TÜRKİYE CUMHURİYET MERKEZ BANKASI

Research Notes in Economics

Firms' Inflation Expectations During the Phases of Inflation

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Özet

Bu çalışma, İktisadi Eğilim Anketi (İYA) verilerini kullanarak firmaların enflasyon beklentilerinin hem enflasyonist hem de dezenflasyonist dönemlerde nasıl değiştiğini İktisadi Eğilim Anketi (İYA) verilerini kullanarak incelenmekte ve firmaların maliyet ve fiyatla ilgili beklentileri ile enflasyon tahminleri arasındaki ilişkiyi analiz etmektedir. Firmaları temel özelliklerine göre eşleştirip, ardından eğilim puanı eşleştirme) yöntemi ve probit modeller kullanılarak, beklentilerdeki değişiklikleri yarı-rastgele tedaviler olarak değerlendirmek için tedavi grubu üzerindeki ortalama etki tahmin edilmektedir. Bulgularımız, enflasyonun yükseldiği dönemlerde firmaların enflasyon beklentilerinde önemli bir dağılım olduğunu göstermektedir. Ancak, enflasyon istikrar kazandıkça, firmaların beklentileri yakınsamaya başlamakta; bu da belirsizliğin azaldığını ve beklentilerin merkez bankası hedeflerine daha yakın hale geldiğine işaret etmektedir. Bu çalışma, gelişmekte olan bir ülkeden elde edilen ampirik bulgularla mevcut literatüre katkı sağlamakta; firmaların enflasyon beklentilerinin enflasyonun farklı evrelerinde nasıl değiştiğine dair değerli bilgiler sunmakta ve bu beklentilerin çıpalanmasında para politikasının rolünü vurgulamaktadır.

Abstract

This study investigates how firms' inflation expectations evolve during both inflationary and disinflationary periods, using data from the Business Tendency Survey (BTS), and analyzes the relationship between firms' cost- and price-related expectations and their inflation forecasts. By matching firms based on their fundamental characteristics, and then employing probit models alongside propensity score matching, we estimate the average treatment effect on the treated (ATT) to assess changes in expectations as quasi-randomized treatments. Our results indicate a significant dispersion in inflation expectations during periods of rising inflation. However, as inflation stabilizes, firms' expectations begin to converge, signaling reduced uncertainty and closer alignment with central bank targets. This study adds to the literature by providing empirical evidence from an emerging market economy, offering valuable insights into how firm-level inflation expectations shift across different inflation phases and highlighting the role of monetary policy in anchoring these expectations.

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1. Introduction and Literature Review

Understanding the formation of firm-level inflation expectations is critical in inflationary environments, as these expectations shape key decisions such as pricing, wage-setting, and investment. During periods of high inflation, expectations diverge across firms—those anticipating larger cost increases or broader price hikes revise their inflation expectations more sharply. As inflation eases, however, expectations tend to converge, underscoring the heterogeneity of firm behavior and its implications for economic policy.

Traditional models suggest that firms form expectations using past inflation trends and forward-looking indicators such as input costs and output prices (Mankiw & Reis, 2002). Firms with higher exposure to cost shocks tend to adjust expectations more frequently, consistent with adaptive expectation theories (Friedman, 1977). Inflation anchoring also behaves asymmetrically: during inflationary surges, expectations may become unanchored, drifting away from central bank targets, while periods of disinflation often see expectations re-align with those targets as monetary credibility is restored. We examine this heterogeneity using a unique dataset from the Business Tendency Survey (BTS) of the Central Bank of the Republic of Türkiye (CBRT), covering monthly data from 2009 to 2024 for around 2,000 manufacturing firms which report qualitative expectations on prices, costs, and business conditions for the next three months.

Our empirical approach assesses how firms' expectations regarding unit costs and sales prices shape their inflation expectations. Using propensity score matching (Rosenbaum & Rubin, 1983), we compare firms that expect cost or price increases to observably similar firms expecting no change. We then estimate the average treatment effect on the treated (ATT) to identify the role of firm-specific expectations in driving inflation forecasts.

This study contributes to the literature on expectation formation by analyzing how inflation expectations diverge and converge across firms in an emerging market context. In doing so, we extend the findings of Coibion et al. (2018), Candia et al. (2022), and Frache and Lluberas (2019) by focusing on inflation dynamics during both rising and declining inflation periods in Türkiye.

We now turn to the central question of our analysis: How do expectations for sales prices and unit costs influence firms' inflation expectations across inflationary and disinflationary periods? We find that firms expecting sales prices or unit costs to rise over the next three months report significantly higher 12-month-ahead inflation expectations—by as much as 6.5 to 10 percentage points during the high-inflation period of 2020–2024—relative to observably similar firms with stable expectations. Conversely, as inflation began to ease after mid-2023, these differences narrowed considerably, suggesting a re-anchoring of expectations and greater convergence in firms' inflation outlooks.

The remainder of the paper is structured as follows: Section 2 introduces the dataset and describes inflation dynamics in Türkiye. Section 3 outlines the empirical strategy and presents the results. Section 4 concludes.

2. Dataset and Inflation Dynamics

2.1 Business Tendency Survey, Balance Sheet, Firm-to-Firm Trade and Employment Data

We utilize several administrative databases, generously provided to the CBRT by various government agencies. Four datasets from different organizations are merged using uniquely generated firm IDs, which are consistent across all datasets.[1] This merging process yields a comprehensive dataset, offering unique insights for analyzing firms' inflation expectations in Türkiye.

This research draws on unique firm-level data from the BTS. The BTS data, provided by the CBRT, is collected through monthly surveys with a representative sample of 1,800 to 2,200 manufacturing firms, depending on the year. The survey follows a "check-box" format, asking firms to provide their general business expectations as well as their projections and actual outcomes for various firm-specific metrics, such as capacity utilization, orders, and inventories. Respondents are required to indicate whether each economic indicator has increased, decreased, or remained unchanged over the past three months. Additionally, they are asked to share their expectations for these indicators over the next three-month period. The survey also requests firms to provide their annual inflation expectations in numerical terms for the end of the upcoming 12-month period. The dataset spans from January 2009 to September 2024.

The balance sheet data, originally provided by the Revenue Administration, contains balance sheets and income statements for both incorporated and unlimited firms that maintain accounting records in compliance with the Tax Procedure Law. The dataset, which spans the period from 2009 to 2022, excludes firms in the financial sector and state-owned enterprises. It offers detailed insights into sub-items of assets and liabilities, along with sales and profitability figures. This comprehensive database covers the entire universe of incorporated and unlimited firms in Türkiye.[2]

Secondly, the Revenue Administration supplies the CBRT with monthly data on firm-to-firm transactions in local currency, specifically for invoice values exceeding 5,000 TL. This dataset provides detailed information on domestic transactions between firms, exclusively covering business-to-business (B2B) invoices within Türkiye, while excluding foreign transactions. Additionally, firm-level monthly export data is obtained from administrative customs registry records, provided by the Ministry of Trade.

Lastly, firm-level monthly employment data provided by the Social Security Institution (SSI) enable us to determine firm size and employment.[3] The SSI in Türkiye offers monthly matched employer-employee data, which includes detailed wage information and employment figures for all firms. By aggregating this employer-employee data at the firm and monthly level, we obtain firm-level monthly employment statistics.

The BTS feeds into the Real Sector Confidence Index, which gauges the economic outlook based on firms' responses. Covering current conditions, future expectations, and factors affecting production and sales, the BTS offers high-frequency insights into the manufacturing sector. Its broad scope, non-inflationary focus, and administration by a national authority ensure high response rates, making it a reliable data source for our analysis. We focus on the following three questions:

[1] The data supplied by the original institutions are accessible at the CBRT with generated firm ID numbers and are available for on-site use. Trade, balance sheet, income statement, and employment data are also accessible through the Ministry of Industry and Technology's Entrepreneur Information System laboratory.

[2] Incorporated firms are required to report balance sheets and income statements in accordance with Türkiye's Tax Procedure Law. Unlimited firms, operating under the personal income tax regime, are only required to report these financials if they exceed a certain size threshold.

[3] Employees are covered under service contracts in accordance with Article 4/a of Social Security Law No. 5510.

Q1. "What is your expectation for the sales price over the next 3-months: increase, stay the same, decrease?"

Q2. "What is your expectation for the average unit cost over the next 3-months: increase, stay the same, decrease?"

Q3. "Expectation for the annual consumer price index (CPI) at the end of the upcoming 12-month period: (please indicate in percentage terms)."

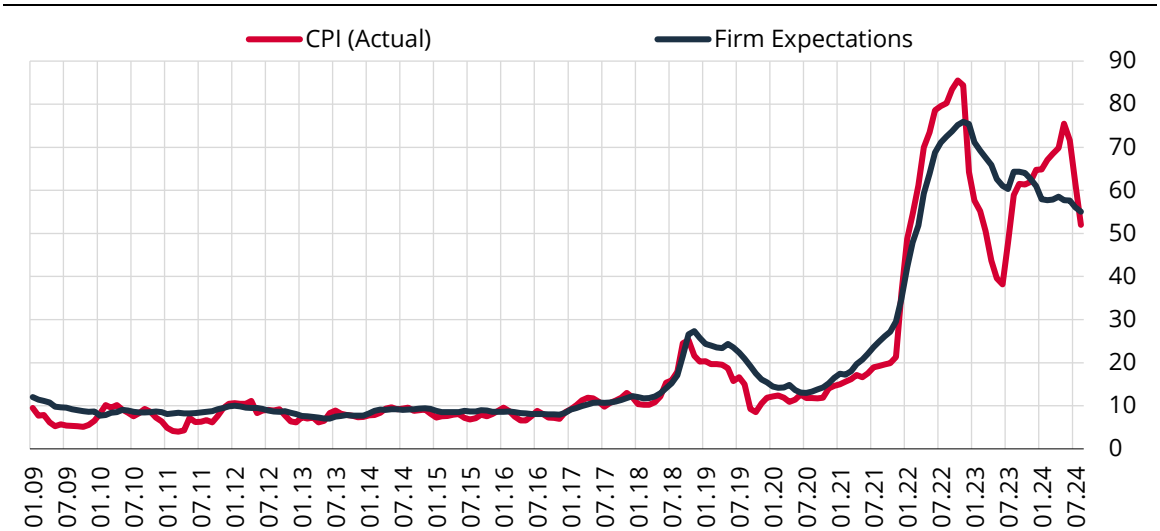
We winsorize 5% of the data by assigning values at the 2.5th and 97.5th percentiles of the CPI distribution. Specifically, any outlier with CPI answers exceeding top and bottom 2.5th percentiles are assigned the value of that percentile.

2.2 Inflation Dynamics in Türkiye

Figure 1 illustrates the monthly firm inflation expectations alongside the actual annual change in the Consumer Price Index (CPI) in Türkiye. Beginning in 2017, the Turkish economy entered a phase of high inflation. Although monetary tightening in the second quarter of 2018 helped reduce demand-driven inflation in the following months, the onset of the COVID-19 pandemic, coupled with interest rate cuts starting in September 2021, led to a peak in 12-month inflation, which reached its highest level by October 2022.

In the summer of 2023, the CBRT initiated a cycle of interest rate hikes alongside fiscal tightening measures. Following the commencement of this rate hike cycle in June 2023, the interest rate surged from 8.5% to 50% by March 2024. As a result, the exchange rate began to stabilize, and with the implementation of tightening monetary and fiscal measures, demand started to cool, as evidenced by a decline in demand-driven inflation since early 2024 (Akarsu and Aktuğ, 2024). Thus, the Turkish economy entered a disinflation period beginning in June 2024.

Figure 1: Average Inflation Expectations and CPI



Source: BTS, TURKSTAT.
Notes: The monthly expectations for the annual CPI at the end of the upcoming 12-month period are derived from the BTS. The actual inflation rate compared to the same month of the previous year is represented by the red line.

Figure 2 shows that firms' inflation expectations diverge based on their anticipated sales price changes. When inflation is stable, expectations are similar across firms, but as inflation rises, divergence emerges: firms expecting price increases report the highest inflation forecasts, consistent with adaptive expectations (Aoki, 2001). Surprisingly, firms expecting price decreases still anticipate higher inflation than those expecting no change—likely reflecting greater uncertainty.

Figure 3 confirms this, showing that these firms face the highest uncertainty, while those expecting price increases report the lowest.[4]

Anchored inflation expectations—stable, target-aligned, and resilient to shocks—typically hold in low-inflation periods (Bernanke, 2007; Draghi, 2014; Dovern et al., 2012). But as inflation rises, the anchor weakens. Firms revise expectations differently, with some re-anchoring at higher levels and others struggling to adjust amid uncertainty. As inflation declines, uncertainty falls and expectations converge. This re-anchoring underscores the importance of consistent monetary policy communication, especially during volatile periods. During disinflation, firms expecting price decreases report the lowest inflation forecasts, as expected.

Figure 1: Mean Inflation Expectations across Firms Conditional on Expected Sales Price

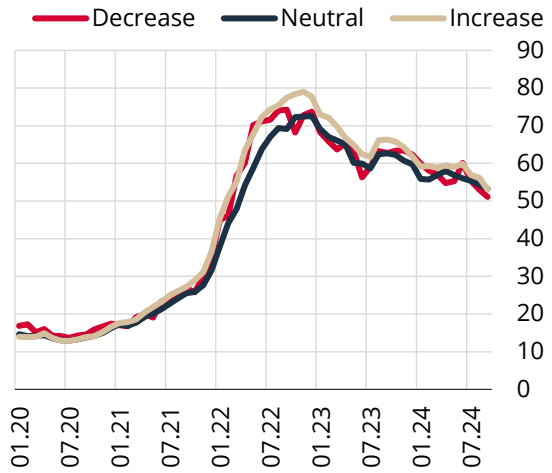
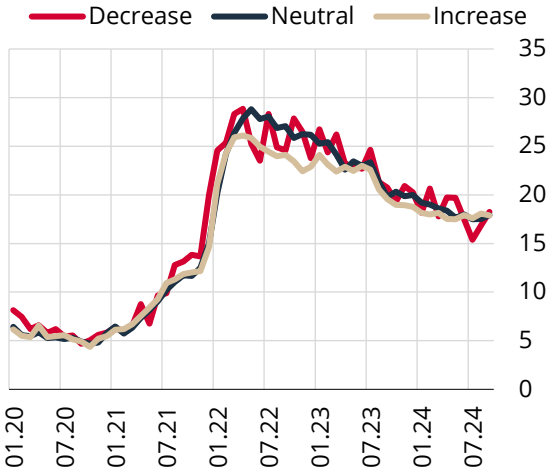


Figure 2: Uncertainty in Inflation Expectations across Firms Conditional on Expected Sales Price



Source: Authors' calculations using BTS.
Notes: The average inflation expectations are derived from firms' responses to the question, "What is your expectation for the sales price over the next 3-months: increase, stay the same, decrease?". Uncertainty in inflation expectations are calculated from the second moment in the inflation expectations.

Figure 3 displays firms' inflation expectations for unit costs over the next three months. In periods of stable inflation, expectations remain similar across firms, even when their unit cost forecasts differ—consistent with Mankiw et al. (2004), who find that expectations tend to converge in low-inflation environments. As inflation rises, however, expectations begin to diverge. More firms anticipate rising costs, and the resulting uncertainty—highlighted by Coibion et al. (2018)—drives greater dispersion in inflation forecasts. Interestingly, firms expecting cost declines report the highest inflation expectations, a pattern possibly driven by uncertainty-induced caution, as noted by Bachmann et al. (2013).

These firms also show the greatest dispersion in expectations, aligning with the "sticky expectations" framework of Mankiw and Reis (2002), where infrequent updates lead to wider variation. During disinflation, expectations realign, and firms anticipating cost declines adjust most rapidly—echoing Kumar et al. (2015), who find that deflation-facing firms tend to revise expectations more quickly and report the lowest inflation forecasts.

[4] Further evidence comes from the coefficient of variation (CV), which measures dispersion in expectations relative to the mean (Figure A3). Since June 2023, the CV has steadily declined—consistent with typical disinflation dynamics. While high inflation drives up the CV due to heterogeneous cost exposures and divergent views, its decline signals growing consensus as firms' expectations increasingly align with actual inflation.

Figure 3: Mean Inflation Expectations across Firms Conditional on Expected Unit Cost

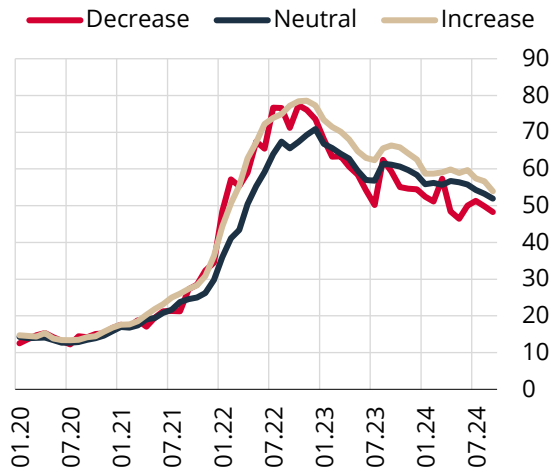
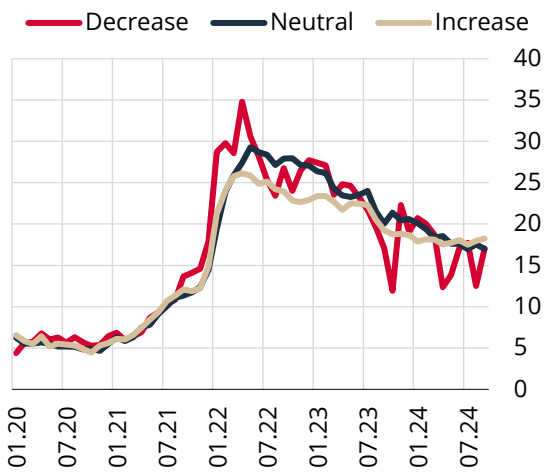


Figure 4: Uncertainty in Inflation Expectations across Firms Conditional on Expected Unit Cost



Source: Authors' calculations using BTS.

Notes: The average inflation expectations are derived from firms' responses to the question: "What is your expectation for the average unit cost over the next 3-months: increase, stay the same, decrease? Uncertainty in inflation expectations are calculated from the second moment in the inflation expectations.

3. Empirical Analysis

This study investigates how firms' expectations about sales prices and unit costs influence their broader inflation expectations across inflationary and disinflationary periods. We compare firms anticipating changes with those expecting no change, using propensity score matching (PSM; Rosenbaum & Rubin, 1983) to address potential selection bias by balancing observable characteristics. Compared to standard regression, PSM improves covariate balance, reduces bias, and separates selection from treatment effect estimation (Dehejia & Wahba, 2002; Heckman et al., 1998; Imbens & Rubin, 2015). Post-matching, we estimate treatment effects through simple mean comparisons in a flexible, non-parametric framework. Specifically, we estimate the treatment effect using a regression specification on the matched sample:

(1)

$$y_{it} = \alpha + \tau D_{it} + \varepsilon_{it} \quad (1)$$

where y_{it} denotes the 12-month-ahead inflation expectation of firm *i* at year-month *t*, D_{it} is a treatment indicator equal to 1 if the firm expects an increase (or decrease) in sales prices or unit costs, and τ captures the average treatment effect on the treated (ATT).

We also estimate the average treatment effect (ATE) on the full, unmatched sample by regressing inflation expectations on the treatment indicator while controlling for firm fixed effects (ϕ_i) and sector-by-year-month fixed effects (δ_{st}).

$$y_{it} = \alpha + \tau D_{it} + \phi_i + \delta_{st} + \varepsilon_{it} \quad (2)$$

Results

We now turn to the central question of the analysis: How do expectations for sales prices and unit costs shape firms' inflation expectations across inflationary and disinflationary periods? To answer this, we estimate the ATT using PSM. Table 1 reports the ATT for firms expecting an increase (Columns 1–3) or a decrease (Columns 4–6) in sales prices, across three distinct periods: the full sample (2009M1–2024M9), the high-inflation period (2020M1–2024M9), and the disinflation phase (2023M6–2024M9). Propensity scores are estimated separately for each sub-period to account for structural shifts in inflation dynamics and firm behavior.[5]

Table 1: ATT and ATE Estimations for Expectations of Sales Price Increase/Decrease
(Effect on Inflation Expectations)

	$E[\pi_{it+12}\|E(P_{it+3}>0)]$			$E[\pi_{it+12}\|E(P_{it+3}<0)]$		
	(1)	(2)	(3)	(4)	(5)	(6)
	2009M1-2024M9	2020M1-2024M9	2023M6-2024M9	2009M1-2024M9	2020M1-2024M9	2023M6-2024M9
Panel A: ATE						
τ_{ATE}	7.39***	10.35***	3.45***	-0.85***	4.51***	-1.02***
	(0.21)	(0.26)	(0.26)	(0.13)	(0.55)	(0.47)
Observations	293,900	79,302	22,282	220,835	33,968	11,825
Panel B: ATT						
τ_{ATT}^{PSM}	3.25***	7.12***	3.04***	-0.52***	1.15***	-0.85***
	(0.12)	(0.21)	(0.27)	(0.19)	(0.19)	(0.29)
Treated	91,318	37,196	11,362	18,322	2,518	919
Untreated	202,582	42,106	10,920	202,513	31,450	10,906
Common Support	91,318	37,196	10,920	18,319	2,518	919
Observations	182,636	79,302	21,840	36,644	5,036	1,838

Notes: Table shows the treatment effects on inflation expectations. Entries are the estimated coefficients, and all estimates are based on Huber-robust estimator. Columns (1), (2), and (3) present the coefficient estimates for inflation expectations based on firms expecting an increase in sales price over the next three months, while Columns (4),(5), and (6) focus on firms anticipating a decrease in sales price during the same period. The control group in both cases consists of firms that expect no change in unit costs.
*** p<0.01, ** p<0.05, * p<0.1

Across the full sample, firms expecting a sales price increase report inflation expectation that are 3.25 percentage points higher than those expecting no change. This gap widens markedly during the 2020–2024 inflationary period, reaching 7.12 percentage points. In contrast, during the disinflation phase starting in mid-2023, the gap narrows to 3.04 percentage points, indicating partial convergence as macroeconomic conditions stabilize. This pattern reflects the unanchoring of inflation expectations during inflationary periods—when firms' forecasts diverge due to cost-push and demand-pull pressures (Blanchard & Galí, 2017)—and a re-anchoring during disinflation, as uncertainty declines and firms align their expectations more closely with actual outcomes (Coibion & Gorodnichenko, 2015). On the other side, firms expecting a decrease in sales prices forecast inflation that is 0.52 percentage points lower than neutral firms in the full sample. This gap briefly turns positive during 2020–2024 (+1.15 pp), before reversing to –0.85 pp in the disinflation period—

[5] See Appendix-A for the PSM.

suggesting that firms expecting price cuts eventually adjust their inflation expectations more rapidly downward as inflation eases.

In addition, firms expecting sales prices to decrease report inflation expectations that are, on average, 0.85 percentage points lower than those with a neutral outlook. However, during high inflation, this relationship reverses—these firms anticipate inflation that is 4.51 points higher, likely due to heightened uncertainty and adaptive expectations shaped by recent price volatility. As disinflation sets in, expectations between groups begin to converge, reflecting improved macroeconomic stability and a re-anchoring of inflation expectations as firms recalibrate based on the new environment.

Table 2 reports the ATT and ATE estimates for the impact of unit cost expectations on firms' inflation forecasts. Over the full sample, firms anticipating rising unit costs expect 8.88 percentage points higher inflation than those expecting stable costs; the ATT in the matched sample is 6.50%. This gap widens to 10.01% during the high-inflation period (2020–2024), reflecting heightened sensitivity to input cost pressures, as highlighted by Coibion and Gorodnichenko (2015) and Ball and Mankiw (1995). As inflation subsides in 2023–2024, the ATT narrows to 4.05%, consistent with the convergence patterns documented by Ehrmann et al. (2015) and the adaptive expectations framework (Mankiw and Reis, 2002). The widening and subsequent narrowing of the gap align with Fuhrer (1997), who shows that firms adjust expectations more frequently during inflation shocks.

Table 2: ATT and ATE Estimations for Expectations of Unit Cost Increase/Decrease
(Effect on Inflation Expectations)

	$\boldsymbol{E}[\boldsymbol{\pi}_{\boldsymbol{it+12}}\|\boldsymbol{E}(Unit\ Cost_{it+3} > 0)]$			$\boldsymbol{E}[\boldsymbol{\pi}_{\boldsymbol{it+12}}\|\mathrm{E}(Unit\ Cost_{it+3} < 0)]$		
	(1)	(2)	(3)	(4)	(5)	(6)
Sample	2009M1-2024M9	2020M1-2024M9	2023M6-2024M9	2009M1-2024M9	2020M1-2024M9	2023M6-2024M9
			Panel A: ATE			
τ_{ATE}	8.88***	11.25***	4.12***	-1.25***	2.03***	-3.87***
	(0.09)	(0.21)	(0.28)	(0.16)	(0.94)	(0.97)
Observations	295,715	79,647	22,374	159,829	27,075	7,240
			Panel B: ATT			
τ_{ATT}^{PSM}	6.50***	10.01***	4.05***	-0.19***	1.71***	-2.59***
	(0.08)	(0.21)	(0.33)	(0.09)	(0.28)	(1.19)
Treated	148,812	51,630	15,340	12,314	1,737	431
Untreated	146,903	28,017	7,034	146,829	25,338	6,809
Common Support	146,903	28,017	7,034	12,314	1,737	431
Observations	293,806	56,034	14,068	24,628	3,474	862

Notes: Table shows the treatment effects on inflation expectations. Entries are the estimated coefficients, and all estimates are based on Huber-robust estimator. Columns (1), (2), and (3) present the coefficient estimates for inflation expectations based on firms expecting an increase in unit costs over the next three months, while Columns (4),(5), and (6) focus on firms anticipating a decrease in unit costs during the same period. The control group in both cases consists of firms that expect no change in unit costs.
*** p<0.01, ** p<0.05, * p<0.1

The second panel of Table 2 further shows ATT estimates for firms expecting unit costs to decrease. While the average gap over the full sample is modest at –0.19%, it unexpectedly widens to +1.71% during high inflation, indicating that even firms anticipating falling costs project higher inflation—likely due to heightened uncertainty (Coibion & Gorodnichenko, 2012). This is consistent with Andrade and Le Bihan (2013), who find that firms revise expectations more frequently under

volatility. As disinflation sets in, the pattern reverses: firms expecting cost declines forecast inflation 2.59 percentage points lower than those with stable cost expectations, in line with theoretical predictions.

For robustness, we also estimate treatment effects separately for the 2009M1–2016M12 and 2017M1–2019M12 periods, corresponding to phases of moderate and rising inflation, respectively. The results, presented in Tables B1 and B2, confirm our main findings.

4. Conclusion

This study analyzes how firms' inflation expectations evolve across inflationary and disinflationary periods, focusing on the role of cost and price expectations as well as the influence of uncertainty. Using firm-level data from the CBRT's Business Tendency Survey and a propensity score matching strategy, we document that firms expecting increases in sales prices or unit costs report significantly higher inflation forecasts, particularly during periods of high inflation. This divergence reflects the unanchoring of expectations in uncertain environments and is consistent with theories of adaptive and sticky expectations.

As inflationary pressures ease, firms' inflation expectations begin to converge—indicating a re-anchoring process aligned with improved macroeconomic stability. This convergence is supported by a decline in the coefficient of variation, pointing to reduced dispersion and greater agreement among firms regarding the inflation outlook.

By revealing how firms adjust their forecasts across inflation regimes, this study offers insights into the behavioral mechanisms behind expectation formation and highlights the importance of managing uncertainty to anchor expectations effectively.

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Appendix

Appendix A: Propensity Score Matching

We follow the potential outcomes framework (Roy, 1951; Rubin, 1974), as outlined in Caliendo and Kopeinig (2008), to estimate the causal effect of firms' expectations about sales prices or unit costs on inflation expectations. The treatment effect for firm *i* at time *t* is defined as:

$$\tau_{it} = Y_{it}(1) - Y_{it}(0),$$

where $Y_{it}(1)$ is the outcome under treatment (e.g., firm expects a price increase), and $Y_{it}(0)$ is the counterfactual outcome without treatment. The average treatment effect (ATE) is defined as $\tau_{ATE} = \boldsymbol{E}[Y_{it}(1) - Y_{it}(0)]$, and the average treatment effect on the treated (ATT) firms is given by:

$$\tau_{ATT} = \boldsymbol{E}[\tau_{it}|D_{it} = 1] = E[Y_{it}(1)|D_{it} = 1] - E[Y_{it}(0)|D_{it} = 1]$$

where $D_{it} = 1$ if firm *i* receives the treatment at time *t*, and $D_{it} = 0$ otherwise. However, the counterfactual mean $\boldsymbol{E}[Y_{it}(0)|D_{it} = 1]$ is unobserved, so a suitable substitute must be chosen to estimate the ATT. We can estimate the following relationship:

$$\boldsymbol{E}[Y_{it}(1)|D_{it} = 1] - \boldsymbol{E}[Y_{it}(0)|D_{it} = 0] = \tau_{ATT} + \boldsymbol{E}[Y_{it}(0)|D_{it} = 1] - \boldsymbol{E}[Y_{it}(0)|D_{it} = 0]$$

The difference between the left-hand side of the equation and τ_{ATT} is referred to as the 'self-selection bias.' The true parameter is only identified if: $\boldsymbol{E}[Y_{it}(0)|D_{it} = 1] - \boldsymbol{E}[Y_{it}(0)|D_{it} = 0] = 0$, which implies that the potential outcomes are independent of the treatment assignment. While this holds in randomized experiments, in observational settings we rely on the conditional independence assumption (CIA): potential outcomes are independent of treatment assignment conditional on observable covariates X_{it}:

$$Y_{it}(0), Y_{it}(1) \perp D_{it}|X_{it}, \qquad \forall X_{it}$$

This implies that selection into treatment depends solely on observable characteristics, and that all factors influencing both treatment assignment and potential outcomes are captured. In our context, this requires accounting for all variables relevant to firms' expectation formation and their anticipated sales prices or unit costs.

However, conditioning directly on a high-dimensional covariate vector X_{it} can be challenging. To address this, Rosenbaum and Rubin (1983) introduce the concept of balancing scores. They show that if treatment is independent of potential outcomes given X_{it} , it is also independent conditional on a balancing score $b(X_{it})$. A commonly used balancing score is the propensity score, defined as: $P(X_{it}) = \Pr(D_{it} = 1|X_{it})$, i.e., the probability of receiving treatment given observable covariates. The CIA can thus be restated as

$$Y_{it}(0), Y_{it}(1) \perp D_{it}|P(X_{it}), \qquad \forall X_{it}$$

An additional requirement for valid inference is the common support or overlap condition, which rules out perfect predictability of D_{it} given X_{it}:

$$0 < P(X_{it}) = \Pr(D_{it} = 1|X_{it}) < 1.$$

This ensures that firms with similar values of X_{it} have a positive probability of both receiving and not receiving the treatment (Heckman et al., 1999). Given that the CIA holds and assuming overlap between both groups (referred to as 'strong ignorability' by Rosenbaum and Rubin (1983), the (PSM estimator for ATT can be written as[6]:

$$\tau_{ATT}^{PSM} = E_{P(X_{it})|D_{it}=1} = E[Y_{it}(1)|D_{it} = 1, P(X_{it})] - E[Y_{it}(0)|D_{it} = 0, P(X_{it})]$$

In simple terms, the PSM estimator calculates the average difference in outcomes between treated and untreated firms within the region of common support, weighted by the propensity score distribution of the treated group. We estimate the ATT by comparing each treated firm's outcome to those of untreated firms with similar propensity scores.

In our setting, each outcome variable (inflation expectations) has two potential treatments: expectations of either an increase or a decrease in sales prices (or unit costs). To identify treatment effects, we compare firms anticipating changes to those expecting no change. Given this structure, we estimate four separate probit models—one for each treatment-outcome pair. Following Caliendo and Kopeinig (2008), we adopt the serial probit approach rather than a multinomial model, as it provides better covariate balancing and estimation performance in multiple-treatment settings.

We estimate four separate probit regressions, for each treatment and outcome. The propensity score $P^{mj}(X_{it})$ for treatment $m = \{increase, decrease\}$ and outcome $j = \{expectation\ of\ sales\ price, expectation\ of\ unit\ cost\}$ is the conditional probability of treatment, given no expected change in future sales prices (or unit costs):

$$\mathrm{P^{mj}}(X_{it}) = Pr^{mj}(D_{it}^{T} = 1 \mid X_{it}) = Pr^{mj}(X_{it}'\beta) = \Phi^{\mathrm{mj}}(X_{it}'\beta)$$

where $D_{it}^{mj} = 1$ is a dummy variable that equals 1 if the firm expects an increase for $m = \{increase\}$ in the probit regressions $j = \{expectation\ of\ sales\ price,\ expectation\ of\ unit\ cost\}$, and $m = \{decrease\}$ for the $j = \{expectation\ of\ sales\ price,\ expectation\ of\ unit\ cost\}$ regressions, where the treatment group consists of firms expecting sales prices (or unit costs) to decrease. In both regressions, the control group comprises firms expecting no changes in sales prices (or unit costs).

X_{it} includes exports, sales, employment, and capacity utilization ratio from the previous month. Additionally, we incorporate yearly balance sheet variables such as short-term liabilities, leverage ratio, and interest coverage ratio to control for the firm's financial constraints, as well as total assets and capital to account for firm size. We also include firm, sector x year-months, and province fixed effects.[7] After estimating the propensity scores, we match the treatment and control group using one-to-one nearest neighbor matching. Consistent with the previous literature employing propensity score matching, we restrict our sample to firms for which a common support is identified. As nearly all firms in the treatment group are matched to a distinct control firm, the final sample size is nearly double that of the treatment group.

[7] Year-month fixed effects account for common time shocks or macroeconomic factors that impact all firms during a given period. Sector fixed effects control for industry-specific factors, allowing for comparisons between firms within the same sector. This helps address differences in competitive environments, regulatory frameworks, and sectoral trends. Additionally, province fixed effects capture geographic-specific influences, such as regional economic conditions, local policies, labor market dynamics, and infrastructure availability, ensuring that firms from different provinces are compared on an equal basis.

Appendix B: Additional Figures and Tables

Figure B1: Fraction of Responses to Expected Sales Price

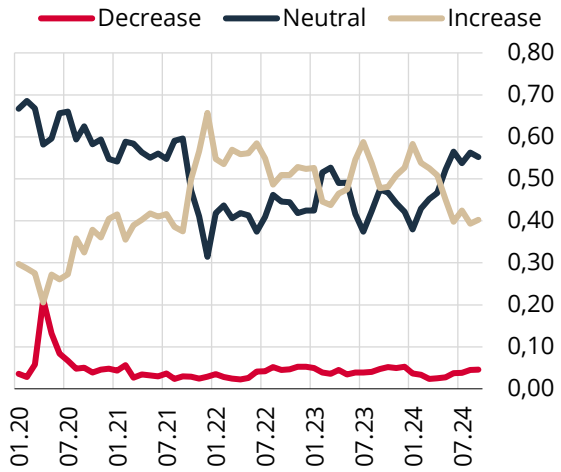
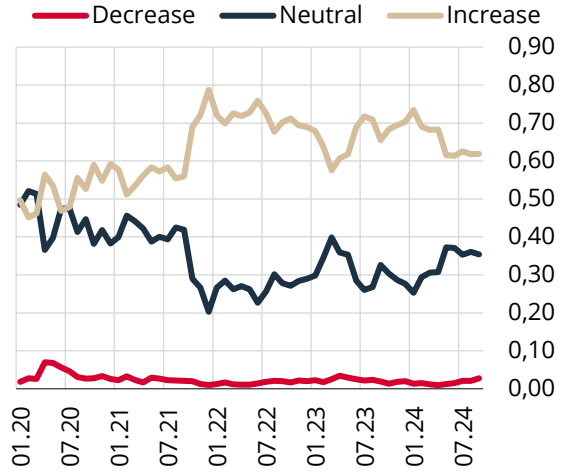


Figure B2: Fraction of Responses to Expected Unit Cost



Source: Authors' calculations using BTS.
Notes: The proportions of three different expectations are derived from firms' responses (increase, stay the same, or decrease) to the questions. We calculate the fraction of firms providing each response by dividing the number of firms giving a specific response by the total number of firms surveyed in that month.

Figure B3: Coefficient of Variation of Inflation Expectations across Firms Conditional on Expected Sales Price

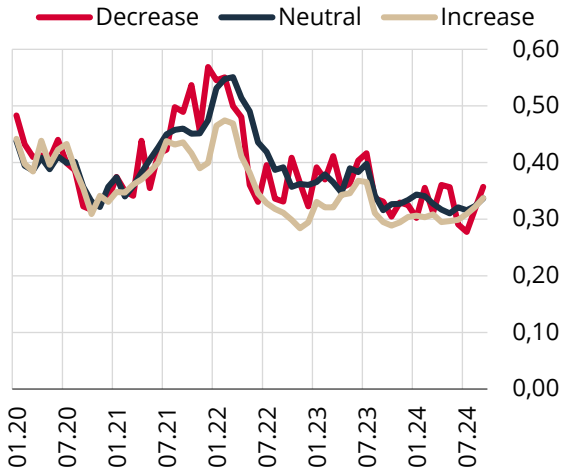
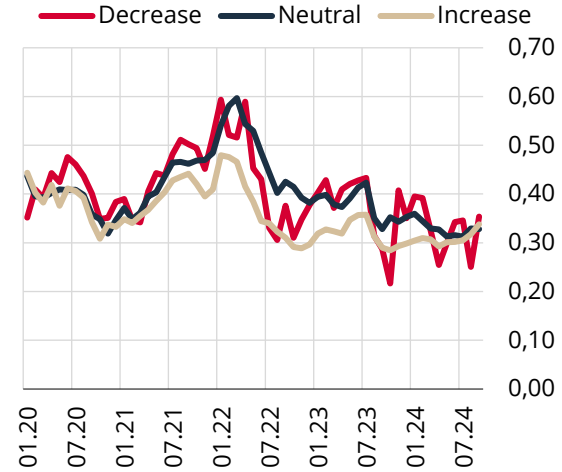


Figure B4: Coefficient of Variation of Inflation Expectations across Firms Conditional on Expected Unit Cost



Source: Authors' calculations using BTS.
Notes: The coefficient of variation in inflation expectations is calculated by dividing the second moment of the inflation expectations by the first moment.

Table B1: ATT and ATE Estimations for Expectations of Sales Price Increase/Decrease
(Effect on Inflation Expectations)

	$E[\pi_{it+12}\|E(P_{it+3} > 0)]$		$E[\pi_{it+12}\|E(P_{it+3} < 0)]$	
	(1)	(2)	(3)	(4)
	Panel A: ATE			
τ_{ATE}	0.03***	1.21***	-0.47***	3.15***
	(0.02)	(0.08)	(0.03)	(0.15)
Observations	154,281	60,317	129,726	45,197
	Panel B: ATT			
τ_{ATT}^{PSM}	0.10***	0.94***	-0.12***	1.65***
	(0.03)	(0.09)	(0.04)	(0.23)
Sample	2009M1-2016M12	2017M1-2019M12	2009M1-2016M12	2017M1-2019M12
Treated	35,454	18,668	11,000	3,548
Untreated	118,726	41,649	118,726	41,649
Common Support	35,454	18,668	11,000	3,548
Observations	70,908	37,336	22,000	7,096

Notes: Table shows the treatment effects on inflation expectations. Entries are the estimated coefficients, and all estimates are based on Huber-robust estimator. Columns (1), (2), and (3) present the coefficient estimates for inflation expectations based on firms expecting an increase in sales price over the next three months, while Columns (4),(5), and (6) focus on firms anticipating a decrease in sales price during the same period. The control group in both cases consists of firms that expect no change in unit costs.

*** p<0.01, ** p<0.05, * p<0.1

Table B2: ATT and ATE Estimations for Expectations of Unit Cost Increase/Decrease (Effect on Inflation Expectations)

	$E[\pi_{it+12}\|E(Unit\ Cost_{it+3} > 0)]$		$E[\pi_{it+12}\|E(Unit\ Cost_{it+3} < 0)]$	
	(1)	(2)	(3)	(4)
	Panel A: ATE			
τ_{ATE}	0.54***	2.49***	-0.07***	1.01***
	(0.02)	(0.07)	(0.03)	(0.19)
Observations	155,236	60,832	97,450	31,715
	Panel B: ATT			
τ_{ATT}^{PSM}	0.47***	2.33***	-0.21***	0.45***
	(0.02)	(0.07)	(0.04)	(0.28)
Sample	2009M1-2016M12	2017M1-2019M12	2009M1-2016M12	2017M1-2019M12
Treated	66,071	31,111	8,378	1,994
Untreated	89,165	29,721	89,072	29,721
Common Support	66,071	29,721	8,378	1,994
Observations	132,142	59,442	16,756	3,988

Notes: Table shows the treatment effects on inflation expectations. Entries are the estimated coefficients, and all estimates are based on Huber-robust estimator. Columns (1), (2), and (3) present the coefficient estimates for inflation expectations based on firms expecting an increase in unit costs over the next three months, while Columns (4),(5), and (6) focus on firms anticipating a decrease in unit costs during the same period. The control group in both cases consists of firms that expect no change in unit costs.

*** p<0.01, ** p<0.05, * p<0.1