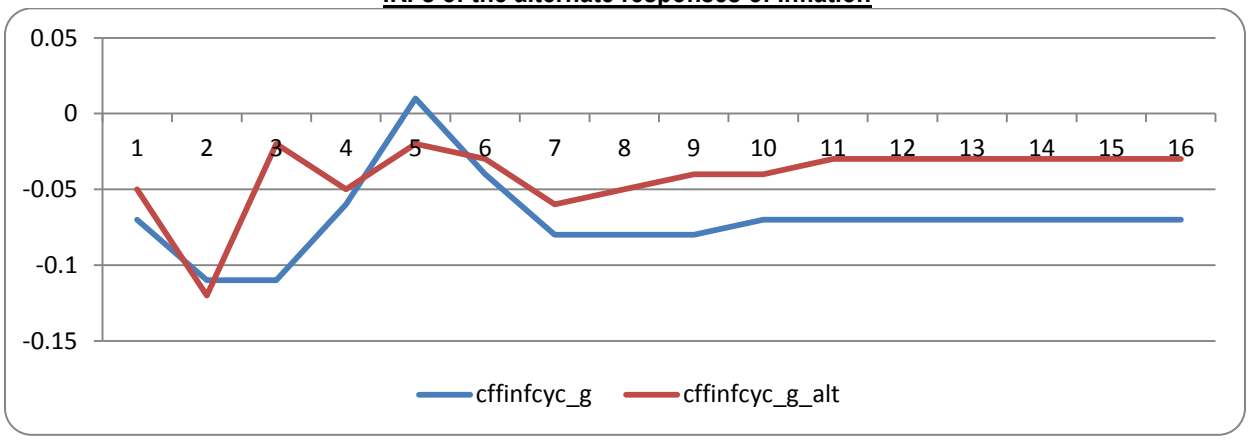
Figure 4
IRFs of the alternate responses of Economic Activity



Source: Authors' derivations in EViews.

The responses of economic activity to the alternative MPI scenarios are considered in Figure 5. The policy-off scenario (DLOGQGI_G) shows a sharp upward response in the initial periods, before dipping suddenly in the fifth period. The IRF then settles at a marginally positive position by the end of the reference period. The IRF for the policy-on scenario (DLOGQGI_G_ALT) shows that after a similarly sharp upward response in the initial periods, economic activity settles at a higher cumulative level than in the policy-off scenario. The implication here is that the macro-prudential intervention staves off losses in economic activity.

Figure 5
IRFs of the alternate responses of Inflation



Source: Authors' derivations in EViews.

The responses of inflation in the various scenarios are considered in Figure 6. In the policy off scenario, inflation (CFFINFCYC_G) settles at a cumulatively lower level after some initial volatility. The policy-on scenario (CFFINFCYC_G_ALT) follows a similar path but does not settle at as low a level. This effect becomes important in the context of inflation targets and shows that a policy-on MPI scenario is preferable to the more deeply affected policy-off scenario.

5. Discussion

The FAVAR included latent information about the economy and financial system outside the variables used to generate the IRFs. As in the present case, where data availability is restrictive, this characteristic of the FAVAR is valuable.

The differences between the IRFs for the policy-on and policy-off scenarios highlight the effect of the macro-prudential policy intervention on the variables. With respect to the policy-on scenario, we observe that the effect of a macro-prudential policy intervention on the MPI index lowers both consumer and business credit. An ideal intervention may not necessarily lower the IRF's of credit over the entire time horizon, as this implies credit levels in these subsectors may be egregiously high in policy-off circumstances. While this may provide an appropriate rationale for intervening against financial instability, an IRF relaying a shorter-term decline followed by a rebound of the credit subsectors settling at a non-negative level would likely be considered more desirable and plausible. The profiles of the particular IRFs however are sensitive to the components and calibration of the MPI itself, as well as the criteria used to intervene.

The research aims to estimate the impact of macro-prudential policy on the dominant central bank objective, of macroeconomic stability through monetary policy. The shock to the financial system results in lower levels of activity

observed in the credit sub-sectors. This relationship is important, as financial instability from the MPI shock, in both scenarios, resulted in credit subsector declines. Expectedly, these declines were followed by decreases in the Repo rate. However, as the IRF business credit in particular increased early in the policy-off scenario, the Repo rate also increased, despite the consumer credit IRF becoming negative. This policy-off relationship between the Repo rate and business credit becomes important if the response of the Repo rate to business credit is interpreted as the monetary authority pursuing financial stability objectives after a financial shock. The increase in the Repo rate IRF can then be interpreted as an attempt to keep business loans from increasing beyond a certain level. This also implies that the decline in consumer credit is less likely to contribute to financial instability in this case.

As the macro-prudential intervention in the policy-on scenario bears out however, the Repo rate IRF is entirely accommodative. Keeping the MPI within one standard deviation of its mean results in a decline in both of the credit sub-sectors, implying either credit levels were too high to remain stable in the context of an MPI shock, or perhaps that the threshold for macro-prudential intervention is restrictive. However, the IRF for economic activity in the policy-on scenario settles at a cumulatively higher level than the policy-off scenario, suggesting that application of the macro-prudential tool results in some gains to output, owing to improved financial stability conditions. This is concomitant with the decrease in the policy-on Repo rate, but not so with declining credit. However, there may be several other channels accounted for in the factor-based aspect of the model that are not explicitly accounted for in the six variables used in the IRFs, but which may transmit the growth inducing effects of a macro-prudential intervention via an accommodative Repo rate. This effect on growth leads to the conclusion that the macro-prudential intervention is not restrictive or onerous.

Additionally, in both the policy-off and policy-on scenarios, inflation cumulatively declines. Inflation in the policy-on scenario however declines to a lesser extent. This seems to constitute a classic 'price puzzle' in the policy-on scenario, as the Repo rate also declines. Why the model eliminates the price puzzle in the policy-off scenario but reveals it in the policy-on scenario can be perplexing. The answer may lie in the notion that the Repo needed to decline more sharply to induce an increase in inflation. The result is however consistent with Kim and Mehrotra (2015) pertaining to the way macro-prudential policy affects inflation. It shows that macro-prudential interventions can facilitate accommodative monetary policy and increased economic activity in the context of low inflation. Even though inflation declines, the policy-on scenario shows it does not deviate as greatly from its original position. Thus, in the context of meeting inflation targets, mitigating financial instability through macro-prudential intervention is shown to be more appropriate than attempting to do so through the Repo rate. This is commensurate with the literature on policy interactions which indicate that it is largely welfare maximising to apply macro-prudential policies to financial stability issues with the exception of business sector credit

6. Recommendations

Generally, interaction of the monetary and macro-prudential policy has been complementary, contingent on sufficient co-ordination. Optimal policy interaction was found to occur where monetary policy focuses on price stability while macro-prudential policy addresses financial stability effects. Internationally, jurisdictions have found that the nature of the shock determines the response. Productivity shocks which occur in the real sector should be met with a broad monetary policy reaction. However, disruptions which are financial or sectoral in nature entail a more bespoke macro-prudential approach. Nonetheless, constraints in either area may require policy makers to widen the policy scope or consider appropriate calibration if financial system risk accelerates. In such situations, policy makers should consider the opportunity costs of policy actions where there is a conflict. This is especially the case when pursuit of immediate economic expansion may compromise stability in the long run.

In this paper, a FAVAR outlining the effects of a counterfactual macro-prudential instrument on the financial sector, the real sector and on monetary policy was modelled to accurately detail the TT condition. The FAVAR was ordered in a manner to examine the impact of a monetary policy shock on macro-prudential policy and financial stability for two reasons. Firstly, as mentioned before monetary policy is the primary policy within the TT legislation. Secondly, macro-prudential policy can respond more quickly than monetary policy, making it the more appropriate policy to adjust. The FAVAR showed that application of the hypothetical macro-prudential tool restricted the consumer and business subsectors of credit, while bolstering economic activity and mitigating inflation in the medium to longer term. This was achieved in the context of more accommodative monetary policy. The FAVAR seems to favour macro-prudential policy as the appropriate short-term response to financial instability owing to its pinning down of the credit subsectors, in the context of increased economic activity. This may reflect that counter-cyclically applied macro-prudential tools like the one used in the model, have a more immediate, sector specific effect on the financial sector than the indirect tools utilised by central banks to conduct monetary policy. This allows the targeting of these specific sectors without large fallout.

While the assumption in this model is that macro-prudential and monetary policies are not coordinated, the bolstering effect on the real economy following a macro-prudential intervention suggests there may be space for coordination. That is, regulatory and economic payoffs may result from leveraging the interactive effects of monetary and macro-prudential interventions on the financial and real economic sectors. However, policymakers should also consider that the magnitude of the effects of countercyclical tools is responsive to the 'Ψ_t' thresholds used. The standard deviation threshold used here gave interpretable results, but less restrictive thresholds may have no effect. Tighter thresholds may even be destabilising. The 'intervention rule' must therefore be carefully considered, taking monetary policy into consideration even if there is no explicit coordination. Authorities should be particularly wary of an excessively severe

policy response which negates monetary policy changes while not adequately responding to systemic risk or policy externalities.

Lastly the choice of the macro-prudential target matters. A countercyclical tool was applied to the MPI in this case mainly because the MPI simulates a practical operational target for Trinidad and Tobago. However, more unified indices of financial or banking stability, retaining a suite of indicators properly reflecting different aspects of financial system risks may be usefully applied in future. The results of this study favour the introduction of macro-prudential measures since their application appears to improve wider economic performance. However, this study does not presume to prescribe a specific macro-prudential policy tool, nor does it suggest that all macro-prudential policies will perform in a similar manner. Future research should examine specific policy mixes and instruments for optimal results. In this fashion, regulators can appropriately address macroeconomic stability in a manner that does not compromise financial system stability.

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Appendix A: List of Variables Used

Full Dataset		Slow Variables
Notation	**Definition**	**Notation**
_3_MONTH_TBILL_RATE	3-month OMO Bill Rate	BOP_SURPLUS_DEFICIT
BOP_SURPLUS_DEFICIT	Quarterly BOP balance	BUSINESS_LOANS
BUSINESS_LOANS	Business Loans	COMBK_ASSETS
BUYRATE	Forex Buying Rate	COMBK_BORROWINGS_FROM_LO
CB_DISCOUNT_RATE	Central Bank Discount Rate	COMBK_LIABILITIES
CFFINFCYC	CF-Filtered Inflation Cycle	COMBK_PAST_DUE_LOANS
COMBK_ASSETS	Commercial Bank Assets	COMBK_TBILL_HOLDINGS
COMBK_BORROWINGS_FROM_LO	Commercial Bank Borrowings	CONSUMER_LOANS
COMBK_LIABILITIES	Commercial Bank Liabilities	CURRENT_ACCOUNT_BALANCE
COMBK_PAST_DUE_LOANS	Commercial Bank Past Due Loans	EXPORTS
COMBK_TBILL_HOLDINGS	Commercial Bank Treasury bill Holdings	FDI
CONSUMER_LOANS	Consumer Loans	FISCAL_BALANCE
COREINF	Core Inflation	FOR_CURR_DEP
CURRENT_ACCOUNT_BALANCE	Current Account Balance	GOVERNMENT_EXP
DEPOSITS	Commercial Bank Deposits	GOVERNMENT_REV
DLOGQGI	Transformed Version of the Quarterly Index of Economic Activity	IMPORTS
EXPORTS	Exports	INTERV
FDI	Foreign Direct Investment	LA_LOCAL_CASH_IN_HAND
FISCAL_BALANCE	Overall Fiscal Balance	LA_REQUIRED_RESERVES
FOR_CURR_DEP	Commercial Bank Foreign Currency Deposits	LA_SPECIAL_DEPOSITS
GOVERNMENT_EXP	Government Expenditure	LACASH_RESERVES
GOVERNMENT_REV	Government Revenue	M2
HEADLINEINF	Headline Inflation	NET_OFFICIAL_RESERVES
HENRY_HUB	Henry Hub Natural Gas Price	NETSALE
IMPORTS	Imports	NON_ENERGY_FISCAL_BALANC
INTERBANK_RATE	Interbank borrowing rate	NON_PERFORMING_LOANS
INTERV	Foreign Exchange Interventions by the Central Bank	OMO
LA_LOCAL_CASH_IN_HAND	Liquid Assets: Cash in hand	PRIVATE_SECTOR_CREDIT
LA_REQUIRED_RESERVES	Liquid Assets: Required Reserves	PUBLIC_SECTOR_LOANS
LA_SPECIAL_DEPOSITS	Liquid Assets: Special Deposits	TOTAL_BANK_CAPITAL
LACASH_RESERVES	Liquid Assets: Cash Reserves	TOTAL_LOANS

Full Dataset (cont'd)		Slow Variables
Notation	**Definition**	**Notation**
M2	Money Supply M2	
NET_OFFICIAL_RESERVES	Net Official Reserves of the Central Bank	
NETSALE	Net Sales of Foreign Currency	
NON_ENERGY_FISCAL_BALANC	Non Energy Fiscal Balance	
NON_PERFORMING_LOANS	Non-performing loans	
OMO	Open Market Operations	
PRIME_LENDING_RATE	Prime Lending Rate	
PRIME_MORTGAGE_RATES	Prime Mortgage Rate	
PRIVATE_SECTOR_CREDIT	Credit to the Private Sector	
PROD_INDEX	Index of Productivity	
PUBLIC_SECTOR_LOANS	Public Sector Loans	
REAL_ESTATE_MORTGAGE_LOA	Real Estate Mortgage Loans	
REALGDP_GROWTH	Real GDP Growth	
REPO_RATE	Repo Rate	
SELRATE	Forex Selling Rate	
SPREAD	Commercial Bank Spread	
TOTAL_BANK_CAPITAL	Total Bank Capital	
TOTAL_LOANS	Total Loans	
UNEMPLOYMENT_RATE	Unemployment Rate	
WADR	Weighted Average Deposit Rate	
WALR	Weighted Average Lending Rate	
WTI	WTI Crude Oil Price	
XSL	Excess Liquidity	