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# Inflation Expectations and Inflation Modelling: The Case of Trinidad and Tobago

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## ABSTRACT

Anchoring inflation expectations is a concern for many central banks around the world, especially those who have adopted inflation targeting as their monetary policy regime. Inflation expectation is the rate at which economic agents expect inflation to be in the future. It is an important determinant of actual inflation and can be influenced by central banks' communication. While the Central Bank of Trinidad and Tobago (the Bank) does not practice inflation targeting, its objective is to promote a low and stable rate of inflation and a stable foreign exchange market that is conducive to sustained growth in output and employment. One aspect of ensuring price stability is ensuring that firms' and consumers' expectations of inflation are monitored and therefore managed as this governs their behavior. In this paper, we examine the impact of a news-based inflation expectations index on inflation for Trinidad and Tobago. We also evaluate whether there is predictive gain from its inclusion in inflation forecasting. The results of the study confirm that higher expectations of inflation can increase headline, food, and core inflation in both the short and long-run. Additionally, contractionary monetary policy was found to have decreasing effects on inflation expectations. Further, the study reveals incorporating expectations in the Bank's forecasting framework can assist with improving inflation forecast accuracy. Some policy prescriptions were provided relating to enhancing the Bank's inflation forecasting and monetary policy surveillance.

**JEL Classification Numbers**: E310; E370 E580; E710
**Keywords**: Inflation Expectation, Price Stability, Temperature, Hybrid New Keynesian Phillips Curve

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# Inflation Expectations and Inflation Modelling: The Case of Trinidad and Tobago

**Andell Nelson and Nikkita Persad**

## Introduction

Monitoring and predicting inflation are integral roles of central banks globally, especially as their key objective is maintaining price stability. An inflation rate that is either too high or too low can present socio-economic challenges, to an economy, therefore, maintaining a low and stable rate of inflation is important. In 2022, inflation surged in many countries around the world owing to supply side disruptions from the coronavirus disease (COVID-19) and geo-political tensions between Russia and Ukraine. While inflation has retreated globally, the rate is still above targets for some countries. This has ignited interest by academia and policymakers on the factors that may be causing its persistence.

One factor, is the possibility of inflation being affected by expectations. Inflation tends to be influenced by expectations of future inflation, a term commonly referred to as inflation expectations (IE). IE can provide a signal of where inflation is likely to be in the future and can influence the credibility of monetary policy. Leduc, Sill, and Stark (2007) investigated the influence of IE on inflation for the United States (US). Utilising data obtained from the Philadelphia Fed's Livingston Survey on forecasters' expectations of inflation it was revealed that IE had a significant effect in the variability of inflation (20.0 to 30.0 per cent variability) in comparison to monetary policy shocks (3.0 to 7.0 per cent variability).

IE is not directly observable, however, many researchers have attempted to measure it via surveys (consumers and firms), professional forecasting models, inferences from market prices of financial instruments and machine learning techniques. Each approach has its advantages and disadvantages. Domestically, the Bank explored the efficacy of text-mining newspaper articles to construct a news-based IE index that tracks expectation of inflation in Trinidad and Tobago. A five-step approach was utilised that involved: web scraping, article filtering, topic modelling, sentiment classification, and index calculation to develop the indicator[1]. A preliminary validation exercise highlighted that the news-based inflation index can be a forward-looking signal of expectations or it can indicate the direction of future inflation in Trinidad and Tobago (Ramlogan, Persad and Nelson 2023).

In the literature, studies have popularly investigated incorporating IE in regression models to forecast inflation. However, for the Caribbean, the literature is sparse[2]. In this paper, we aim to relate the aforementioned news-based IE index with inflation for Trinidad and Tobago. Understanding how IE influences inflation can support the Bank's mandate of ensuring price stability especially as the country is a small open economy vulnerable to external shocks that can affect domestic prices and expectations. Roopnarine, Bowrin and Ramirez (2019) found that shocks to crude oil prices, the United States (US) Gross Domestic Product (GDP), domestic wages, import prices and regional financial conditions have a significant pass-through effect on domestic prices. Similarly, expectations of higher inflation based on budgetary measures or some development with perceived inflationary or deflationary tendency can impact agents' expectations of inflation and by extension their behaviour.

[1] For details on the methodology, refer to Ramlogan, Avinash, Persad Nikkita, and Nelson Andell. 2023. "Developing a News-Based Index of Inflation Expectations for Trinidad and Tobago." Research Review Seminar. In June 2024, the methodology was revised to improve the accuracy of the Index.

[2] In the Caribbean, there are two surveys of IE, both of which are conducted for the country of Jamaica. With respect to studies in the area, Henry (2013) have attempted to explore the dynamics of how inflation expectations are formed among businesses in Jamaica while Greenidge and DaCosta (2008) in their study on the determinants of inflation alluded to some inertia in the inflation process reflecting economic agents' revisions to their inflation expectation. However, inflation expectation was not explicitly modelled in the paper.

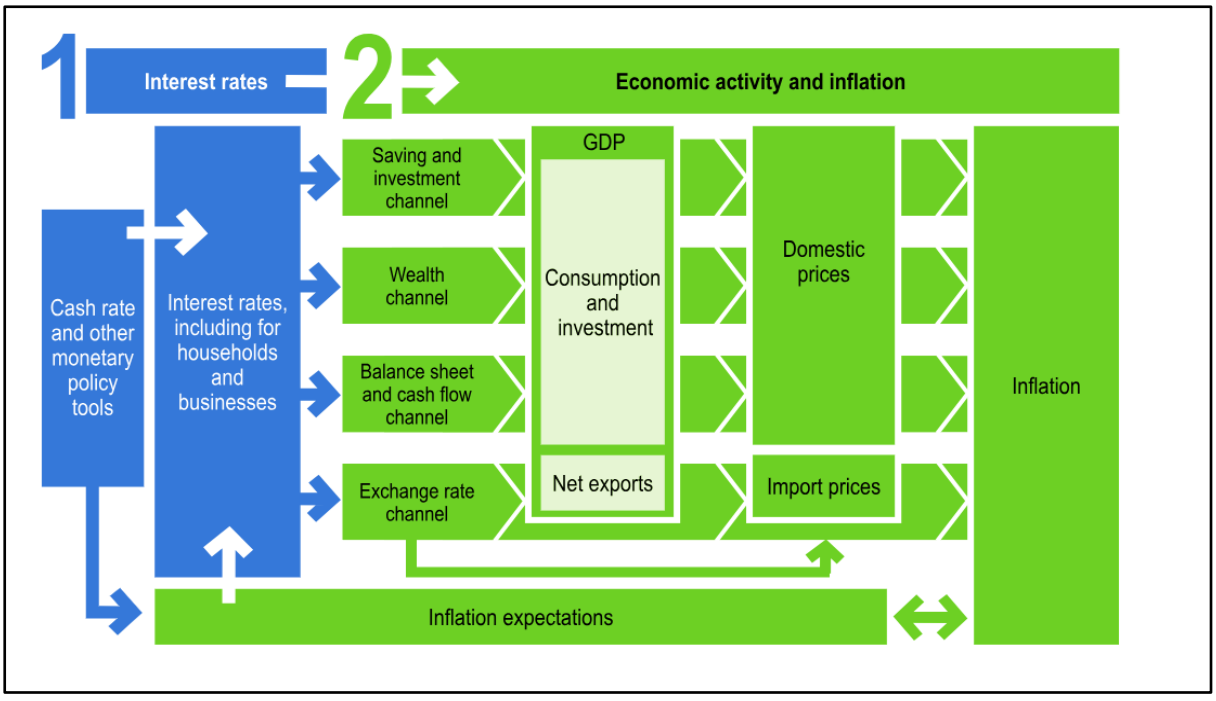
The results of the study confirm that inflationary expectations (positive shock to inflation expectation) increases headline, food and core inflation[3] in both the short and long-run. We show that incorporating the IE index developed by Ramlogan, Persad and Nelson (2023) improves the Bank's inflation forecasts. This research contributes to the literature by exploring inflation through the expectation channel for Trinidad and Tobago. The remainder of the paper is organised as follows: Section 2 discusses the literature on modelling inflation and future expectations of inflation while Section 3 examines some stylised facts on inflation and inflation expectations in the domestic economy. Section 4 outlines the methodology adopted while section 5 discusses the attendant results. Section 6 provides some policy prescriptions for enhancing the Bank's monetary surveillance and oversight while section 7 concludes.

## Literature Review

Predicting inflation is a challenging task for central banks but is crucial for appropriate monetary policy decision making, particularly for those practicing inflation targeting. Central banks often rely on econometric models to aid in assessing inflation dynamics. Studies have concluded added predictive gains in utilising IE to forecast inflation. Given that consumption, investment choices and price setting behaviours (including wage negotiations) partially reflect households' and firms' prospects on future price changes, IE play a critical role in influencing inflation dynamics and monetary policy. The Reserve Bank of Australia (RBA) outlined the main channels through which monetary policy affects IE **(Figure 1)**. The RBA recognises IE as a critical pathway through which agents' economic decisions affect inflation.

**Figure 1**

**The Transmission of Monetary Policy**




Source: Reserve Bank of Australia

[3] Core inflation excludes volatile items such as food and energy.

Several studies incorporate IE in modelling inflation **(Table 1)**. Stockhammar and Osterholm (2016) and Öğünç (2019) utilised Bayesian Vector Auto-Regression (BVAR) models to forecast inflation in Sweden and Turkey, respectively. The data on IE were sourced from consumer and business surveys. Other variables included in the modelling exercise were inflation, the unemployment rate and the 3-month Treasury bill rate. Forecast evaluation using the Root Mean Squared Error (RMSE) showed that the inclusion of IE improved forecast precision (Stockhammar and Österholm 2016). Öğünç (2019) used seven different BVAR models, each applying a different combinations of variables[4]. RMSE was employed to assess the forecast accuracy of the models. This exercise highlighted that log-differenced variables performed better than using log-level data.

Rohoia & Sharma (2021) utilised a Hybrid New Keynesians Phillip curve model (HNKPC)[5] to examine the inflation dynamics in the Solomon Islands. The HNKPC is an augmentation of the New Keynesians Phillips Curve model which projects inflation by incorporating current and lagged inflation rates. The variables employed in the study were; lagged inflation, expected inflation derived from surveys, fuel prices, real effective exchange rate, reserves, the output gap and a dummy to account for a rise in inflation due to a supply side shock. The authors also applied the generalised methods of moments approach to estimate the HNKPC model to correct for autocorrelation and address the issue of endogeneity. Findings of the study highlighted that individuals are more back-ward looking in forming IEs as economic agents base their choices largely on past information rather than future information due to uncertainty and the lack of accurate information for the future. The results indicate that fuel prices were important for assessing IE since the country is vulnerable to global price shocks due to its trade in this product.

Similarly, the International Monetary Fund (IMF) in its October 2023 World Economic Outlook report also utilised a Hybrid Phillips curve model to assess IE and inflation dynamics for both advanced and emerging economies. The Hybrid Phillips curve, which is estimated from current inflation, IE of near-term professional forecasters, lagged inflation and the output gap highlighted that a 1 percentage point increase in near-term expectations resulted in a 1.1 percentage point increase in current inflation for advanced economies, compared to a 0.8 percentage point increase for emerging economies. Further, it was revealed that lagged inflation had greater statistical significance in emerging economies compared to advanced economies. For both advanced and emerging market economies, the pass-through of IE on current inflation is significant when inflation is high (International Monetary Fund 2023).

In the literature, several studies applied text mining techniques. Adebiyi, et al. (2022) employed an inflations perception index, created from text mining data to improve inflation forecasting at the central bank of Nigeria.[6] The sentiment index was derived based on text mined data obtained from Twitter on economic agents' perception about inflation. To measure inflation dynamics two estimation techniques were employed: i) a predictive regression/ordinary least squares model and ii) seasonal autoregressive

[4] The main variable of interest was the Consumer Price Index (CPI) excluding unprocessed food and tobacco due to its predictive power. Several variables that are expected to affect inflation were selected based on a pseudo-out-of-sample methodology. Survey based indicators capturing IE were considered, including: i) the Business Tendency Survey, which assesses the expectations of firms' executives, and ii) the Survey of Expectations, which measures the expectations of experts from the macro-financial sectors (Özer and Mutluer 2005).

[5] While BVAR estimates the relationships amongst multiple variables, the NKPC focuses on inflation dynamics and the rational expectations and forward looking behavior of economic agents (Rohoia and Sharma 2021).

[6] The data used inclusive of the sentiment indicator were; headline; core; and food inflation; the annual growth rate of the narrow money; the manufacturing purchasers' managers index; non-manufacturing purchasers' managers index; price of premium motor spirit; exchange rate; real agricultural output; real non-agricultural output; and real government expenditure.

integrated moving average model. The results highlighted that the sentiment index provided a useful indication of future price movements. Further, comparing the summary measures of forecast performance, it was found that the models which included the sentiment index outperformed the models without the index. Further, Gabrielyan, Masso and Uusküla (2020) applied text mining (Latent Dirichlet Allocation) to extract inflation expectation-related topics for the United Kingdom[7]. The authors used the Least Absolute Shrinkage and Selection Operator (LASSO) to improve the forecast of expected inflation. Results suggest that with an optimal number of topics the machine-learning method performed better in predicting IE than autoregressive models. However, some authors indicated that the LASSO technique has limitations and may be inappropriate for variable selection (Zou (2006) and Araujo and Gaglianone (2023)).

In the Caribbean, the literature on IE and inflation modelling is quite sparse. A scan of the literature shows two major studies- Henry (2013) and Greenidge and DaCosta (2008). Henry (2013) attempted to explore the determinants of inflation expectations among businesses in Jamaica. The study utilised a two-stage procedure that included a Seasonal Autoregressive Integrated Moving Average (SARIMA) model to estimate expected inflation in the country which was compared to survey data on inflation, followed by a reduced form equation that included the inflation expectation, modelled as a function of country-specific monetary and macroeconomic variables. The study found that international fuel prices in real terms have a positive impact on expectations. Additionally, monetary policy has a statistically significant but small impact on inflation expectations, compared to exchange rate depreciation which had a more significant impact. Greenidge and DaCosta (2008) on the other hand, examined the determinants of inflation in the Caribbean – Trinidad and Tobago, Jamaica, and Barbados. Though inflation expectation was not explicitly modelled in the paper, using an unrestricted error-correction model (ECM) and Pesaran et al. (2001) bounds test for cointegrating analysis, the study found some inertia in the inflation process for Trinidad and Tobago which they perceived reflects economic agents' revisions to their inflation expectation. The authors concluded that the determinants of inflation in the Caribbean are both cost-push and demand-pull.

[7] Domestically, the IE derived for Trinidad and Tobago followed this approach for topic modelling.

**Table 1**

**Summary of Studies in the Literature**

| Authors/ Country | Modelling Approach Used |
|---|---|
| (Stockhammar and Österholm 2016) **(Turkey)**<br>(Öğünç 2019) **(Sweden)** | BVAR |
| (Rohoia and Sharma 2021) **(Soloman Islands)**<br>(International Monetary Fund 2023) | HNKPC |
| (Adebiyi, et al. 2022) **(Nigeria)**<br>(Gabrielyan, Masso and Uusküla 2020) **(UK)** | Text Mining/Machine learning and regression analysis |
| (Henry 2013) **(Jamaica)**<br>(Greenidge and DaCosta 2009) **(Caribbean)** | Regression Analysis – SARIMA and ECM Model |

## Stylised Facts

### *Background on Inflation*

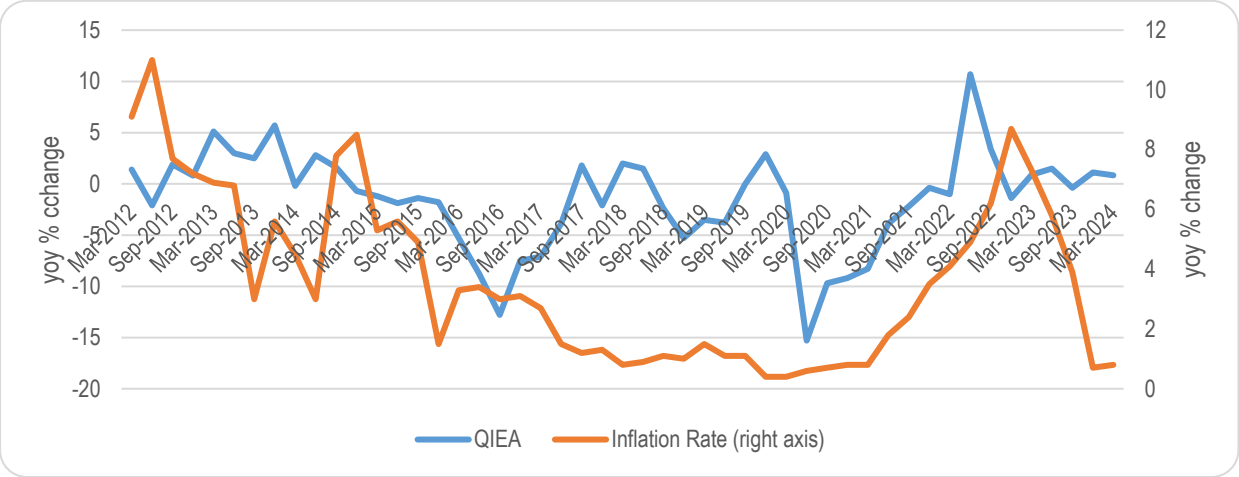
To measure inflation in Trinidad and Tobago, the Central Statistical Office (CSO) calculates a monthly Consumer Price Index (CPI). The CPI captures the overall price of a fixed group/basket of goods and services in 15 jurisdictions in Trinidad and Tobago. The rate of change in the CPI for a given period compared to the corresponding period one year earlier represents the headline inflation (INF) rate. INF is classified into two categories: food inflation (FI) and core inflation (CI). The former reflects movements in general food prices and is typically more volatile due to the susceptibility of both internal (for example, the weather) and external factors (for example, changes in international food prices). The latter category removes the fluctuating food component and reflects a measure of underlying inflation.

### *Trends in Inflation*

Generally, inflation has coincided with the domestic economic cycle, rising in periods of economic booms and falling during recessions. The oil price shock of 2014, which represented an end to the commodity boom, saw inflation decelerating **(Figure 2)**. Immediately following the COVID-19 pandemic, INF remained low (less than 1.0 per cent) up until March 2021 when it accelerated consecutively to reach a high of 8.7 per cent in December 2022. This was due to, supply chain disruptions stemming from the pandemic, as well as increased international energy and food commodity prices owing to Russia's invasion of Ukraine. Meanwhile, economic conditions as reflected by the Quarterly Index of Economic Activity (QIEA) deteriorated following the pandemic reaching a low of -15.3 per cent in June 2020. In the latter half of 2023, economic activity improved though remaining subdued, whilst inflation decelerated due to declining international food commodity prices and increased availability of local produce. However,

in early 2024 with the intense heatwaves experienced over the dry season, vegetable prices accelerated, leading to an uptick in FI, and overall INF[8]

**Figure 2: Economic Activity and Inflation**




Sources: Central Statistical Office and Central Bank of Trinidad and Tobago

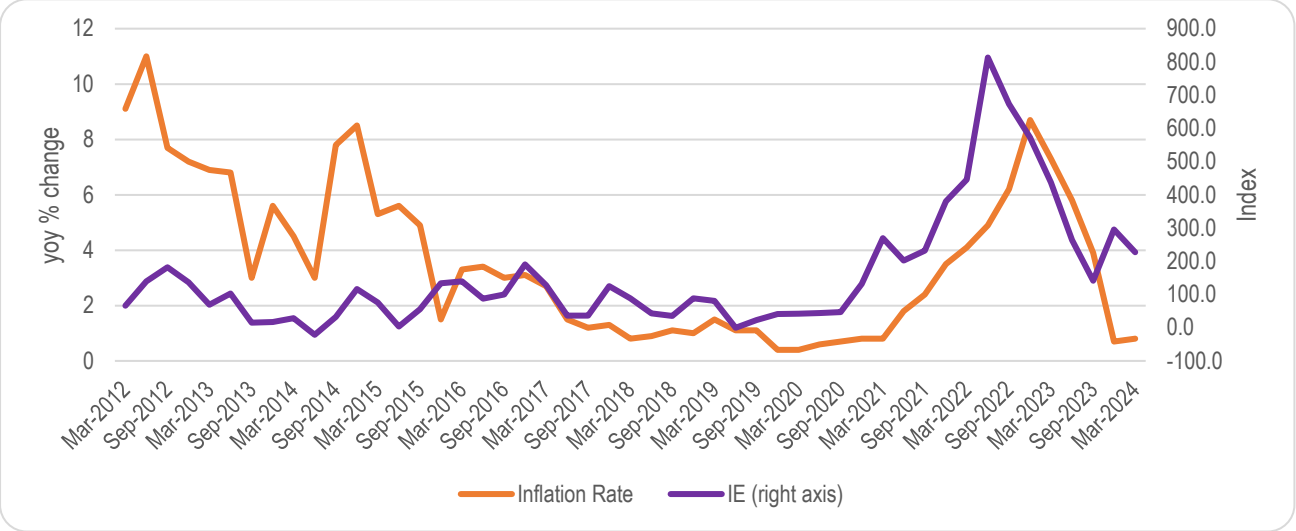
### *Relationship between Inflation and Inflation Expectations*

In 2023, the Bank began utilising the news-based IE index to support its economic surveillance. A historical analysis of the IE index and INF rate reveals both indicators have been moving in tandem with each other **(Figure 3)**. From the plot, periods of high inflation rates have coincided with a high IE index value and these points correspond with events that have triggered heightened inflationary pressures, such as those experienced of late throughout the world. The IE index was highest during the period of the COVID-19 pandemic when supply side challenges affected international prices, which spilled over to the domestic economy. During this period, price pressures was compounded by conflicts in the Middle East. As a result, economic agents adjusted their expectations based on observed trends and/or experiences with domestic price changes. This observation is critical for policymakers as IE can influence consumers' behaviour and future INF[9]. Analysis that is more recent showed that over the period December 2023 to May 2024, INF and IE moderated. This was fashioned by the decline in negative sentiments reported in May 2024 compared to December 2023. The slowdown in international food prices and anticipated improvements in the domestic economy at the time may have contributed to this outturn.

[8] In May 2024 the Vegetables Sub-Index accelerated to 15.3 per cent from -7.3 per cent in January 2024. As such, FI accelerated to 3.1 per cent from -1.9 per cent in January 2024. INF rose to 0.9 per cent in May 2024 from 0.3 per cent in January 2024. CI on the other hand decelerated to 0.3 per cent in May 2024 from 1.0 per cent in January 2024. The Vegetable Sub-Index accounts for 14.0 per cent of the Food Sub-Index while, Food sub-index account for 17.0 per cent of INF.

[9] According to the granger causality test, there appears to be unidirectional causality. That is, INF granger causes IE while IE does not granger cause INF.

**Figure 3: Headline Inflation and Inflation Expectation**




Sources: Central Statistical Office and Central Bank of Trinidad and Tobago

## Methodology and Data

### *Model Description*

To relate the IE index with inflation, a HNKPC model similar to Rohoia & Sharma (2021) was adopted. The HNKPC describes how past inflation, expectations about future inflation and a measure of aggregate demand, drive the current inflation rate. It was specified utilising IE[10], output (Y) - estimated as the year-on-year changes in the QIEA, international food prices (FAO), the gross fiscal ratio (GFR) – calculated as the ratio of government revenue to expenditure; INF – measured as the year-on-year changes in the CPI; repo rate (REPO); and temperature (TEMP). These variables constitute the vector of endogenous variables $y_t$ in equation 1 below. Food inflation (FI) and core inflation (CI) which are subcomponents of the CPI are also included in the model to give a more granular analysis[11].

To estimate the HNKPC, Vector Error Correction Modelling (VECM) was adopted which included a specification of a VAR in the first instance utilising data for the period 2012Q1 to 2022Q4. Given the time deterministic nature of inflation expectation, evaluating inflation in both the short-run and long-run using VECM will be beneficial in evaluating the development of expectations (anchored versus unanchored) over time. The VAR framework is specified based on the following equation:

$$Zy_t = W_t + \Gamma(L)y_{t-1} + \varepsilon_t \qquad \textbf{Equation 1}$$

[10] IE provides an indication of economic agents' perception of price movements in the future. The measure of IE is derived from a news-based index constructed from web-scraped text data published in the Trinidad Express newspaper and captures a time horizon of 2 months ahead. For details on the methodology, refer to: Ramlogan, A., Persad, N. and Nelson, A. September 2023. "Developing a News-Based Index of Inflation Expectations for Trinidad and Tobago." Research Review Seminar 2023.

[11] Other macroeconomic variables were also considered in the model such as the unemployment rate, Treasury Rates, West Texas Intermediate (WTI) Prices, the exchange rate and the CSO's quarterly index of real economic activity. However, based on their level of responsiveness to inflation and output and stationarity properties among other factors they were excluded from the model.

where: Z is an $n \times n$ matrix of contemporaneous coefficients of $y_t$; $W_t$ denotes the $n \times 1$ vector of constants; $\Gamma(L)$ is the $n \times n$ matrix of lag operator polynomials which captures lags of the endogenous variables; and $\varepsilon_t$ is the $n \times 1$ vector of white noise processes that is normally distributed with a mean of 0 and variance of 1 (that is, $\varepsilon_t \backsim N(0, \Omega)$). It should be noted that three models are estimated, each utilising a different measure of inflation[12]. Stationarity and cointegration of variables are examined using the Augmented Dickey-Fuller and Johansen tests, respectively. Further, standard tests are applied to test the validity of the estimated models[13].

The model specification is guided by the theories of cost-push inflation, demand-pull inflation and the Structuralist model of imported inflation[14]. The FAO variable reflects world food prices and its inclusion in the model captures the transmission of international food prices to domestic food prices, particularly, given our dependency on imports. Several authors in the literature, including the most recent Nelson and Cox (2024), have verified this price relationship. Output, among other variables, are repeatedly seen as important to the inflation process from the literature. As such, output is deemed to capture demand pressures in the economy, since increasing output indicates that demand pressures are present and inflation is increasing. The GFR and the REPO are also incorporated in the model to reflect fiscal and monetary policy and to examine the interplay between these key policy variables and IE. A contraction in the REPO variable implies expansionary monetary policy, that is, 'too much money is chasing too few goods' and therefore, demand-pull inflation is expected. Similarly, a contraction in the GFR variable (ratio of revenue to expenditure) could imply expansionary fiscal policy, therefore, demand-pull inflation could be expected[15]. Meanwhile, the inclusion of TEMP, though atypical follows from the Structuralist school of thought where inflation is said to be a consequence of weather conditions and trading or protectionist policies (Greenidge and DaCosta 2009)[16]. The inclusion of TEMP in the model is supported by the growing body of research which finds that climate variables have been found to add to the inflation momentum in recent years (Heinen et al. (2018) and Nelson and Melville (2025))[17].

**Data Description**

Data on the CPI and its subcomponents (FI and CI) are sourced from the Central Statistical Office (CSO). Revenue and expenditure data used to compute the GFR is sourced from the Ministry of Finance (MoF). Y, IE, and REPO are sourced in-house at the Central Bank. TEMP is sourced from the Trinidad and Tobago Meteorological Society (TTMS). Lastly, FAO is an exogenous variable in the model and is sourced from the United Nation's Food and Agriculture Organization. The INF, CI and FI variables are reflected in log differenced form. The FAO, GFR, and Y variables are represented as year-on-year per

[12] Model 1 relates INF with FAO, IE , Y, REPO, GFR and TEMP. Model 2 relates FI with FAO, IE , Y, REPO, GFR and TEMP. Model 3 relates CI with FAO, IE , Y, REPO, GFR and TEMP.

[13] These include: VAR stability test, VAR Lag Order Selection Criteria, VAR Residual Serial Correlation LM Tests and the VAR, Heteroskedasticity Test.

[14] The demand-pull theory regards price changes as a market clearing mechanism and inflation is seen as a result of excess demand in commodity and factor markets. Conversely, the cost-push theory, regards inflation as the result of factor prices accelerating more rapidly than factor productivities. The Structuralist school of thought, more specifically the Scandinavian model, hypothesises that inflation is influenced by world prices, wages and productivity (Greenidge and DaCosta 2009).

[15] The authors recognise that the GFR could be a misleading indicator of fiscal policy (expansion and contraction) particularly under conditions where revenue severely outstrips expenditure. Therefore, it should be looked at under cyclical conditions.

[16] In the event of a natural disaster such as a hurricane, which reduces food supply and damages infrastructure, prices of goods and services will increase. Also, protectionist policies in certain industries, prevents entry of cheaper goods and services and results in higher domestic prices for these goods and services (Greenidge and DaCosta 2009).

[17] Emergent studies on climate change expectations and inflation can also be found in the literature verifying the need for climate in examining the future dynamics of prices. See for example Meinerding, Poinelli and Schuler (2022).

cent changes. The REPO variable reflects the basis point change while the IE variable reflects quarter-on-quarter changes in the index[18]. TEMP on the other hand is recorded in Degrees Celsius.

## Results and Analysis

### Correlation, Granger Causality, Stationarity Analysis and Model Authenticity Checks

*Correlation and Granger Causality Analysis*

Cross-correlation was evaluated in the model to assess intensity and direction of the variables with INF, specifically IE and INF **(Appendix 1)**. IE and REPO, were found to have a moderate and positive association 0.55 and 0.48 respectively with INF when compared to all other variables in the model[19]. The positive relationship between IE and headline inflation implies that inflationary expectation could increase headline inflation. The positive association between INF and the REPO suggest that contractionary monetary policy could increase headline inflation, which seems counterintuitive and requires further investigation. All other variables were found to have a weak association with headline inflation. Disaggregated data on INF (CI and FI) were also evaluated to determine their association with inflation expectations. It was found that CI and FI has a higher correlation coefficient with the news-based inflation expectation index than INF. The results of the correlation matrix suggest that higher expectations of inflation could increase FI and CI and based on the intensity of the relationship FI and CI could be more responsive to inflationary expectations than INF. However, this relationship will be further evaluated using VECM. Evaluating causation, the granger causality test suggest unidirectional causality. That is, INF granger causes IE while IE does not granger cause INF.

*Stationarity Analysis*

VAR requires variables to be stationary while VECM requires all variables to be integrated of the same order. Using the Augmented Dickey-Fuller (ADF) Test and the Phillips Perron Test, all variables specified in the model were found to be non-stationary, therefore, integrated of order one (I(1). That is all variables required differencing once to become stationary. The results of the unit root tests are presented in **Appendix 2**.

*Model Authenticity Checks*

Following the estimation of the VAR, several model authenticity checks were undertaken to ensure a reliable model **(Appendix 3)**. The stability of the models was assessed using the eigenvalues of the companion matrix of the VAR model. The models were found to be stable as all the unit roots lie inside the unit circle. The VAR Lag Order Selection Criteria, was evaluated and it was found that two lags were sufficient to remove serial correlation and heteroscedasticity from the model. The VAR Residual Serial Correlation LM Tests and the VAR, Heteroskedasticity Tests were also evaluated. The results suggest the null hypothesis of no serial correlation and no heteroskedasticity, respectively were accepted. The

[18] The Index of Expectation is computed from 2012 onwards. Quarter-on-quarter changes were utilised to include 2012 in the analysis versus year-on-year which would have eliminated 2012.

[19] Correlation coefficients between: (i) 0 and 0.2 are regarded as **very weak**; (ii) 0.2 and 0.4 are regarded as **weak**; (iii) 0.4 and 0.6 are regarded as **moderate**; (iv) 0.6 and 0.8 are regarded as **strong**; and (v) 0.8 and 1 are regarded as **very strong**. +/- indicates the direction (same/opposite) of the correlation.

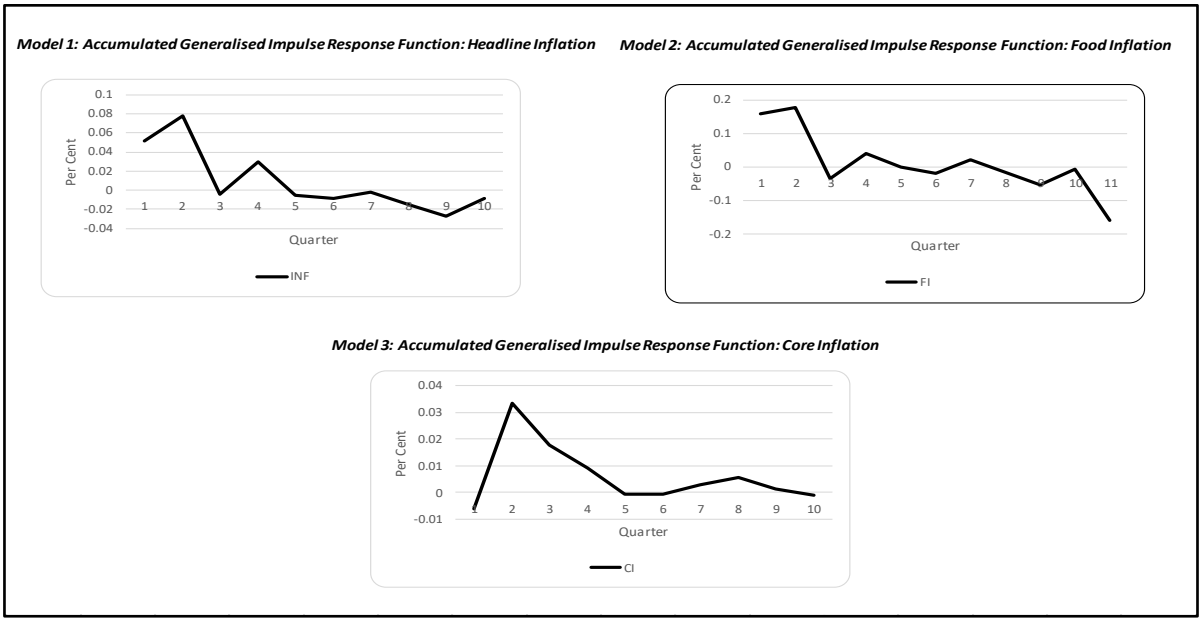
results of the Johansen Cointegration test revealed at most four cointegrating equations among the variables, with at least one negative and statistically significant error correction term[20], allowing for the evaluation of a short-run dynamic and long-run equilibrium impact **(Appendix 3)**.

**Model Results**

The results of the VAR models are evaluated using Impulse Response Functions (IRFs)[21]. A generalised impulse response ordering was adopted to examine the interplay between IE and inflation and its subcomponents – FI and CI[22]. From the IRFs, it was revealed that a one-standard-deviation shock to IE results in an instantaneous increase in INF. The inflationary impact lasts for 5 quarters ahead before becoming deflationary. Similarly, in the long-run[23], a one-standard-deviation shock in IE increases INF over the forecast horizon **(Figure 4 and 5)**. This implies that the news-based IE index can be a forward-looking indicator in predicting future inflation in both the short and long-run. Looking more closely at the short-run impact, a shock to IE increases inflation by five basis points in the first quarter. In the second quarter it reaches its peak at seven basis points before declining to its trough. The one quarter delay of inflation towards its peak, according to Greenidge and DaCosta (2009), may capture inertia in the inflation process as economic agents' revise their expectation towards inflation. It could also reflect the time it takes for firms to adjust their prices to rising cost of inputs.

[20] Model 2, was found to have at most four cointegrating equations with two significant error correction terms while Model 3 was found to have at most two cointegrating equation with one significant error correction term.
[21] This is based on the characteristic that VAR models are a-theoretical and its estimation output should not be interpreted.
[22] Given the sparse literature on studies that have employed the VAR and VECM methodologies to explore the response of inflation to shocks, particularly for small open developing economies (see for example, Christiano et al. 2005), the generalised impulse response ordering was adopted.
[23] The IRFs of the VECM are considered long-run results while the IRFs of the VAR are short-run responses.

## Figure 4
## Accumulated Generalised Impulse Response Functions of Inflation from Inflationary Expectations
## (Short-run)




The figure show the estimated IRFs using the VAR method. X-axis in quarters; t=0 is the year preceding the expectations shock; t=1 is the first year of impact. The solid black line denotes the response of INF, FI and CI to a shock in expectations.

## Figure 5
## Accumulated Generalised Impulse Response Functions of Inflation from Inflationary Expectations
## (Long-run)

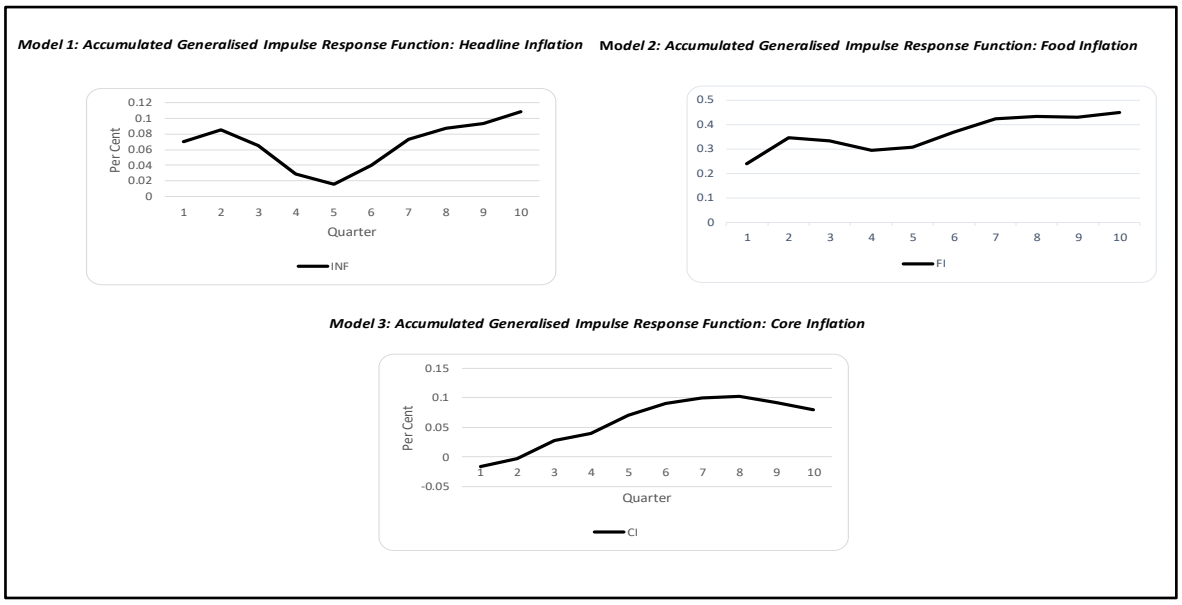



Figure 4 shows estimated IRFs using the VECM method. X-axis in quarters; t=0 is the year preceding the expectation shock; t=1 is the first year of impact. The solid black line denotes the response of INF, FI and CI to a shock in expectation

Considering FI, a one standard deviation shock to IE or higher inflation expectation increases food price inflation. The increasing effect last for three quarters ahead before becoming deflationary. In the long-run inflationary expectation increases FI over the forecast horizon. CI also responds positively to increasing expectations in the short-run. Similarly, in the long-run inflationary expectations has an increasing effect on CI **(Figure 4 and 5)**. This implies that factors that increases individuals' perception of future inflation can affect agents' expectations of inflation and increase underlying inflationary pressures[24]. These include information about past inflation, monetary policy, fiscal policy, global developments and information about the market and market structure - for example how people respond to events (Osorio-Barreto, Mora and Sierra-Suárez 2025) and.

The influence of macroeconomic variables on IE is also analysed in the study. A one-standard-deviation shock to international food prices increases INF, and future expectations of inflation in the short-run. This overall positive response has been verified in the literature by Nelson and Cox (2024) who outlined the centrality of international food prices in driving INF and domestic food price inflation. Provided that most of what we consume locally is imported, an increase in international food prices, through the expectations channel is expected to increase consumers' expectation of a future price increase as well as firms alike would adjust their prices to reflect the higher input cost. This pass-through of higher international prices to domestic prices generally occurs with a lagged effect. Mahabir and Jagessar (2011) revealed that changes in international commodity prices (rice, wheat, milk and soya beans) have an impact on related domestic items by the second month, and the effects last between five to nine months. In the long-run, a shock to the FAO is found to have a negative effect on INF and a positive effect on IE.

A one standard deviation shock to the GFR (contractionary fiscal policy) is found to have deflationary effects on inflation and future expectations of inflation. This seems intuitive, considering the procyclical nature of fiscal policy in Trinidad and Tobago. A a surplus of revenue over expenditure – which implies an improving fiscal balance and generally suggest contractionary fiscal policy, results in lower government spending and aggregate demand lowering prices. On the flip side, fiscal expansion increases optimism and can drive further spending and investing decisions leading to rising perception of future price increases. In the long-run, contractionary fiscal policy reduces INF following an initial shock for about four quarters ahead while inflation expectation decelerates over the forecast horizon. From the IRFs inflationary expectations dissipate from contractionary monetary policy (increasing REPO) three quarters ahead in the short-run. However, in the long-run contractionary monetary policy reduces inflationary expectations.

The impact of TEMP on INF and future expectations of inflation are also considered in the study. A one-standard deviation shock to TEMP results in an increase in INF in the first instance lasting for three quarters before decreasing in the short-run while in the long-run INF decreases. The results suggest that TEMP without hot days – which refers to days when temperature reaches or exceeds the 95th percentile which is 34.0 Degrees Celsius (Carvalho and Wanderley 2022, TTMS 2022), may not be sufficient to increase INF. In terms of IE, a one standard deviation shock to TEMP increases future expectation of inflation in both the short and long-run. This is contrary to Meinerding, Poinelli and Schuler (2022) who

[24] Property taxes and utility rates are captured in the Housing, Water, Electricity, Gas and Other Fuels sub-index which was identified by Nelson and Cox (2024), as a net receiver of inflation, implying that it is very responsive to price changes and could fuel inflation spirals.

found a negative correlation between inflation expectation and climate concern. Therefore, a one notch decrease in climate concern increased IE. The results contribute to the mix findings in the literature on climate change. It is important to note that model results can change depending on the length of the dataset, methodology employed, variables selected and country characteristics (income level, monetary policy regime, size of the impact). Additionally, climate data is classified as trend data and may impact macroeconomic data in a non-linear fashion. As such, in the future, it may be pivotal to consider climate non-linearities in modelling climate and inflation and future expectations of inflation.

**Forecasting Inflation**

Inflation forecasting at the Bank dates back to the 1980s with the commencement of the Trends, Analysis and Projections exercise. This exercise was subsequently replaced with the International Monetary Fund's Financial Programming and Projection (FPP) framework, which began in 2010 and was subsequently modified in 2017 to produce quarterly forecasts. Both the TAP and the FPP involved the calibration of macroeconomic forecast over a three-year horizon. Over the years, several measures were developed to forecast inflation. These included; the development of an inflation diffusion index, a composite leading indicator of inflation and a consumer confidence index. These indicators provided information on the future directional changes of inflation but did not provide information on the magnitude of the change. Econometric approaches such as VAR and VECM were also adopted to assist with inflation forecasting.

More recently, as part of the FPP forecasting exercise a reduced form Phillip's curve model was adopted to forecast inflation. The new approach utilised the VAR methodology to make out-of-sample forecasts of both CI and FI inflation on a quarterly basis over a three-year forecast horizon. Using the estimates of core and food inflation, a weighted summation was utilised to derive headline inflation. **Table 2** below provides a snapshot of the forecast performance of inflation for 2023 utilising the current methodology and an overview of the forecast performance (2020-2022) based on the previous methodology which was largely based on expert judgment. Examination of the forecast errors revealed that during the period of exogenous shock, such as those associated with the COVID-19 pandemic and the Russia/Ukraine conflict, errors increased significantly. Further evaluation of the model revealed that while the current methodology incorporated variables such as; the output gap (YGAP), exports and imports reflected by the current account balance (CAB), private sector credit (PSC), government revenue (GR), West Texas Intermediate (WTI) prices, the unemployment rate (UR), US real GDP and the FAO Food Price Index (FAO), it was not accounting for some of the volatility arising from climate change and inflation expectations.

**Table 2**
**Inflation Forecast Performance (Per Cent)**

| | *Quarterly Forecasts* | | | | | | | | | | | | | | | | *Annual Forecast* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2020 Q1 | 2020 Q2 | 2020 Q3 | 2020 Q4 | 2021 Q1 | 2021 Q2 | 2021 Q3 | 2021 Q4 | 2022 Q1 | 2022 Q2 | 2022 Q3 | 2022 Q4 | 2023 Q1 | 2023 Q2 | 2023 Q3 | 2023 Q4 | 2020 | 2021 | 2022 | 2023 |
| *Forecast* | 0.5 | 0.5 | 0.5 | 0.6 | 0.9 | 1.1 | 1.3 | 1.7 | 4.0 | 5.0 | 5.1 | 5.4 | 7.1 | 6.5 | 6.1 | 5.9 | 0.6 | 1.3 | 5.0 | 6.4 |
| *Actual* | 0.4 | 0.6 | 0.5 | 0.8 | 0.8 | 1.4 | 2.3 | 3.7 | 4.0 | 4.9 | 6.1 | 8.0 | 7.8 | 5.8 | 4.2 | 1.1 | 0.6 | 2.0 | 5.8 | 4.6 |
| *Forecast Error* | 0.1 | -0.1 | 0.0 | -0.2 | 0.1 | -0.3 | -1.0 | -2.0 | 0.0 | 0.1 | -1.0 | -2.6 | 0.7 | -0.7 | -1.9 | -4.8 | 0.0 | -0.7 | -0.8 | -1.8 |

Source: Central Statistical Office and Central Bank of Trinidad and Tobago
Note: Actual data sourced from Central Statistical Office. Forecasts are sourced from Central Bank of Trinidad and Tobago's Financial Programming and Policies (FPP) forecasting exercise.

Today, because of the availability of the IE index, a HNKPC model can be estimated to consider future expectations of inflation in inflation forecasting. Since IE was found to have increasing effects on INF, FI and CI, it is incorporated into the forecasting equation to determine whether it enhances model forecast performance. The Root Mean Squared Error (RMSE)[25], Mean Absolute Error (MAE)[26], and Theil Inequality Coefficient are used to evaluate model forecast accuracy similar to Stochhammar and Osterholm (2016) and others. These measures are computed for three models (INF, FI and CI) with IE (HNKPC_IE) and three models without (INF, FI and CI) expectation (HNKPC) based on in-sample estimates for the period 2020Q1 to 2022Q4. The forecast performance of each model are summarised and presented in **Table 3**. With IE included in all three models and the RMSE, MAE, and Theil coefficient evaluated, the analysis suggests incorporating expectations into the inflation modelling equation can improve forecasting performance. This is particularly evident with the forecasts of FI and CI. The summary measures associated with the forecasts of FI and CI in the model that includes IE were lower when compared to the models without IE[27]. The ability to forecast other macroeconomic/climate variables accurately was also considered. The models including IE appear to forecast TEMP and the FAO with greater forecast accuracy particularly model 1 (for the forecast of TEMP) and model 3 (for the forecast of the FAO). Model 2 was also found to forecast IE with greater precision when compared to the other two models that includes IE. From the analysis the study confirms that accounting for IE can improve the Bank's forecasting framework and support policy analysis.

[25] The root mean squared error (RMSE), which takes the square root of the average of the sum of the squared forecast errors was utilised.
[26] The Mean Absolute Error (MAE) measures the average difference between the model's predicted values and the actual values.
[27] A lower RMSE, MAE, and Theil coefficient imply greater forecast accuracy.

**Table 3**
**Forecast Performance Statistics of Estimated Models**

| | HNKPC | | | HNKPC_IE | | |
|---|---|---|---|---|---|---|
| **Model 1** | **RMSE** | **MAE** | **Theil** | **RMSE** | **MAE** | **Theil** |
| FAO | 8.6 | 7.42 | 0.93 | 8.59 | 7.33 | 0.94 |
| GFR | 9.96 | 7.96 | 0.9 | 9.99 | 8.11 | 0.89 |
| INF | 0.25 | 0.18 | 0.82 | 0.25 | 0.18 | 0.82 |
| IE | | | | 155.35 | 109.14 | 0.82 |
| Y | 6.64 | 4.74 | 0.94 | **6.65** | 4.83 | 0.96 |
| REPO | 0.61 | 0.26 | 0.95 | **0.61** | **0.27** | 0.96 |
| TEMP | 0.65 | 0.58 | 0.58 | **0.61** | **0.54** | **0.52** |
| **Model 2** | | | | | | |
| FAO | 8.55 | 7.4 | 0.93 | 8.51 | 7.3 | 0.95 |
| GFR | 9.92 | 7.92 | 0.9 | **9.96** | **8.07** | 0.89 |
| FI | 0.51 | 0.42 | 0.84 | 0.51 | 0.4 | 0.82 |
| IE | | | | **155.31** | **108.19** | **0.82** |
| Y | 6.68 | 4.79 | 0.94 | 6.71 | 4.92 | 0.97 |
| REPO | 0.61 | 0.26 | 0.95 | **0.61** | **0.27** | **0.95** |
| TEMP | 0.66 | 0.58 | 0.59 | 0.62 | 0.55 | 0.53 |
| **Model 3** | | | | | | |
| FAO | 8.57 | 7.37 | 0.94 | **8.5** | **7.27** | 0.94 |
| GFR | 10.12 | 8.15 | 0.9 | 10.05 | 8.16 | **0.88** |
| CI | 0.2 | 0.13 | 0.92 | 0.2 | 0.13 | 0.93 |
| IE | | | | 156.04 | 109.03 | 0.85 |
| Y | 6.51 | 4.68 | 0.91 | 6.49 | **4.72** | **0.92** |
| REPO | 0.62 | 0.27 | 0.95 | 0.62 | **0.27** | **0.95** |
| TEMP | 0.69 | 0.61 | 0.64 | 0.64 | 0.57 | 0.58 |

Values shaded in blue reflect summary statistics generated by HNKPC_IE that are lower than the summary statistic for the HKKPC. Values shaded in light orange reflect summary statistics generated by HNKPC_IE that are higher than the HNKPC. Values that are not shaded reflect summary statistics generated by HNKPC_IE that are equal to HNKPC. Values bolded reflect the lower of the summary statistics generated by the three HNKPC_IE model.

## Policy Recommendations

Greater information access almost in real time is shaping agent's expectation of inflation. The pervasiveness of the internet and increased presence of online users following the pandemic have altered the way economic agents interact and process information. This makes the news-based inflation expectation index developed a good gauge for predicting inflation. Policymakers must leverage clear and consistent communication to manage expectations while addressing structural drivers. Given the increasing effect inflationary expectation has on FI, CI and INF, in both the short and long run, it can be suggested that the Central Bank - though not an inflation targeter, consider managing inflation, by shaping expectations through its communication on online social media platforms. This could support the development of a clear and consistent inflation expectation channel. A key prerequisite would be

becoming proficient at what is communicated and how it is communicated. Additionally, developing a complementary measure of expectations that is based on hard survey data (consumer and/or firm) could provide additional information to better understand expectations further strengthening monetary policy decision-making.

Having a long-term and short-term measure of IE may also serve as better predictors of future inflation and can further enhance model performance. The IE index can be included in the Bank's financial programming and policy framework to forecast inflation as the study confirms better forecast performance can be achieved. Having a one-year, three- year and five- year ahead index of IE could assist with the short and medium term calibration of inflation forecast. This would put the Bank in a better position to manage inflation and achieve its monetary policy objectives. A central measure of IE at different horizons will be beneficial in evaluating whether expectations are becoming unanchored or not and could shed some light on its persistence and effectiveness with monetary policy. Additionally, as the local capital market develops, the adoption of inflation-indexed bonds can be used to support the measure of IE.

## Conclusion

Globally, anchoring IE has become a major concern for many central banks in recent times given the concerted effort to bring inflation back to their targets. IE influence economic behaviour and outcomes. They influence consumer spending, investment decisions, wage negotiations, and financial market dynamics. It is for this reason, in this study, our recently developed news-based index of IE is incorporated into our HNKPC model to examine its interaction with inflation. The study confirms that IE affects INF, FI and CI in both the short and long-run. The study also found that incorporating expectations in the Bank's policy analysis and forecasting framework can assist with improving inflation predictions.

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## Appendices

**Appendix 1**

**Correlation Matrix**

| Variable | Headline Inflation Correlation Coefficient | Food Inflation Correlation Coefficient | Core Inflation Correlation Coefficient |
|---|---|---|---|
| REPO | 0.48 | 0.44 | 0.38 |
| FAO | -0.32 | -0.28 | -0.21 |
| GFR | 0.35 | 0.36 | 0.42 |
| Y | -0.25 | -0.25 | -0.18 |
| IE | 0.55 | 0.59 | 0.62 |
| TEMP | -0.39 | -0.41 | -0.44 |

**Appendix 2**

**Results of the Unit Root Test**

| Variable | Acronym | First Difference |
|---|---|---|
| Headline Inflation | INF | √ |
| Food Inflation | FI | √ |
| Core Inflation | CI | √ |
| Food and Agriculture Organisation Real Food Price Index | FAO | √ |
| Gross Fiscal Ratio | GFR | √ |
| Output | Y | √ |
| Repo Rate | REPO | √ |
| Inflation Expectation | IE | √ |
| TEMP | TEMP | √ |

## Appendix 3
## Model Authenticity Checks (VAR and VECM) and Johansen Cointegration

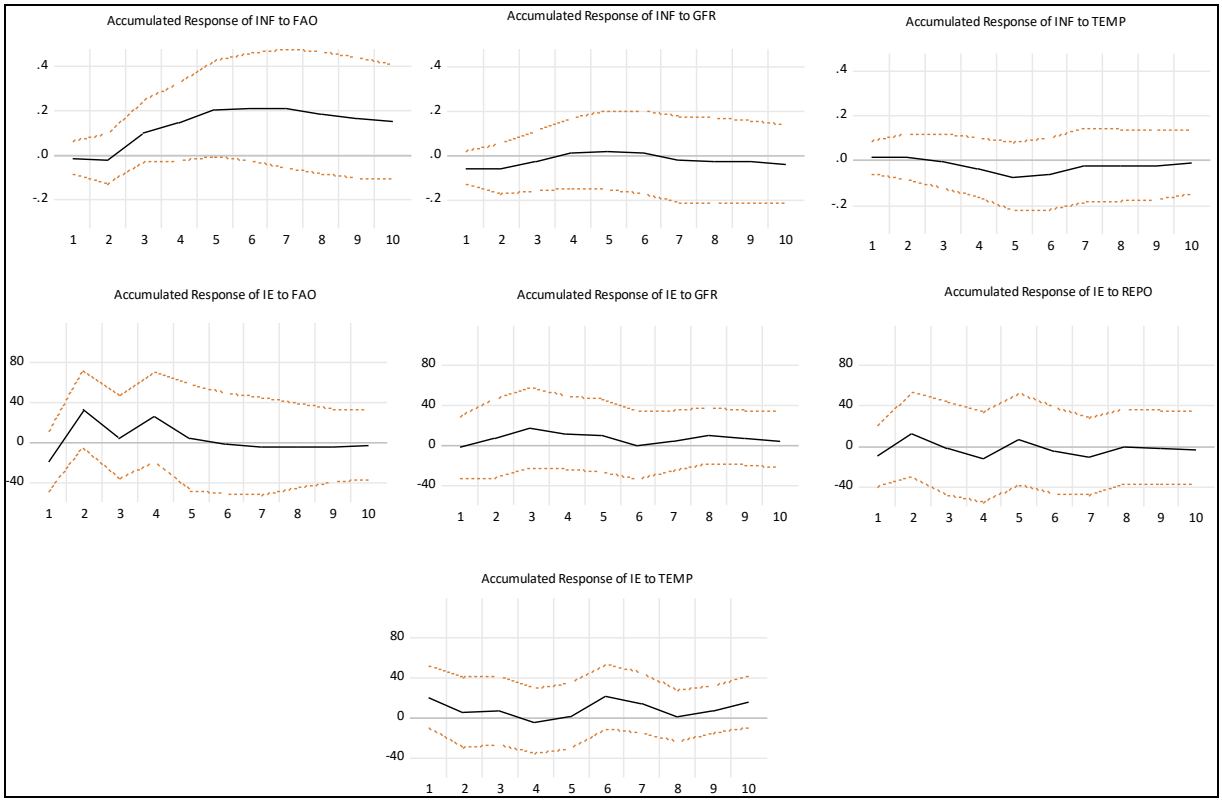
| Models | VAR Stability | No. of Lags | No Serial Correlation | No Heteroskedascity | Johansen Cointegration | VEC Error Correction Term | VECM Stability | VECM No Serial Correlation | VECM No Heteroskedascity |
|---|---|---|---|---|---|---|---|---|---|
| **VAR** | | | | | | | | | |
| Model 1 comprise the variables: INF; FAO; GFR; REPO; IE; Y and TEMP | √ | 2 | √ | √ | | | | | |
| Model 2 comprise the variables: FI; FAO; GFR; REPO; IE; Y and TEMP | √ | 2 | √ | √ | | | | | |
| Model 3 comprise the variables: CI; FAO; GFR; REPO; IE; Y and TEMP | √ | 2 | √ | √ | | | | | |
| **VECM** | | | | | | | | | |
| Model 1 comprise the variables: INF; FAO; GFR; REPO; IE; Y and TEMP | | 2 | | | At most 4* | At least 1 significant ECT | √ | √ | √ |
| Model 2 comprise the variables: FI; FAO; GFR; REPO; IE; Y and TEMP | | 2 | | | At most 4* | At least 1 significant ECT | √ | √ | √ |
| Model 3 comprise the variables: CI; FAO; GFR; REPO; IE; Y and TEMP | | 2 | | | At most 4* | At least 1 significant ECT | √ | √ | √ |

Model 1 comprise the variables: INF; FAO; GFR; REPO; IE; Y and TEMP

Model 2 comprise the variables: FI; FAO; GFR; REPO; IE; Y and TEMP

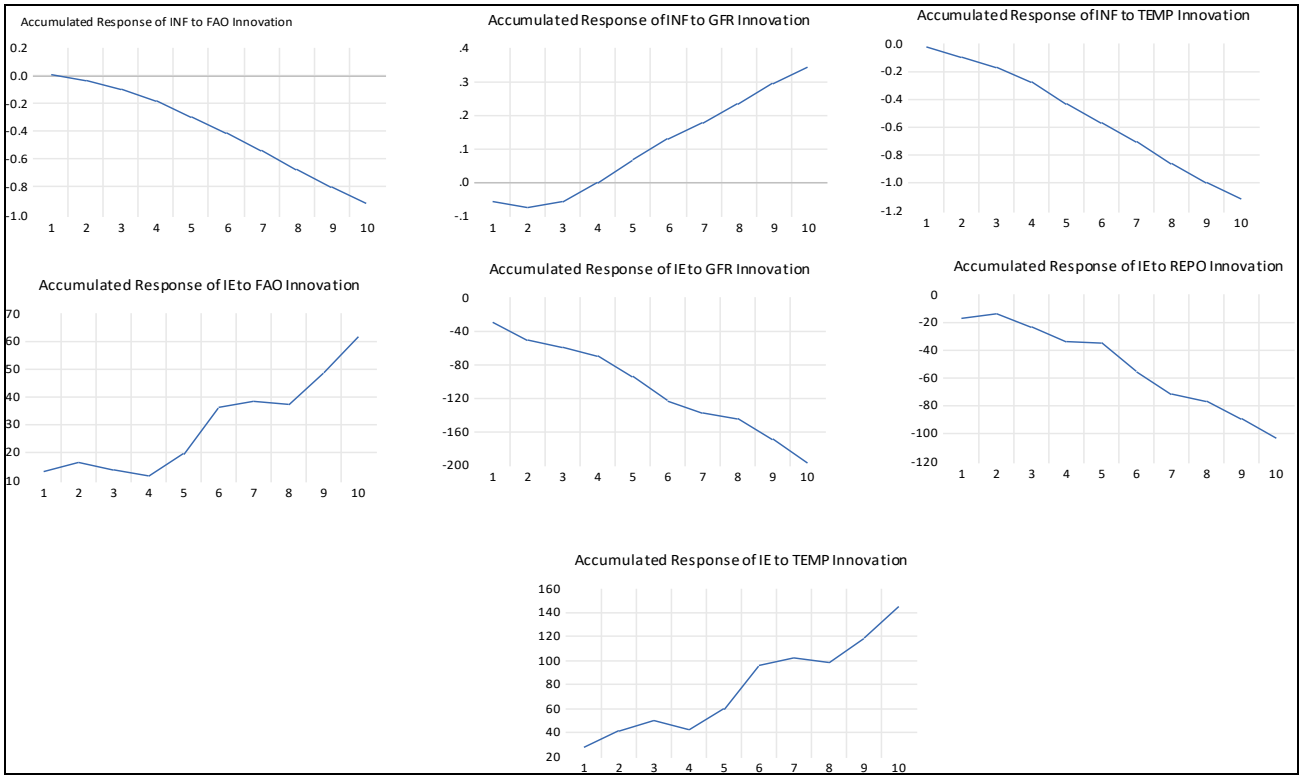
Model 3 comprise the variables: CI; FAO; GFR; REPO; IE; Y and TEMP

## Appendix 4
## Accumulated Generalised Impulse Response Function of Selected Macroeconomic Variables
## (Model 1)
## (Short-run)




The exhibit shows estimated IRFs using the VAR method for Model 1. x-axis in quarters; t=0 is the year preceding the shock; t=1 is the first year of impact. The solid black line denotes the response, the red dotted line denotes the confidence bands.

## Appendix 5
## Accumulated Generalised Impulse Response Function of Selected Macroeconomic Variables (Long-run)




The exhibit shows estimated IRFs using the VECM method for Model 1. x-axis in quarters; t=0 is the year preceding the shock; t=1 is the first year of impact. The solid blue line denotes the response.