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A SECTORAL APPROACH TO INFLATION EXPECTATIONS IN THE TURKISH ECONOMY: THE VECTOR ERROR CORRECTION MODEL (VECM) AND TIME-VARYING LA-VAR GRANGER CAUSALITY ANALYSIS

Türkiye Ekonomisinde Enflasyon Beklentilerine Sektörel Bir Yaklaşım: Vektör Hata Düzeltme Modeli (VECM) ve Zamanla Değişen LA-VAR Granger Nedensellik Analizi

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Keywords:
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JEL Codes:
E31, E37, E52.

Abstract

The high inflation rates in Türkiye in recent years highlight the importance of expectations and motivate studies on this issue. This study employs a Vector Error Correction Model (VECM) alongside a Time-Varying LA-VAR Granger Causality framework to investigate the relationship between inflation expectations and the prices of goods and services in Türkiye over the period 2013:01–2023:12. The results demonstrate the existence of co-integrating links between the variables. The results show that an orthogonalized shock to goods price has a temporary effect on inflation expectations, but an orthogonalized shock to services price has a permanent effect on inflation expectations. In addition, according to time-varying Granger causality analysis, the service sector, in particular, has a significant impact on inflation expectations. In this context, expectations are a significant factor that limits the effectiveness of the central bank's monetary policies. Although it is not a task that monetary policy can carry out on its own, the central bank should implement regulations that ensure stability regarding price movements in the service sector.

Anahtar Kelimeler:
Enflasyon Beklentileri,
Para Politikası,
Türkiye,
Vektör Hata Düzeltme Modeli.

JEL Kodları:
E31, E37, E52.

Öz

Türkiye'de son yıllarda görülen yüksek enflasyon oranları beklentilerin önemini ortaya koymakta ve bu konuda yapılacak çalışmaları teşvik etmektedir. Bu çalışmada, 2013m1-2023m12 dönemine ilişkin Türkiye'de enflasyon beklentileri ile mal ve hizmet fiyatları arasındaki ilişkiyi değerlendirmek için Vektör Hata Düzeltme Modeli (VECM) ve Zamanla Değişen LA-VAR Granger Nedensellik Analizi kullanılmıştır. Değişkenler arasında eşbütünleşik bağların varlığını gösteren bulgulara ulaşılmıştır. Sonuçlar, mal fiyatlarına ortogonalize edilmiş bir şokun enflasyon beklentileri üzerinde geçici bir etkiye sahip olduğunu, ancak hizmet fiyatlarına ortogonalize edilmiş bir şokun enflasyon beklentileri üzerinde kalıcı bir etkiye sahip olduğunu göstermektedir. Ayrıca, zamanla değişen Granger nedensellik analizine göre, özellikle hizmet sektörünün enflasyon beklentileri üzerinde anlamlı bir etkisi vardır. Bu bağlamda, beklentiler merkez bankasının para politikalarının etkinliğini sınırlayan önemli bir faktördür. Her ne kadar para politikasının tek başına yürüteceği bir görev olmasa da, Merkez bankası, hizmet sektöründeki fiyat hareketleri konusunda istikrarı sağlayıcı düzenlemeler yapmalıdır.

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1. Introduction

Different schools of thought, from Keynes to Friedman and Lucas, have tried to respond to shocks in the economy by modeling expectations (Matthews and Ong, 2022). The increasingly dominant New Keynesian Phillips Curve in the recent literature underscores the pivotal role of expectations in shaping macroeconomic dynamics. Thus, current inflation depends on past inflation, inflation expectations, and supply conditions (Yılmaz, 2012). Empirical studies have proven that expectations are one of the important factors in determining inflation (Süslü, 2012; D'Acunto et al., 2023). Periods of high inflation have enhanced understanding of the importance of expectations and their influence on economic behavior (Figlevski and Wachtel, 1981). Carlson and Parkin (1975) argue that expected inflation is determined by the error learning process during high inflation periods. This indicates that individuals incorporate both the inflation rate and its rate of change when forming their expectations. Moreover, under conditions of moderate inflation, expectations exhibit a fully autoregressive structure. Similarly, Mankiw et al. (2003) stated that some people act on outdated information, and the sticky information model has a central tendency in inflation expectations. Inflation expectations are a primary driver of consumption and, consequently, of macroeconomic dynamics. Long-term inflation expectations are therefore highly sensitive to shocks and play a pivotal role in transmitting monetary policy through the expectations channel. In this context, they affect consumption, investment, savings, and borrowing through expected real interest rates (ECB Strategy Review, 2021). When shocks lead to the indexation of wages and service-sector prices, becoming embedded in the economy via indirect channels, supply-side disturbances may acquire persistence, exerting upward pressure on core inflation and undermining the effectiveness of monetary policy (Adolfsen et al., 2024).

In recent decades, many central banks have turned to inflation targeting in order to reduce inflation and ensure price stability. Within the scope of this regime, efforts are exerted to ensure that the public believes in the explicitly announced inflation target and to ensure that long-term inflation expectations are at the target level (Yılmaz, 2012). The degree to which economic agents trust central banks' ability to maintain price stability plays a decisive role in shaping inflation expectations (Damar, 2010). Consequently, assessing the effectiveness of the expectations channel, one of the main transmission mechanisms of monetary policy, is crucial for ensuring price stability. Monetary policy is more successful in reducing inflation and maintaining stability when inflation expectations are well-anchored to the central bank's target (Yılmaz, 2012). Well-anchored long-term inflation expectations enhance confidence in central banks. If inflation expectations are not firmly anchored, price shocks may lead to heightened persistence of inflationary pressures. In other words, if the inflation target lends support to long-term inflation expectations, there will be a decrease in inflation (Bomfin and Rudebusch, 2000; Soybilgen and Yazgan, 2017). Dräger et al. (2024) attribute heterogeneity in inflation expectations to differences in agents' risk attitudes and intertemporal preferences, revealing that informational asymmetries among economic agents are the main source of divergence in expectations. Rangan and Das (2025) find that the dispersion of inflation expectations has increased, particularly in the post-COVID period, due largely to uncertainties in sectoral profit margins.

Over the past two decades, long-term inflation expectations have exhibited a declining trajectory across both advanced and emerging economies. Davis and Presno (2014) find that, under inflation targeting regimes, the responsiveness of inflation expectations to shocks originating from both oil prices and observed inflation decreased significantly. However, in developing countries, expectations remain highly sensitive to shocks. Başkaya et al. (2012) show

that inflation expectations in Türkiye are more responsive to high inflation but that this sensitivity diminishes over time. Inflation has thus become a structural issue for the Turkish economy. Since 2001, the Central Bank of the Republic of Türkiye (CBRT) has adopted policies aimed first at stabilizing financial markets and subsequently at achieving price stability under an inflation-targeting framework (Başkaya et al., 2008). Between 2001 and 2014, Türkiye maintained single-digit inflation, largely due to contractionary fiscal policies, subdued import demand, and low oil prices—all of which contributed positively to the anchoring of expectations. Positive growth during this period was driven not by the evolution of monetary policy itself, but by reduced uncertainty, phases of global expansion, and increased investment, consumption, public spending, and exports (Balmumcu and Süslü, 2017).

Since 2017, rising inflation, particularly in developing economies, has been largely attributed to substantial fiscal deficits and high public debt, leading to fiscal dominance, recurrent supply shocks stemming from agricultural cost pressures, and asymmetric information that weakens monetary transmission in underdeveloped financial markets (Ha et al., 2023). Central banking and monetary policy in Türkiye, which had already exhibited an erratic trajectory after 2014, became increasingly unstable from 2018 onwards, with policy directions frequently altered in response to the global pandemic. In 2021, completely abandoning the use of the policy rate against inflation, export-oriented growth with an undervalued TL (Turkish Lira) model and the reversal of the contractionary effects of the pandemic in 2020 with the easing of restrictions led to significant increases in inflation rates and expectations. Following 2010, the policy rate was redefined as the one-week repo rate, and structural instruments such as liquidity management and reserve requirements were incorporated into the monetary framework. During this period, the CBRT, conceptualizing financial instability primarily through exchange rate volatility and excessive credit growth, restructured the design of monetary policy accordingly, with a particular emphasis on credit dynamics and the exchange rate within the monetary transmission mechanism. Price stability was no longer the only objective; financial stability was also taken into consideration. However, the de facto erosion of the independence of the Central Bank in Türkiye after 2014, the increasing volatility of monetary policy in the same period, and the frequent changes in the CBRT administration due to the increase in the powers of the President in the system changed after the 2017 referendum, have decreased confidence in central banking and monetary policy in Türkiye. As a result of this process, expectations worsened and became adaptive, leading to an increase in price uncertainty (CBRT, 2024).

The operation of the expectations channel within the monetary transmission mechanism is closely linked to central bank credibility. In other words, the degree of perceived credibility determines the extent to which short-term interest rate decisions influence inflation expectations (Yılmaz, 2012). The central bank utilizes both the projections derived from its own inflation expectations survey and its internally generated inflation forecasts. The expectations survey incorporates the views of decision-makers and experts from the financial and real sectors concerning prospective macroeconomic developments (Bulut, 2018). Surveys suggest that decision makers and experts have lower inflation expectations for the next 24 months than for the next 12 months in Türkiye (CBRT, 2025a). Therefore, decision makers and experts have optimistic expectations for the future. The inferences regarding the inflation target, inflation rates, and inflation expectations are as follows: The central bank is not successful in achieving the inflation target, the inflation expectations of decision makers and experts are inconsistent with the inflation rates, and inflation expectations are not well anchored (Bulut, 2018). Following the

exchange rate shock in 2018, inflation and inflation expectations increased significantly, and the dispersion of expectations around the mean expectation worsened (Koç et al., 2025). Additionally, when inflation starts to rise in Türkiye, the Central Bank is not fully successful in shaping inflation expectations. The reason for this, the effect of a shock in actual or expected inflation spreads to expected or actual inflation, and this effect continues period of time (Çiçek and Alkan, 2019). In general, after periods of high inflation, central banks experience a credibility gap problem. This is due to the fact that decision-making units base their inflation expectations on past inflation rates rather than future inflation rates. Backward indexing behavior weakens as the monetary authority builds confidence (Damar, 2010). In sum, shaping inflation expectations is essential for central banks to guide economic decisions and ensure macroeconomic stability. Effective management of expectations requires clear communication, trust, and the correct use of forecasts. When trust in the central bank increases, average inflation expectations fall and are anchored closer to the target inflation.

This article makes two key contributions to the literature. First, although the determinants of inflation in Türkiye have been extensively examined, there are only a limited number of studies that analyze the influence of inflation expectations on actual inflation and link these dynamics to central bank policies. Second, to the best of our knowledge, no prior study has disaggregated inflation into goods and services categories in the context of Türkiye. In this regard, the present study sheds light on how movements in goods and services prices shape expectations, and how monetary policy decisions are subsequently formulated along the axis of those expectations.

The objective of this study is to investigate the impact of goods and services prices on inflation expectations in Türkiye during the period 2013M1-2023M12. The remaining sections of the paper are designed as follows: Section 2 covers the literature review. Section 3 provides information on the data, model, and methodology. Section 4 presents the results of the analysis. The final section includes the study's conclusions and policy implications.

2. Literature Review

The significance of expected inflation in monetary policy can be traced back to Milton Friedman's seminal presidential address to the American Economic Association in 1968. Since then, the role of expectations—whether rational or adaptive—and the speed of their adjustment to policy regimes have attracted increasing attention (Mankiw et al., 2003). Carlson and Parkin (1975) analyzed the United Kingdom over the period 1961–1973 and found that the only variable influencing expected inflation was exchange rate devaluation. They concluded that reducing actual inflation is essential for lowering expected inflation. Figlewski and Wachtel (1981) demonstrated that inflation expectations were inconsistent with the rational expectations hypothesis but aligned with the adaptive expectations model in the post-war period. Moreover, decision-makers did not fully incorporate previous forecast errors into their expectations.

Gramlich (1983) showed that inflation expectations in the United States depend on supply shocks, fiscal policy, and political factors. Lee (1994) examined the process of expectations formation regarding price and cost inflation in the United Kingdom from 1972 to 1989 and found that expectations did not fully reflect actual inflation. Additionally, expectations were revised upward more quickly during rising inflation periods than during declining inflation phases. Dräger (2015) analyzed the interaction between consumers' perceptions and expectations of

quantitative inflation and actual inflation in Sweden. Using a structural VECM approach, the study found stable cointegration between perceived, expected, and actual inflation.

Tran (2018) investigated the monetary policy transmission channels in Vietnam and found a negative effect of the interest rate channel on inflation, while no short- or long-term relationship was detected between exchange rates and inflation. Kose et al. (2019) reported that long-term inflation expectations in developing economies are less well anchored than in advanced economies. They recommended enhancing central bank transparency, adopting inflation-targeting regimes, maintaining low public debt levels, and strengthening trade integration to better anchor inflation expectations. Lennard et al. (2023) showed that inflation expectations played a crucial role in the recovery of the UK economy during the 1930s. In contrast, Esady and Mate (2025) investigated the persistence of sectoral inflation in the UK and distinguished between goods and services inflation. Their findings revealed that while goods inflation exhibited higher volatility and persistence, services inflation displayed a more moderate yet persistent structure. Consequently, shocks in the goods sector were identified as the main driver of overall inflation persistence. Thus, the extent to which rising household inflation expectations translate into inflationary pressures depends on sectoral price expectations within the inflation basket.

Anesti et al. (2025) examined the sensitivity of household inflation expectations to sectoral price changes and found that households were more responsive to food price movements than to other prices. The persistence of inflation expectations, therefore, depends on whether shocks have a lasting effect on headline inflation. Similarly, Amatyakul et al. (2024) concluded that in the United States, the Eurozone, and the United Kingdom, the service sector contributes more persistently to inflation compared to food and energy prices. Moessner (2025) estimated the relationship between inflation and inflation expectations using the GMM method for 36 OECD economies during 2000Q1–2021Q1 and found that inflation expectations exert a significant influence on inflation. Moreover, the impact of expectations becomes more pronounced during high-inflation periods.

Although the number of studies on inflation expectations in Türkiye remains limited, existing analyses offer valuable insights. A significant portion of this literature examines the determinants of inflation expectations, while the remainder focuses on the relationship between expectations and price dynamics. Empirical evidence suggests that past inflation, exchange rate fluctuations, supply shocks, inflation forecast errors, and changes in the central bank's inflation target are the primary factors influencing survey-based inflation expectations in Türkiye (Koç et al., 2025).

Barlas and Mutluer (2005) found that expected and actual inflation series in Türkiye moved closely together during 1999–2004. Başkaya et al. (2008) argued that inflation expectations were strongly aligned with announced targets during the rapid disinflation period between 2002 and 2005. In a subsequent study, Başkaya et al. (2012) identified inflation forecasts, inflation targets, and lagged inflation as key determinants of inflation expectations for the period 2006M4–2012M5. They also found that expectations were more sensitive to inflation at higher inflation levels. Furthermore, the authors suggested that the CBRT's tight monetary policy stance and intensive communication efforts may have mitigated this sensitivity.

Yılmaz (2012) examined the macroeconomic variables affecting 12-month-ahead inflation expectations based on the CBRT Expectations Survey for 2002–2011 using cointegration analysis. The findings indicate that participants used inflation targets as reference values in

forming expectations; however, past inflation continued to exert a positive influence. The coefficient on inflation targets increased following the adoption of the explicit inflation-targeting regime in 2006. Similarly, Çiçek and Akar (2014) analyzed the relationship between inflation and expectations using the Quantile Kolmogorov–Smirnov (QKS) test for the period 2002M1–2013M1 and found that economic agents form expectations based on both actual inflation and announced targets.

Çiçek and Alkan (2019) examined the dynamic covariance between realized and expected inflation uncertainty using the BEKK-GARCH model for the period January 2004–March 2019. Their findings revealed a spillover effect between realized and expected inflation uncertainty. The study concluded that asymmetric information between the central bank and economic agents leads to a divergence between inflation expectations and actual inflation, implying that volatility in expectations translates into fluctuations in realized inflation. This, in turn, indicates that the central bank has limited success in anchoring expectations.

Buyun (2021) explored the asymmetric relationship between expected and realized inflation in Türkiye using the NARDL model for the period 2016M1–2021M3. The results revealed both long-run and short-run asymmetries: a 1% increase in realized inflation raised expectations by approximately 0.61%, while a 1% decline in realized inflation reduced expectations by 0.64%. Additionally, a 1% depreciation in the exchange rate was found to increase inflation expectations by 0.52%.

Finally, Alpağut (2023) identified a negative relationship between inflation and inflation expectations in Türkiye over the period 2013M5–2023M8 using the GMM estimator. The results suggest that higher expected inflation exerts a dampening effect on actual inflation, while increases in actual inflation lead to declines in expectations. Moreover, the analysis reveals unidirectional causality from expected to actual inflation. Alpağut (2023) notes that although a positive relationship between inflation and expectations is generally anticipated, factors such as shifts in central bank policy, unexpected changes in the monetary policy stance, effective communication with markets, and timely policy interventions may alter this dynamic, occasionally producing a negative relationship between inflation and expectations.

3. Data, Model, and Methodology

3.1. Data and Model

The dataset covers the period from January 2013 to December 2023 with a monthly frequency. The rationale for selecting this time frame is the absence of a consistent and overlapping dataset for earlier periods. In Eq. 1, GD refers to the CPI (Consumer Price Index) Goods index basket, and SR refers to the CPI services index basket. In determining the goods and services to be included in the CPI consumption basket are compiled from the CBRT. These variables are arranged in logarithmic form.

The following function is dependent on the general model employed in the study:

$$EXP = f(GD, SR) \tag{1}$$

The VECM form used in the study is as follows:

$$\Delta LNEXP_t = \beta_0 + \sum_{i=0}^{n} \beta_1 \Delta LNEXP_{t-1} + \sum_{i=0}^{n} \beta_2 \Delta LNGD_{t-1} + \sum_{i=0}^{n} \beta_3 \Delta LNSR_{t-1} + \beta_4 EC_{t-1} + \varepsilon_t \quad (2)$$

where Δ is the first difference; t time; β_0 is the intercept (constant) term; $\beta_1, \beta_2, \beta_3$ are the coefficients; EC_{t-1} is the one-period lagged error-correction term; β_4 is the long-run coefficient of error correction term; and ε_t is the error term.

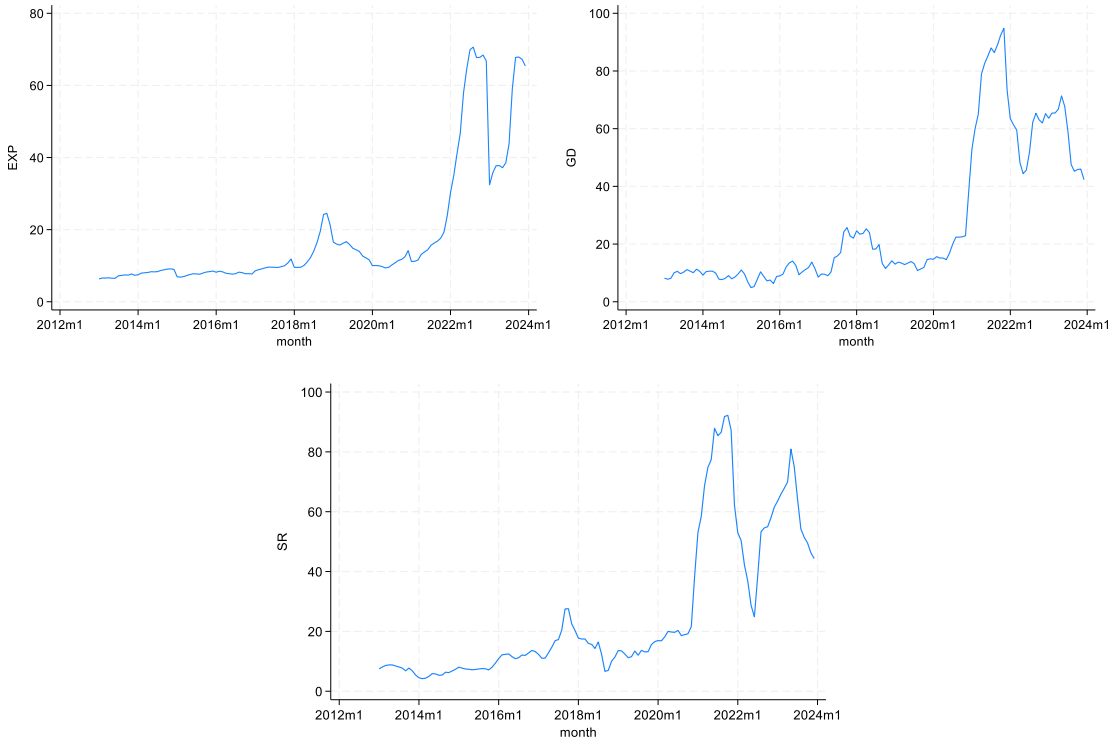


Figure 1. Trend in Respectively Expectations, and Price of Goods and Services
Source: Created by Authors

Figure 1 shows the time path of the variables. As can be seen, inflation expectations have broken upwards in the goods and services sub-sectors in 2018 and 2020. Especially with the COVID-19 pandemic process, the inflation series increased from the 20% band to the 60-80% band. The strong demand that emerged with the COVID-19 pandemic, combined with the constraints in the supply chains, led to supply and demand imbalances, which caused goods inflation to exceed services inflation in the short term. On the other hand, rigidity in both prices and labor has led to an increase in price uncertainties in the long term (Tobin, 1989). Another reason for the break in inflation expectations, especially after 2020, is the changes in central bank governors. This situation has reduced the confidence of economic units in the central bank and led to price rigidity by creating price uncertainties in both the goods and services sectors (Bodea and Hicks, 2015). Figure 2 shows the time path graph of the series in logarithmic form. It is seen that expectations after the pandemic have mostly diverged from the changes in the goods and services sector.

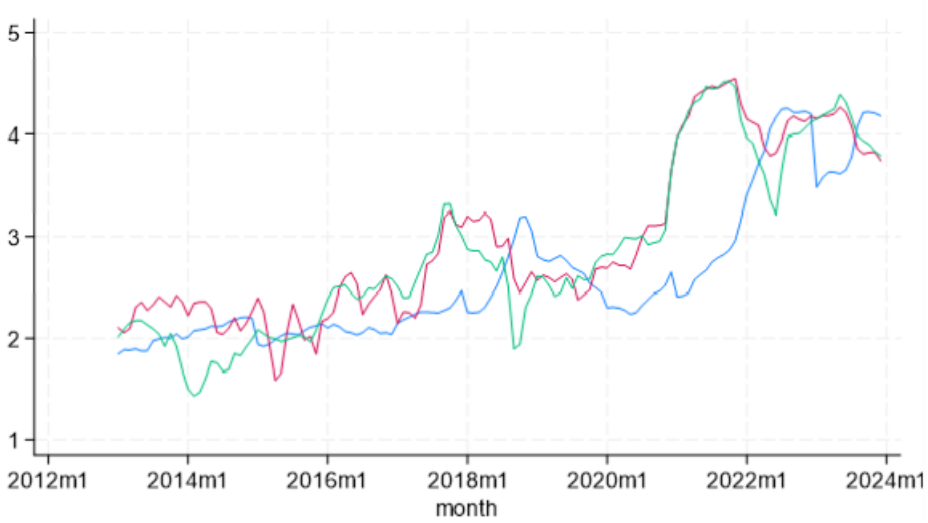


Figure 2. Inflation and Expectation Series Over Time
Source: Created by Authors

Table 1 contains descriptive statistics for the variables. Accordingly, it is seen that the logarithmic forms of the series have values close to each other. Goods prices are the variable with the highest maximum and average values. These values are 4.5515 and 2.9557, respectively. The variable with the lowest standard deviation is inflation expectations, which is 0.7026.

Table 1. Description and Summary Statistics of Variables

Variables	Description	Data Sources	Obs.	Mean	Std. Dev	Min	Max
EXP	Inflation expectation	CBRT	132	2.6121	0.7026	1.8437	4.2570
GD	Goods Prices Index	CBRT	132	2.9557	0.8107	1.5898	4.5515
SR	Service Prices Index	CBRT	132	2.8615	0.8589	1.4357	4.5242

Note: Inflation expectation shows 12-month ahead expected inflation rate.

3.2. Econometric Methodology

3.2.1. The Vector Error Correction Model (VECM)

The VECM approach, a restricted form of the VAR model, is employed when the variables exhibit cointegration and is frequently utilized in empirical studies on monetary policy. Its general formulation is expressed as follows:

$$Y_t = A_0 + \sum_{i=1}^{k} A_i Y_{t-i} + \emptyset X_t + \varepsilon_t \quad (3)$$

where Y_t and Y_{t-i} are both $(jx1)$ column vectors with j as number of endogenous variables, Y_t includes observations at time t and Y_{t-i} includes ith lagged value of endogenous variables. A_0 denotes a $(jx1)$ vector of intercept terms, while X_t indicates an $(mx1)$ column vector of m exogenous variables. ε_t is a $(jx1)$ vector of disturbance terms. When I(1) variables are cointegrated, the VAR model can be expressed by the first-differenced error correction form.

$$\Delta Y_t = A_0 + \Pi Y_{t-1} + \sum_{i=1}^{k-1} A_i^{*} \Delta Y_{t-i} + \emptyset X_t + \varepsilon_t \quad (4)$$

where ΔY_t is the first difference of Y_t . Π is coefficient matrix containing information on long-run relationship among Y_t , and the rank Π written as $\Pi = \alpha\beta'$reflects the number of cointegrating relations (r). α and β are both (jxr) matrix. The coefficient α_i measures the speed of adjustment of i*th* variable towards the equilibrium, while β_i denotes the long-run estimator of that variable. Matrix A_i^{*} contains information on short-run dynamics in a cointegrated system (Tran, 2018).

3.2.2. Time-Varying LA-VAR Granger Causality

The Granger causality test is applied to determine the causality relationships between variables. Time-varying Granger causality analysis developed by Shi et al. (2018) is used to explain the causal relationships between variables in different time domains. This method is based on the lagged augmented VAR (LA-VAR) model proposed by Toda and Yamamoto (1995) and used in the time-varying Granger test (Ren et al., 2023). Time-varying Granger causality is established based on the premise that causality relationships may alter during periods of financial conjuncture.

Without loss of generality, the two-variable stationary VAR(m) model can be written as follows:

$$y_{1t} = \emptyset_0^{(1)} + \sum_{k=1}^{m} \emptyset_{1k}^{(1)} y_{1\,t-k} + \sum_{k=1}^{m} \emptyset_{2k}^{(1)} y_{2\,t-k} + \varepsilon_{1t} \quad (5)$$

$$y_{2t} = \emptyset_0^{(2)} + \sum_{k=1}^{m} \emptyset_{1k}^{(2)} y1_{\,t-k} + \sum_{k=1}^{m} \emptyset_{2k}^{(2)} y_{2\,t-k} + \varepsilon_{2t} \quad (6)$$

where y_{1t} and y_{2t} indicates two time series variables. In this equation, if past values of y_1 have predictive power for the current value of y_2, then variable y_1 is said to Granger-cause variable y_2. Therefore, the null hypothesis that there is no Granger causality from variable y_1 to variable y_2 is tested. The null hypothesis here involves testing the joint significance $\emptyset_{1k}^{(2)}$ $(k = 1, \dots, m)$ via the Wald test (Baum et al., 2022).

Recasting the bivariate VAR(m) in matrix notation:

$$\begin{gathered} y_t = \Pi x_t + \varepsilon_t \\ y_t = [y_{1t} \;\; y_{2t}]' \\ x_t = [1 \;\; y'_{t-1} \;\; y'_{t-2} \dots y'_{t-k}]' \\ \Pi_{2x(2m+1)} = [\emptyset_0 \; \emptyset_1 \; \dots \; \emptyset_m] \\ \emptyset_0 = [\emptyset_0^{(1)} \;\; \emptyset_0^{(2)}]' \\ \emptyset_k = \begin{bmatrix} \emptyset_{1k}^{(1)} & \emptyset_{2k}^{(1)} \\ \emptyset_{1k}^{(2)} & \emptyset_{2k}^{(2)} \end{bmatrix} \text{ for } k = 1, \dots, m \end{gathered} \quad (7)$$

In this equation, y_{1t} represents the $y_t = [y_{1t}\ y_{2t}]'$ matrix variable at time, $x_t = [1\ y'_{t-1}\ \ y'_{t-2} \dots\ y'_{t-k}]'$ matrix variable Π represents the $\emptyset_k = \begin{bmatrix} \emptyset_{1k}^{(1)} & \emptyset_{2k}^{(1)} \\ \emptyset_{1k}^{(2)} & \emptyset_{2k}^{(2)} \end{bmatrix}\ k = 1, \dots, m$ matrix coefficients and ε_t represents the error term.

The heterokedastic-consistent Wald statistic of the null hypothesis is denoted by $W_{1\to2}$ and is defined as

$$W_{1\to2} = T\big(R_{1\to2}\widehat{\Pi}\big)'\big[R_{1\to2}\big(\hat{V}^{-1}\hat{\Sigma}\hat{V}^{-1}\big)R'_{1\to2}\big]^{-1}(R_{1\to2}\widehat{\Pi})$$

where, T is the sample regression size and $R_{1\to2}$ is the coefficient restriction matrix. This restriction matrix is used to obtain test statistics that detect changes in the causality relationship under the null hypothesis. $R_{1\to2}\Pi = 0$, which states that there is no Granger causality from y_1 to y_2.

where, $\hat{V} = I_n \otimes \hat{Q}$ and $\hat{Q} = T^{-1}\sum_t x_t x'_t$ and $\hat{\Sigma}T^{-1}\sum_t \hat{\xi}_t\hat{\xi}'_t$ with $\hat{\xi}_t = \dot{\varepsilon}_t \otimes x_t$ and $\dot{\varepsilon}_t = y_t - \widehat{\Pi}x_t$

This procedure is intended to detect Granger causality in a valid VAR analysis in the case of stationary variables. To show the relationship between the integrated variables, an LA-VAR model is needed, which is the original VAR(m) model augmented with d lags for the maximum order of integration as suggested by Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996). This model is denoted as $VAR\ (m + d)$ (Baum et al., 2022).

The time-varying Granger test includes three different algorithms: forward expanding (Thoma, 1994), rolling window (Swanson, 1998), and recursive evolving. Forward, Rolling, and recursive algorithms provide real-time insight into causality using only historical data (Shi et al., 2018). The forward expanding window (FE) algorithm is a standard forward iteration. The Wald test statistic is first calculated for the minimum window length, and the sample size is then sequentially expanded by one observation until the final test statistic is calculated using the entire sample (Baum et al., 2022). The rolling window (RO) algorithm is passed through a window of samples, one observation at a time, and a Wald test statistic is calculated for each window. The recursive evolving window (RE) algorithm covers both FE and RO iterations as special cases. When the Wald statistics obtained in the change periods exceed the critical values corresponding to the 95% confidence level, the causal relationship is considered to have begun, and when they fall below the critical values, the causal relationship is considered to have ended (Shi et al., 2018).

4. Findings

Regression analysis produces efficient and time-invariant estimates as long as the variables are stationary over time. However, many macroeconomic time series have random walks (Kim, 1998). It is also necessary to avoid spurious regression. Therefore, unit root tests were applied to detect stationarity. According to Table 2, the Augmented Dickey Fuller (ADF) and Phillips Perron (PP) tests, including the constant and constant and trend versions, all variables are integrated of order one I(1). To perform the cointegration testing, all variables must be I (1).

Table 2. Stationary Tests

Variable	Level. ADF	Δ. ADF	Level. PP	Δ. PP
		constant		
LNEXP	0.264	-8.483***	-0.250	-8.569***
LNGD	-1.068	-8.454***	-1.192	-8.246***
LNSR	-0.887	-7.203***	-1.163	-6.979***
		constant and trend		
LNEXP	-1.280	-8.523***	-1.828	-8.598***
LNGD	-1.963	-8.422***	-2.261	-8.210***
LNSR	-2.092	-7.176***	-2.663	-6.949***

Note: ***, **, * significance at 1%, 5%, and 10% respectively.

Table 3 shows the Zivot-Andrews breakpoint test. Accordingly, there was a major breakout in the inflation expectations variable at the beginning of the pandemic, and expectations showed a downward trend. The upward recovery has gained momentum since 2021. In the prices of goods and services, the breakout period corresponds to the first months of 2021, when the impact of the pandemic began to wane. Based on this, it can be said that the prices of goods and services are realized depending on expectations.

Table 3. Zivot-Andrews Breakpoint Test

Variable	Level	time	Δ	time
LNEXP	-3.173	2020m7	-8.526***	2019m11
LNGD	-2.351	2014m11	-8.964***	2021m3
LNSR	-3.220	2018m9	-7.912***	2021m1

Note: The critical values for the constant model are as follows: 1%: -4.93; 5%: -4.42; 10%: -4.11. ***, **, * significance at 1%, 5%, and 10% respectively.

The vector error correction mechanism (VECM) is a suitable analysis because the variables are cointegrated at the I(1) level. The cointegration method is important in terms of combining the short and long-term dynamics between variables. In order to test cointegration or determine cointegrating VECMs, it is necessary to determine the number of lags. Table 4 shows the lag order of the VAR model. The Final Estimation Error (FPE), Akaike Information Criterion (AIC) method, and the rank-ordered likelihood ratio (LR) test suggested three lags. Therefore, three lags were used in the model.

Table 4. Lag-Order Selection Criteria

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-248.617				0.01023	3.931	3.959	3.998
1	276.759	1050.8	9	0.000	3.2e-06	-4.137	-4.028	-3.869
2	311.344	69.171	9	0.000	2.2e-06	-4.537	-4.346*	-4.069*
3	322.86	23.031*	9	0.006	2.1e-06*	-4.576*	-4.304	-3.907
4	326.294	68.671	9	0.651	2.3e-06	-4.489	-4.136	-3.619

Note: ***, **, * significance at 1%, 5%, and 10% respectively.

Table 5. Johansen Tests for Cointegration

Maximum rank	Parms	LL	Eigenvalue	Trace Statistic	Critical value 5%
0	21	310.1696	.	31.7454	29.68
1	26	319.8987	0.1400	12.2871*	15.41
2	29	326.0358	0.0908	0.0130	3.76
3	30	326.0423	0.0001		

Note: ***, **, * significance at 1%, 5%, and 10% respectively.

The applied cointegration tests are based on the Johansen method. Table 5 shows that the test statistics are based on the model with three lags and a fixed trend. The table reflects the test statistics and critical values for the null hypothesis of no cointegration, one or fewer cointegration equations, and two or fewer cointegration equations. The null hypothesis of no cointegration is rejected, and the existence of one cointegration equation at most is accepted. In addition, since the modulus of all eigenvalues is less than one, the estimated VECM converges towards its long-term equilibrium, satisfying the stability condition (Tran, 2018).

Table 6. Vector Error-Correction Model

Equation		Parms	RMSE	R-sq		chi2	P>chi2
D_LNEXP		5	0.0905	0.3096		56.0557	0.0000
D_LNGD		5	0.1315	0.2296		37.2578	0.0000
D_LNSR		5	0.1298	0.1980		30.8661	0.0000
		Coefficient	**Std. err.**	**z**	**P>z**	**[95% conf.**	**interval]**
D_LNEXP _ce1	L1.	-0.0448	0.0122	-3.65	0.000	-0.0688	-0.0208
	LNEXP LD.	0.1524	0.0788	1.93	0.053	-0.0021	0.3068
	LNGD LD.	-0.1953	0.0672	-2.91	0.004	-0.3270	-0.0637
	LNSR LD.	-0.1466	0.0691	-2.12	0.034	-0.2821	-0.0112
	_cons	0.0135	0.0083	1.63	0.104	-0.0028	0.0297
D_LNGD _ce1	L1.	0.0438	0.0178	2.46	0.014	0.0089	0.0787
	LNEXP LD.	0.1476	0.1145	1.29	0.197	-0.0768	0.3721
	LNGD LD.	0.1612	0.0976	1.65	0.098	-0.0300	0.3525
	LNSR LD.	0.3573	0.1004	3.56	0.000	0.1605	0.5542
	_cons	0.0091	0.0120	0.75	0.452	-0.0145	0.0327
D_LNSR _ce1	L1.	0.0207	0.0176	1.18	0.238	-0.0137	0.0551
	LNEXP LD.	0.0094	0.1130	0.08	0.933	-0.2121	0.2310
	LNGD LD.	-0.0283	0.0963	-0.29	0.769	-0.2170	0.1605
	LNSR LD.	0.4338	0.0991	4.38	0.000	0.2395	0.6281
	_cons	0.0099	0.0119	0.84	0.401	-0.0133	0.0333

After determining that there is a cointegration equation between the LNEXP, LNGD, and LNSR series, the parameters of the three-variable cointegrated VECM for this series are now estimated. Table 6 presents the data on the significance of the VECM method for three variables. The generated estimation table includes the short-term estimates of the data, standard errors, z-statistics, and confidence intervals. The three coefficients on L. ce1 show the effect of adjusting the matrix in this model. Table 7 includes the coefficients, standard errors, z-statistics, and confidence intervals of the cointegration vector.

Table 7. Cointegrating Equations

Equation	Parms	chi2	P>chi2				
_ce1	2	43.02993	0.000				
	beta	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
_ce1	LNEXP	1	.	.	.	.	.
	LNGD	-2.2956	0.6364	-3.61	0.000	-3.5430	-1.0481
	LNSR	1.1330	0.5986	1.89	0.058	-0.0402	2.3061
	_cons	0.8039	.	.	.	.	.

Table 8 is constructed to check whether the number of cointegrating equations is correctly determined. The accompanying matrix of a VECM with an endogenous variable K, and a cointegration equation r has a unit eigenvalue $K - r$. If the modulus of the eigenvalues is less than one, it shows that the process is stable. None of the eigenvalues is outside the circle. Therefore, according to the stability check, the model is correctly established (Figure 4).

Table 8. Eigenvalues of the Companion Matrix

Eigenvalue			Modulus
1			1
1			1
0.830988	+	.5918702i	0.830988
0.014079	-	.5918702i	0.592038
0.014079			0.592038
0.53363			0.533630
0.32588	+	.3993773i	0.515461
0.32588	-	.3993773i	0.515461
-0.27797			0.277969

Table 9 shows that there is no serial correlation in the residuals. From these results, it is understood that the appropriate number of lags was selected for the model.

Table 9. Lagrange-Multiplier Test

lag	chi2	df	Prob > chi2
1	6.6003	9	0.6787
2	6.7023	9	0.6681
3	8.0172	9	0.5324

The coefficients obtained are as follows:

$\hat{\alpha} = (-0.0447861, 0.0437741, 0.0207178)$

$\hat{\beta} = (1, -2.29556, 1.132959)$

$\hat{v} = (0.0134893, 0.0090689, 0.0099986)$

$$\hat{r} = \begin{pmatrix} 0.1523641 & -0.1953214 & -0.14664 \\ 0.1476155 & 0.1612256 & 0.3573486 \\ 0.0094332 & -0.0282391 & 0.4338047 \end{pmatrix}$$

where $\hat{\alpha}, \hat{\beta}, \hat{v},$ and $\hat{r}$ show the effect of adjusting the matrix in the VECM model, long-term coefficients of the variables, constant terms, and the short-term coefficients matrix of the variables, respectively.

This study investigates the effect of inflation expectations on inflation rates, so the results of the model in which the dependent variable is inflation expectations are interpreted. VECM includes an error correction coefficient that expresses the speed of adjustment of imbalances formed after the shock to the equilibrium level over time. The L1. ECT coefficient should take a value between 0 and -1. The adjustment process coefficient in the model is -0.045, which is significant. This means that approximately 4% of the deviation from equilibrium is corrected per period. Imbalances in expectations reach their long-term equilibrium after approximately 22 months (1/0.045). Accordingly, expectations converge to their long-term equilibrium slowly. Accordingly, expectations reach their long-term balance slowly. In the short term, inflation expectations are explained by the change in prices of goods and services together with their lagged value. A 1% increase in inflation expectations leads to a 0.152% increase above expectations. A 1% increase in goods prices reduces inflation expectations by 0.195%. A 1% increase in service prices reduces inflation expectations by 0.147%. In the long run, a 1% increase in goods prices reduces inflation expectations by 2.296%. A 1% increase in service prices increases inflation expectations by 1.133%.

According to the coefficients obtained from the VECM analysis, the impact of price movements on expectations is stronger in the long run than in the short run. The effect of price behavior in the goods and services markets on expectations is measured with similar coefficients (-0.195 and -0.147, respectively). In the long term, the dampening effect of price movements in the goods market on inflation expectations becomes more pronounced. In contrast, price increases in the services sector lead to higher inflation expectations.

This divergence stems from the differing effects of price changes on inflation expectations. In the short run, increases in goods and service prices are generally perceived as temporary and therefore do not translate into persistent inflation expectations. In the long run, however, external determinants such as commodity prices, exchange rates, and production costs influence price dynamics.

Service prices, which are driven by wages, rents, and domestic demand, exert an upward effect on long-term inflation expectations. Moreover, differences in price flexibility and rigidity further reinforce this phenomenon. Service prices tend to be sticky, wages and rents are rarely adjusted, which causes price increases in this sector to have a more persistent upward impact on expectations. In contrast, goods prices, particularly those of durable goods, exhibit relative flexibility, allowing expectations to adjust downward more rapidly once prices stabilize.

Furthermore, this finding is consistent with studies in the literature documenting a nonlinear or negative relationship between inflation and expectations in Turkey (e.g., Başkaya et al., 2012; Alpağut, 2023). Çiçek and Akar (2014) emphasize the potential for asymmetries in the convergence of inflation expectations toward inflation targets or actual inflation, while Yılmaz (2012) demonstrates that the impact of realized inflation on expectations weakened following the adoption of the explicit inflation targeting regime.

Since inferences about parameters depend heavily on the stationarity of the cointegrating equations, it is important to check the specification of the model. Firstly, cointegration equations

should be estimated and plotted over time. The large shocks seen in the graph of the logarithmic series have clear effects on the estimates obtained from the cointegration equations (Figures 2 and 3). The overall downward trajectory in both the general price level and inflation expectations observed between late 2019 and the end of 2021 can largely be attributed to the effects of the COVID-19 pandemic. Following this period, both variables began to exhibit an upward trend. Moreover, elevated inflation appears to influence firms' price-setting behavior, which constitutes a critical channel in the transmission of nominal shocks. Therefore, nominal shocks have led to stickiness in prices. Sticky prices produce temporary deviations in relative prices, thus leading to supply shortages and the cost of welfare resulting from inflation or deflation. This will complicate the valuation process of both the current period and the future period.

Pricing behaviour is related to a lack of coordination arising from demand uncertainty, confidence in economic policies, and excessive price volatility. This will lead to a decline in the proportion of firms forecasting price increases and longer price-setting periods. Therefore, as the price determination process is interdependent under relative prices, the resulting uncertainty will create a self-reinforcing imbalance that both increases price stickiness and causes expectations to become adaptive. According to Klenow and Malin (2011), in the presence of pricing uncertainty, shocks substantially increase price variance and exert significant effects on real economic variables. The effectiveness of a central bank's aggregate demand policies in influencing real output critically depends on the pricing behavior of firms. Under conditions of price uncertainty, price-setting agents tend to translate increases in aggregate demand into higher prices rather than expanded output. Moreover, price uncertainty diminishes social welfare by inducing aggregate demand volatility, as it amplifies fluctuations in real income and, consequently, in expenditures. Since inflation targeting frameworks fundamentally rely on the expectations of price-setting economic units, price rigidities assume a pivotal role in shaping both the conduct of monetary policy and the formation of market expectations. Accordingly, the decisions of economic agents, and the extent to which these decisions affect revenues, are contingent upon their perceptions of relative prices, transaction costs, and the prevailing market structure. In cases where economic agents lack timely and comprehensive information on sectoral prices, the price adjustment process becomes uncertain, thereby impairing the functioning of the price system (Gordon, 1981: 513).

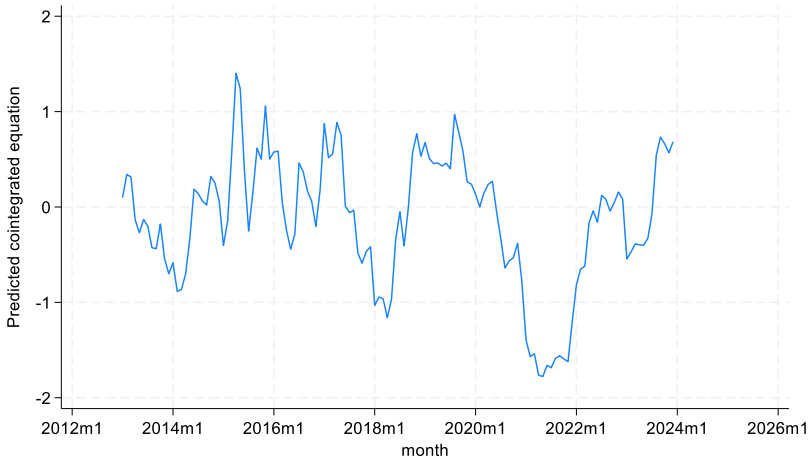


Figure 3. Cointegration Graph

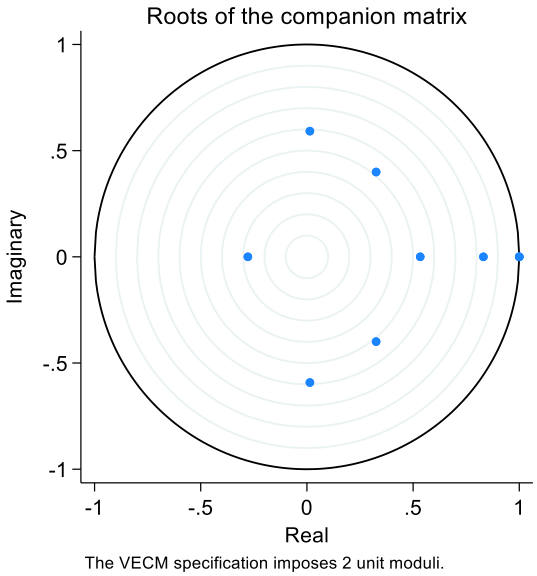


Figure 4. Eigenvalues of the Companion Matrix

While the IRFs from a fixed VAR always disappear over time, the IRFs from a cointegrated VECM do not. Since each variable in a fixed VAR has a time-invariant mean and a finite, time-invariant variance, the effect of a shock to any of these variables must disappear before the variable can revert to its mean. In contrast, the I(1) variables modeled in a cointegrated VECM do not mean-revert, and the identity modules in the accompanying matrix imply that the effects of some shocks will not vanish over time. If the effect of a shock decreases to zero over time, the shock is temporary. Conversely, if the effect of a shock does not lessen to zero over time, the shock is permanent. The graphs show that a shock orthogonalized to goods prices (LNGD) has a transitory effect on inflation expectations (LNEXP), but a shock orthogonalized to services prices (LNSR) has a permanent effect on inflation expectations (LNEXP).

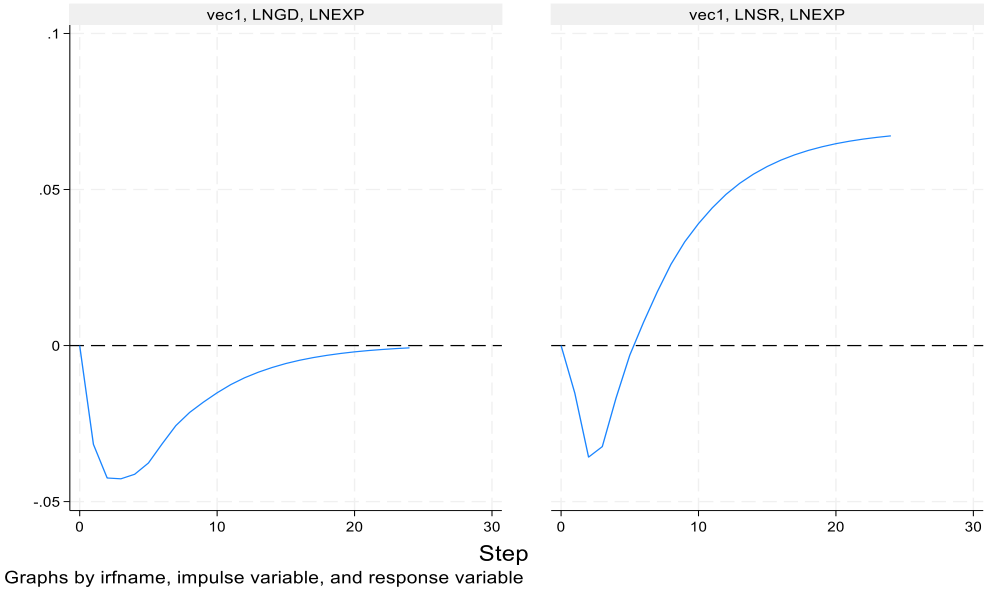


Figure 5. Impulse–Response Functions for VECMs

According to this model, unexpected shocks to the goods market will have a temporary impact on inflation expectations, but unexpected shocks to the services sector will have a permanent impact on inflation expectations. In other words, the economic slowdown that emerged with the COVID-19 pandemic reduced the permanence of the general inflation expectation, but the restrictions that emerged with the COVID-19 pandemic increased the inflation permanence of the service sector (Figure 5). As a matter of fact, in their study, Yılmaz and Süslü (2018) revealed that the economic units that make pricing in the Turkish economy frequently change their prices, so the price frequency is a function of the inflation rate. Also, in the study it has been observed that cost-pushing factors (cost-pushing factors) have a positive effect on price frequency in Türkiye. In addition, it is concluded that the effect of the demand factor on price frequency is unclear.

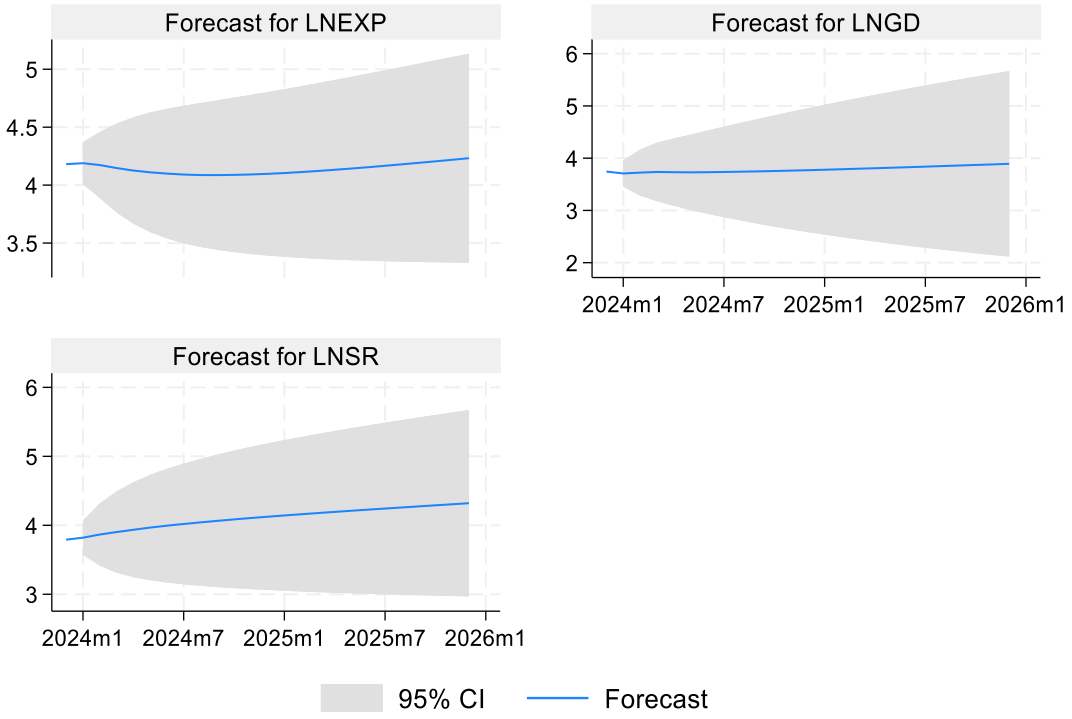


Figure 6. Forecasting with VECMs

Cointegrated VECMs are used to produce estimates of both the level and first-difference stationarity of variables. For a stationary VAR, the variances of the forecast errors converge to a constant value as the forecast horizon grows. On the other hand, the variances of the forecast errors for cointegrated VECM levels grow farther away from the forecast horizon. Since all variables in the model are first-difference stationary, the forecast errors for the dynamic forecasts of first differences diverge to infinity. Figure 6 shows the dynamic forecasts of the levels and their asymptotic confidence intervals. As expected, the widths of the confidence intervals grow with the forecast horizon. It also appears that inflation expectations converge toward the future value of the services sector.

The time-varying Granger causality test is estimated using moving windows with different lag lengths. The results of the Wald statistics are shown in tables and graphs. The Wald statistics obtained with the FE, RO, and RE algorithms are transferred to graphs with critical values (Erer, 2023). In this study, the Granger causality relationship between inflation expectations and the goods and services sector is determined over time.

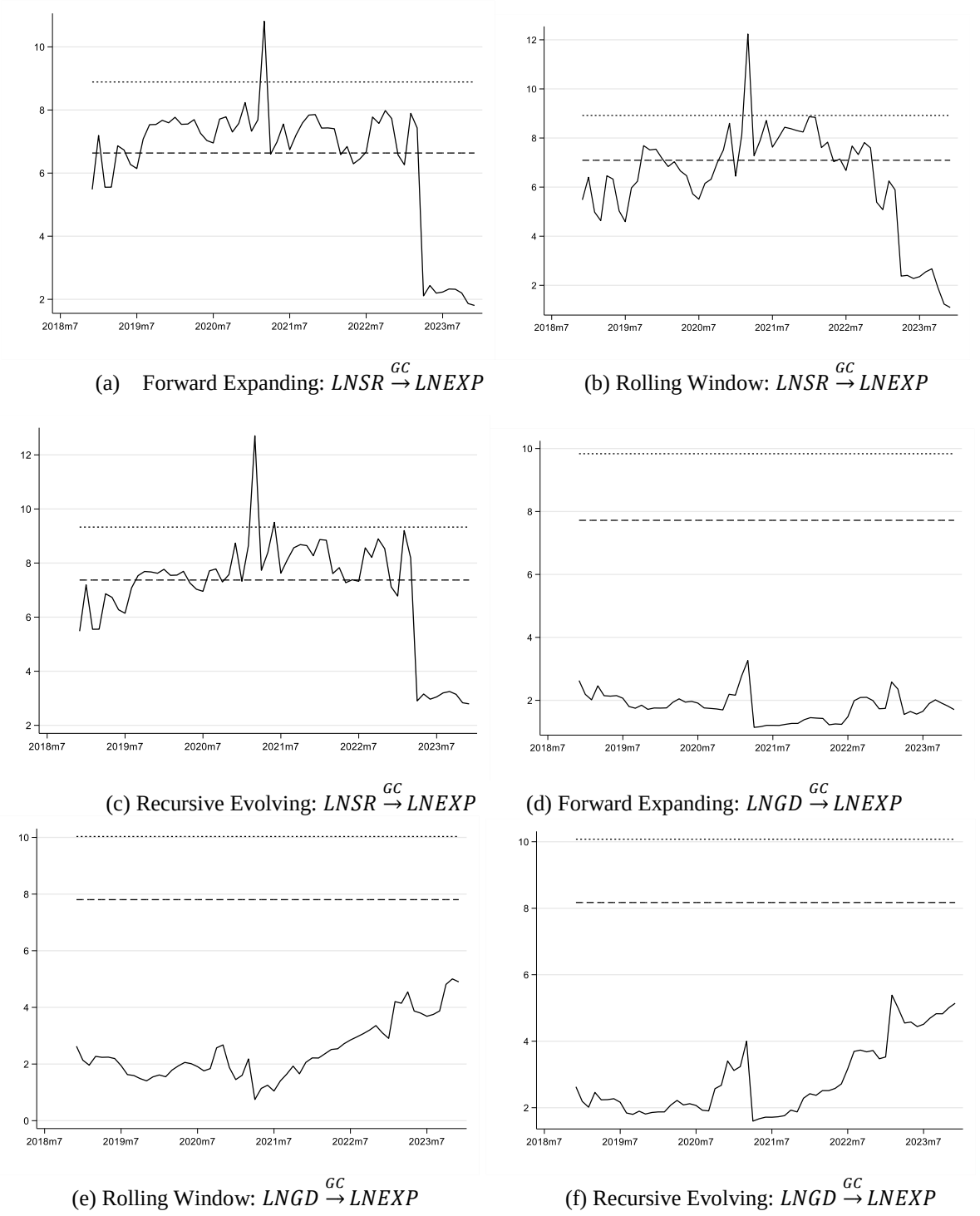
Table 10 reports the robust Wald test statistics with 95% and 99% critical values calculated by the bootstrap procedures. From the table, it is understood that the effect of price changes in the goods sector on expectations is weak, while the services sector is stronger. According to this table, the null hypothesis of no Granger causality from the service sector to inflation expectations is rejected. This strong rejection of the null hypothesis is evidence of Granger causality between the service sector and inflation expectations and is valid for all algorithms. On the other hand, the null hypothesis of no Granger causality from the goods sector to inflation expectations is accepted. There is no Granger causality from the goods sector to inflation expectations.

Table 10. Wald Tests of Granger Causality

Causality		**Wald**	**95th**	**99th**
$LNGD \overset{GC}{\rightarrow} LNEXP$	Forward	3.266	9.835	15.621
	Rolling	5.006	10.033	14.176
	Recursive	5.387	10.076	15.621
$LNSR \overset{GC}{\rightarrow} LNEXP$	Forward	10.811**	8.887	16.669
	Rolling	12.237**	8.921	14.088
	Recursive	12.705**	9.330	16.669

Note: *, **, *** denotes 10%, 5%, 1% significance level respectively.

In Figure 7, $x \overset{GC}{\rightarrow} y$ shows that the direction of the tested Granger causality runs from x to y. The underlying VAR model is fit with $p = 3$ lags and with $d = 1$ lag-augmented part, and it includes a trend. Y-axis represents the value of Wald test statistics, and (--) represents the 90% confidence interval, (-) represents the 95% confidence interval (Mishra et al., 2022). The critical values with 10% and 5% bootstrap are based on 499 replications with a one-year period to control the size. The minimum window size is based on 72 observations. Wald statistics are robust to heteroskedasticity (Baum et al., 2022). When the value of the test statistic exceeds the critical values, the existence of Granger causality is accepted. In this case, the null hypothesis stating that there is no Granger causality is rejected. Therefore, Figures 7(a), 7(b) and 7(c) confirm Granger causality, while 7(d), 7(e) and 7(f) do not confirm Granger causality. In other words, all estimations pertaining to the services sector confirm the presence of Granger causality running from services prices to expectations, whereas all estimations concerning the goods sector reject the existence of such causality. These results support that the service sector is closely related to inflation expectations.



(a) Forward Expanding: $LNSR \overset{GC}{\rightarrow} LNEXP$

(b) Rolling Window: $LNSR \overset{GC}{\rightarrow} LNEXP$

(c) Recursive Evolving: $LNSR \overset{GC}{\rightarrow} LNEXP$

(d) Forward Expanding: $LNGD \overset{GC}{\rightarrow} LNEXP$

(e) Rolling Window: $LNGD \overset{GC}{\rightarrow} LNEXP$

(f) Recursive Evolving: $LNGD \overset{GC}{\rightarrow} LNEXP$

Figure 7. Time-varying Granger Causality Tests between LNSR to LNEXP and LNGD to LNEXP.

Figure 7 shows the effect of price movements in the goods and services sector on expectations over time. Accordingly, the impact of the service sector on expectations is very evident. The causality periods determined by forward, rolling, and recursive algorithms regarding the expectations of the services sector are quite similar. Causality follows a fluctuating course in all three algorithms. However, a sharp decline in the causality is observed in the forward

expanding and recursive evolving algorithm, while a gradual decrease is observed in the rolling window algorithm at the end of 2022. In other words, the impact of the service sector has started to decrease, and the impact of the goods sector has started to increase since the last quarter of 2022.

The primary reason for this phenomenon is the emergence of base effects. The price increases observed in previous years have made it difficult for annual inflation to continue rising at the same pace. Consequently, the capacity of price increases in the service sector to push inflation expectations upward has weakened. Another factor is that the rise in global commodity and energy prices, coupled with exchange rate movements, has increased production costs, leading to the reemergence of goods inflation as a dominant factor.

Therefore, prior to 2022, inflation expectations in the service sector were mainly shaped by wage increases, rents, transportation costs, and the effects of post-pandemic reopening. After 2022, however, factors such as demand-side pressures, demand for durable goods, cost shocks, and exchange rate fluctuations have become the primary determinants of inflation expectations in the goods sector. Indeed, Akarsu and Aktuğ (2025) demonstrate in their study that while the COVID-19 pandemic initially triggered inflation through supply-side factors, the implementation of loose monetary policies after 2022 also contributed to an increase in demand-driven inflation.

As price uncertainty increases, aggregate demand will decrease, so inflation expectations will decrease in the short term. The impact of factors such as exchange rates and interest rates, which have shaped expectations separately from the goods and services sector in the last few years, may have increased. As a matter of fact, in his study, Yılmazkuday (2022) found that the effect of the policy rate on inflation in inflation determinants for the Turkish economy was negative in the long run, while oil prices and exchange rates were positive and high.

5. Conclusion and Policy Implications

The Central Bank incorporates the price-setting behavior of economic agents as given and determines interest rate adjustments in response to price uncertainty. Nevertheless, under such uncertainty, price stickiness constrains the effectiveness of interest rate instruments. Consequently, central banks must identify which sub-sectors contribute most significantly to price uncertainty within the price-setting process (Afrouzi et al., 2024).

Within the scope of this study, which differentiates between goods and services in analyzing the interaction between inflation expectations and realized inflation for the period 2013M1–2023M12 in Türkiye, the evidence indicates that developments in the services sector exert persistent effects on inflation expectations. In the short run, increases in both goods and services prices negatively influence expectations. In the long run, however, goods price increases reduce inflation expectations, whereas services price increases reinforce them. Put differently, inflation expectations do not converge towards realized inflation in the short term; instead, convergence occurs in the long term through sustained increases in service prices.

According to these findings, in the short term, increases in both goods and service prices reduce inflation expectations. The main reason for this is that under conditions of price uncertainty, shocks significantly increase price volatility and thereby affect real variables. Economic agents that set prices adjust them in response to increases in aggregate demand. As price fluctuations intensify, price uncertainty rises, leading to changes in firms' marginal

productivity and consequently to declines in profits, which in turn cause economic fluctuations. If a firm operates in an imperfectly competitive market, it tends to mitigate the effects of emerging uncertainties, resulting in little to no change in pricing decisions in the short term (Solow, 1998). In particular, even when prices rise, if future demand expectations are uncertain, inflation expectations may decline.

Price increases are also associated with demand uncertainty, confidence in economic policies, and coordination failures stemming from excessive price volatility (Ball et al., 1991). This situation leads to a decline in the proportion of firms anticipating further price increases and to a lengthening of price adjustment intervals (CBRT, 2025b).

Moreover, individuals perceive the current price as a reference point. When the price rises significantly, the perception that it is "already expensive" emerges, making further increases appear unfair or irrational. As a result, the expectation that "prices will not rise further" develops. Consumers interpret high prices as a loss, and in this context, the desire to avoid additional losses leads to a downward adjustment in expectations. In other words, individuals psychologically comfort themselves by assuming that "prices will not increase further" (Minsky, 1977; Boztuğ et al., 2014). However, deviations from central bank targets weaken the explanatory power of these targets and thereby attenuate the relationship between price expectations and pricing behavior. Indeed, the findings of Başkaya et al. (2008) indicate that the real sector is less responsive to both short-term inflation expectations and central bank targets.

This finding aligns with strands of the literature documenting a non-linear or negative relationship between inflation and expectations in Türkiye (e.g., Başkaya et al., 2012; Alpağut, 2023). Çiçek and Akar (2014) further emphasize the probability of asymmetries in the convergence of inflation expectations with inflation targets or realized inflation, while Yılmaz (2012) demonstrates that the influence of actual inflation on expectations weakened following the adoption of an explicit inflation targeting regime.

In the long run, however, a divergence emerges: while higher goods prices dampen inflation expectations, sustained increases in services prices reinforce them, highlighting the asymmetric nature of the expectations–inflation nexus. These findings suggest that inflation expectations in Türkiye do not converge toward realized inflation in the short run but instead converge in the long run through persistent services-sector dynamics.

The policy implications of these findings are substantial. First, they underline the central role of the services sector in shaping expectations and, by extension, in determining the persistence of inflation. This sector-driven persistence amplifies the importance of incorporating sectoral heterogeneity into the design of monetary policy. In particular, the CBRT should strengthen its monitoring of services-sector inflation and communicate its stance on this component more explicitly to anchor expectations effectively. Second, the results support the view that well-anchored expectations are essential for enhancing the credibility and efficiency of monetary policy. As the evidence indicates, weakly anchored expectations increase the likelihood of adaptive behavior, price stickiness, and instability in aggregate demand.

Finally, the time-varying Granger causality analysis reveals that while service prices were the dominant driver of expectations during most of the sample period, goods prices have become increasingly influential since late 2022. The main factor behind this development is that demand-

side pressures, durable goods demand, cost shocks, and exchange rate effects have become the key determinants of inflation expectations in the goods sector.

This shift underscores the need for a flexible policy framework that can adapt to changing drivers of expectations. Maintaining a tight monetary policy stance appears to have contributed positively to anchoring consumer perceptions of inflation, yet the persistence of sectoral price shocks continues to pose a challenge. Thus, the CBRT should not only preserve its commitment to price stability through a consistent and transparent policy framework but also design sector-sensitive instruments to mitigate the asymmetric effects of goods and services prices on expectations.

As a result, it appears that, as of 2013M1, price movements in both the goods and services markets continue to have strong and long-lasting effects on inflation expectations. Because price theory is fundamentally concerned with relative prices, the uncertainty surrounding the pricing process for goods and services in terms of other goods and services will complicate the valuation process and increase relative prices, creating self-determining imbalances.

The findings of this study also yield several important policy implications for the conduct of monetary policy in Türkiye. First, strengthening the anchoring of inflation expectations should be considered a primary objective of the CBRT. Clear, transparent, and credible communication strategies, particularly forward guidance that conveys medium-term inflation targets, are crucial in reducing uncertainty and enhancing the effectiveness of the expectation channel. In this regard, the persistent role of services-sector shocks highlights the necessity of incorporating sector-specific dynamics into the design and implementation of monetary policy. Developing sector-sensitive instruments and publishing disaggregated inflation forecasts, with a particular focus on housing, health, education, and transportation, would allow for a more accurate assessment of inflation persistence and help anchor expectations more effectively. Moreover, ensuring institutional independence and policy consistency is indispensable for sustaining central bank credibility. Frequent changes in policy direction or leadership undermine public trust and increase the reliance of economic agents on backward-looking behavior, thereby amplifying inflation volatility. In addition to credibility, reducing information frictions is also critical; the regular and detailed dissemination of sectoral inflation data and expectations surveys can mitigate asymmetric information problems and enhance the effectiveness of monetary policy.

However, while monetary policy plays a significant role in controlling inflation in today's economy, the pricing process is not independent of the time preferences, political priorities, and resource allocation of market actors and the public. Therefore, today, when monetary policy alone cannot control inflation, price stability requires stable economic policies from public authorities and an economic environment free of fiscal dominance. Especially since late 2022, as fiscal dominance increases, uncertainty surrounding central bank policies increases, increasing external pressures on monetary policy. As external pressures, particularly from public policies, increase, the pricing process will be disrupted. Consequently, price instability in the service sector will persist, and inflation expectations will continue to rise.

6. Limitations and Future Directions

This article focuses on the impact of price movements in the goods and services sectors on inflation expectations in Türkiye. Changes in central bank policies or macroeconomic shocks can

lead to structural breaks and parameter instability. Therefore, this study integrates the VECM analysis with time-varying Granger causality. However, regime-switching and time-dependent models perform better than standard linear VECMs in capturing the dynamics and structural breaks caused by policy changes. Hence, future research should take this into account.

In this study, a sectoral analysis is conducted to measure the effect of goods and services inflation on inflation expectations. The study addresses only the distinction between goods and services markets, without incorporating other variables. Therefore, this analysis does not assess the effectiveness of the transmission mechanism or the determinants of expectations. Consequently, including only price changes as the determinant of inflation expectations constitutes a key limitation of the study.

Future research could incorporate subcategories of the goods and services sectors, such as food, housing, transportation, and communication, into the model. Additionally, inflation expectations may be associated with variables such as exchange rates and interest rates, alongside price changes. Cross-country comparative analyses could also contribute to a deeper understanding of the issue. Future studies may include time-varying or regime-switching econometric techniques and relevant macro-financial controls to better identify the driving forces of inflation expectations under different policy and market conditions.

Declaration of Research and Publication Ethics
This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher's Contribution Rate Statement
The authors declare that they have contributed equally to the article.

Declaration of Researcher's Conflict of Interest
There is no potential conflicts of interest in this study.

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