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**FORMATION OF INFLATION EXPECTATIONS:  
DOES MACROECONOMIC AND POLICY  
ENVIRONMENT MATTER?**

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Working Paper No: 2017  
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# Formation of inflation expectations: Does macroeconomic and policy environment matter? \*

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## Abstract

This paper investigates the changing behavior of inflation expectations in response to the macroeconomic and policy environment. Using a panel of professional forecasters covering thirteen years of inflation targeting period from Turkey, we present evidence on the behavioral shifts in the inflation expectations associated with evolving macroeconomic and policy performance. We use a unique survey with the feature of including matched policy rate and fixed-horizon inflation expectations at the individual level, therefore enabling to estimate the impact of monetary policy surprises on inflation expectations without reliance on strong identifying assumptions. Moreover, we employ a novel technique where direct feedback from survey respondents is used to determine the baseline empirical model governing expectations dynamics. Interpretation of the empirical findings joint with the direct feedback results from the survey indicate that the anchoring power of inflation targets depend on the policy performance. The weights attached to inflation targets in forming expectations are strongly associated with the size of the inflation deviation from the targets. When the targets no longer serve as a strong anchor, the survey participants assign increasingly higher weight to past inflation and the relationship between exchange rates and inflation expectations becomes stronger. Overall, our results imply that expectations behavior display significant and rapid shifts with the underlying economic and policy performance.

*Keywords:* Inflation expectations; Monetary policy; Inflation; Survey data.

*JEL Codes:* C51; C53; E31; E37; E58.

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*“Another gap in our knowledge about the nature of the inflation process concerns expectations... Perhaps most importantly, we need to know more about the manner in which inflation expectations are formed and how monetary policy influences them.” – Janet Yellen (2016), In: “Macroeconomic Research after the Crisis.”*

## **1. Introduction**

Inflation expectations constitute an integral part of the monetary theory and policy (Blinder et al. 2008, Gali 2008). The behavior of inflation expectations is often the key input for forecasting and policy analysis models used by policymakers. Anchored longer-term inflation expectations is the hallmark of effective and credible monetary policy. Expectations drive a wide range of economic variables, which, in turn, affect real economic activity and inflation dynamics. Therefore, understanding inflation expectations and their interaction with monetary policy is important from an academic and policy perspective.

This paper seeks to understand how the behavior of inflation expectations shifts in response to policy performance. With the widespread adoption of price stability oriented policies during the past decades, inflation expectations have been increasingly anchored in many economies (Gürkaynak et. al. 2010). One important question is whether this success should be taken for granted in designing future monetary policy. The question is particularly of relevance, given the excessive reliance on monetary expansion through unconventional tools and the tendency towards curbed central bank independence across the globe. Our study aims to shed some light into this question by utilizing a unique data set on inflation expectations. Using a panel of expectations covering thirteen years of inflation targeting period from Turkey, we investigate the changing behavior of inflation expectations in response to macroeconomic and policy environment. Turkish macroeconomic conditions and policy framework, which has been subject to frequent changes during the past decade provides an ideal laboratory for the analysis of time varying aspects of the expectations behavior.

Using a unique survey data set and rolling panel regressions, we explore several questions pertaining to the behavioral aspects of inflation expectations: How do agents form their inflation

expectations in relation with the macroeconomic and policy environment? Do expectations dynamics change through time and across policy regimes? How do inflation expectations respond to shifts in the monetary policy framework and the policy performance? Answering these interrelated questions would not only yield insights into the main question of interest but also improve our general understanding of the behavior of inflation expectations, which, in turn, may contribute to build more realistic models and formulate sound policy responses.

In order to conduct an analysis on inflation expectations, we need a quantitative measure of expectations. This paper employs the survey compiled by the Central Bank of the Republic of Turkey (CBRT), called “Survey of Expectations” (the Survey). The Survey comprises one- and two-year ahead fixed horizon inflation expectations at the monthly frequency since 2006 along with some key macro variable forecasts, incorporating a rich variety of responses at the individual level. A unique property of the Survey is including policy rate expectations at the micro level, which allows to extract forecaster-specific monetary policy surprises—a rare feature for such surveys.

Using individual level survey data helps to identify the relationships through cross sectional variation. Moreover, survey based measures of inflation expectations reflect direct forecasts by economic agents, thus they have low sensitivity to varying market liquidity and do not require any adjustment or inflation risk compensation as opposed to market based measures. These advantages may become more relevant in an emerging economy with relatively less developed financial markets and volatile risk premium. However, surveys may also have some weaknesses compared to market based measures (Armantier et al., 2017). Because of the absence of direct financial consequences and limited ability to process information, survey responses may suffer from cheap-talk problems, weak incentives, herd behavior, strategic misreporting as well as sticky information and/or inattention issues.<sup>2</sup> Notwithstanding these shortcomings, exploring the behavioral aspects of survey-based expectations on a micro basis and identifying the major shifts through time has the potential to provide important insights for the design and formulation of monetary policy (Coibon et al. 2018).

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<sup>2</sup> See e.g., Keane and Runkle (1990); Manski (2004); Pesaran and Weale (2006); Inoue et al. (2009); Marinovic et al. (2013).

Determinants of inflation expectations and their interaction with the monetary policy have been studied extensively in the literature. A significant fraction of the previous work has concentrated on the variations of empirical closed economy New Keynesian models across advanced economies (Mankiw et al., 2003, Coibon et al., 2018), whereas our playground is an open emerging economy with rapidly evolving policy environment and imperfect credibility of institutions. Some related papers have explored the role of the policy framework in the behavior of inflation expectations, assessing the significance of the inflation targeting regime in affecting expectations dynamics across countries (see e.g. Gürkaynak et al., 2010; Brito and Bystedt, 2010). Another strand of the literature, closer to our work, has investigated the changing behavior of inflation expectations through time within a particular economy.<sup>3</sup>

Our paper's contribution to the literature can be summarized in four dimensions: First, we use a unique data set including matched monetary policy and inflation expectations at the individual level, which is a valuable feature especially for estimating the impact of policy surprises on inflation expectations and their evolution through time. Availability of matched inflation and policy rate expectations at the micro level is a rare asset for expectation surveys. Second, we link the documented changes in the behavior of expectations to several aspects such as operational framework and credibility gap, showing that the role of nominal anchors may shift quickly depending on the policy performance. Third, we adopt a novel methodology where direct feedback from the survey participants is received regarding the construction of their inflation forecasts, where the results are used to build the base for the empirical model and to complement the main findings. Fourth, we use a macro data set with ample variation in variables of interest, which helps to identify key relationships. High volatility in inflation expectations and macro variables in Turkey provides substantial variation to explore the shifts in the dynamics of inflation expectations. Overall, both the rich content of our data set and the rapidly changing nature of the Turkish economic context present a suitable background to

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<sup>3</sup> Some examples are Celasun et al. (2004), Carvalho and Minella (2012) and Cortes and Paiva (2017) , for emerging economies; Blanchflower and MacCoille (2009), Strohsal et al. (2016), Ciccarelli et al. (2017) for advanced economies. See also Köse et al. (2019) for a comprehensive literature survey on the dynamics of inflation expectations.

study the behavior of inflation expectations and their interaction with the macroeconomic and the policy environment.

To our knowledge, this is the first study to employ individual level direct policy surprises to investigate the response of inflation expectations to monetary policy surprises. The literature has used event studies (Bernanke and Kuttner, 2005; Gürkaynak et al., 2005), SVAR models (Christiano et al., 1999), or a combination of both (Gertler and Karadi, 2015) to identify the impact of monetary shocks on the inflation expectations. These papers, by nature, implicitly assume that monetary policy surprises are identical for each agent. Moreover, SVARs and other structural models often impose strong identifying assumptions. Using individual level monetary policy surprises directly extracted from surveys might provide complementary evidence to the existing work on identifying the effect of monetary policy on inflation expectations.

More recently, some studies have explored the impact of monetary policy surprises using survey data. These papers have mostly focused on the effect of unconventional monetary policy (quantitative easing and forward guidance) on economic agents' expectations. However, none of these studies use *direct* monetary policy surprises at the *individual level*. For example, Boneva et al. (2016) explore the impact of asset purchase amounts on firms' inflation expectations, but they implicitly assume that the unexpected component of the quantitative easing is identical for all firms. Altavilla and Giannone (2017) extract the revision in agents' monetary policy expectations from their bond yield forecasts at the individual level, which provides a micro but *indirect* measure for policy effects at the individual level. Eminidou et al. (2019) utilize an estimated monetary policy reaction function to extract consumer level monetary policy surprises; yet, their measure is *indirect and model-dependent*. Our study, on the other hand, uses individual level direct policy surprises, enabling us to assess the impact of monetary policy on the inflation expectations without imposing model-dependent identifying assumptions, which is a unique feature compared to the related work in the literature.

Given this background, we run full sample and rolling panel regressions to explore the dynamics of inflation expectations and their interaction with the economic environment. Our estimates suggest

that the inflation expectations are significantly related to macro variables such as exchange rates, oil prices, inflation realizations, and inflation targets, as well as individual level policy surprises, consistent with the previous literature on emerging economies.<sup>4</sup> More importantly, rolling regressions reveal that the parameters governing the expectations formation process change considerably through time, possibly responding to the shifting performance of the policy framework and sliding external conditions. Empirical results indicate that the weight attached to inflation targets by forecasters is inversely related to the size of the target breaches. Moreover, we document that the sensitivity of inflation expectations to monetary policy surprises vary significantly with the policy framework.

Empirical findings are suggestive of a significant change in the expectation behavior, possibly associated with the policy performance through time. Despite the fairly anchored inflation expectations during the initial years of the inflation targeting framework, expectations behavior changes rapidly through time with the persistent breaches of the targets on the upside. The relationship between exchange rates and inflation expectations becomes stronger and survey participants assign increasingly higher weight to past inflation. These findings are supported by the direct feedback survey we conducted among the participants, which indicates that, as of the end of the sample period, inflation target ceases to be a key parameter in driving medium-term expectations. Taken together, these results point to a significant weakening in the anchoring power of inflation targets, associated with the underlying policy and economic performance.<sup>5</sup>

Our findings imply that the existing stability of expectations across the globe should not be taken for granted in the design of future policies. The credibility and the ability to shape expectations around an inflation target may change rapidly depending on the policy performance. Persistent undershoots of inflation targets in many advanced economies and the tendency towards more discretionary policies in other jurisdictions warrant caution in this respect.

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<sup>4</sup> See, for example, Carvalho and Minella (2012) for Brasil; Pedersen (2015) for Chile; Kara and Küçük (2010), Çiçek, Akar and Yücel (2011), Başkaya, Gülşen and Kara (2012) for Turkey.

<sup>5</sup> These results are broadly in line with the findings of Çakmaklı and Demiralp (2020) who show that the credibility of the monetary policy in Turkey has declined over time. These authors define credibility as the central bank's ability to lower inflation expectations towards its inflation target via interest rate decisions.



The remainder of the paper is organized as follows: The next section explains the main features of the expectation survey used in the paper and summarizes the evolution of inflation expectations throughout the sample period. The third section presents the empirical model and the changing behavior of inflation expectations along with some robustness analysis. The last section presents final remarks and some reflections.

## **2. An overview of inflation and inflation expectations in Turkey**

Turkish economy and inflation dynamics have witnessed a comprehensive transition after 2001 with the adoption of a floating exchange regime along with an implicit inflation targeting regime. Following a successful disinflation period between 2002 and 2005, which brought inflation down to single digits after many decades of high double digit inflation, explicit inflation targets were adopted in 2006 to lock in the gains from disinflation. The period between 2006 and 2010 can be described as a standard inflation targeting regime where the central bank used a single policy rate with a medium-term forecast horizon. The policy framework has evolved into a more flexible form of inflation targeting through time. Following the global financial crisis and the European debt crisis, multiple instruments were used to deal with the consequences of excessive global liquidity and the volatility in capital flows, with financial stability being adopted as a supplementary goal. To this end, the period between 2011 and 2015 involved unconventional interest rate corridor policies along with the active use of reserve requirement tools, where credit and exchange rate served as intermediate variables. Monetary policy operational framework reverted to a relatively more conventional set up after 2016 when leading central banks started implementing exit strategies from quantitative easing policies. These frequent shifts in the background policy framework provide ample variation to identify the changes in the expectation behavior associated with the monetary framework.

Another interesting feature of our data set is the variation in inflation targets, which is typically absent in many inflation targeting countries. Since 2006, CPI inflation targets have been announced by the CBRT in each December for a three-year horizon. During the initial years, the multi-year targets were set constant at 4 percent. However, targets were revised on the upside in June 2008, where 2009-

2011 inflation targets were set at 7.5, 6.5, and 5.5 percent respectively. Inflation target has stayed at 5 percent thereafter (Figure 1). Deviation of inflation from the targets have also showed considerable variation. The targets were breached consistently on the upside at varying degrees, except for the years 2009 and 2010. The size and the volatility of the deviation of inflation from the targets, coupled with the variation in targets, allow us to explore whether and how the performance of the inflation targeting framework has affected the anchoring role of the targets.

### *The Survey*

The CBRT has launched the “Survey of Expectations” in August 2001 to measure and monitor expectations for inflation and some key macroeconomic variables.<sup>6</sup> Expectations behavior analyzed in this paper pertains to the forecasts collected through this Survey. The Survey participants include commercial banks, asset management and investment banks, insurance and factoring companies, pension funds, large firms and conglomerates, economists, and other professionals. Financial institutions constitute a large fraction (around 80 percent) of the Survey participants. The Statistics Department of the CBRT regularly monitors the quality of the survey and contacts the participants to ensure a satisfactory participation rate. The survey is distributed to around 100 participants every month comprising of professionals and institutions. The response rate has varied between 60-70 percent since 2006.<sup>7</sup> For the financial sector and large firms, the Survey is sent directly to a representative of the institutions—typically the chief economist or the head of research. In a recent feedback study covering survey participants, around 3/4<sup>th</sup> of the respondents have stated that their reported forecasts are institutional projections, implying that the responses largely reflect the institutions’ official forecasts, possibly incorporating multiple cross checks. Given this structure, forecast production process should be less prone to the criticisms cited in the literature such as herd behavior, cheap-talk problems, and strategic misreporting.

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<sup>6</sup> The most recent set of the Survey questions can be found [here](#).

<sup>7</sup> Gülşen and Kara (2019) provides for more detail on the survey response rates through time.

Because forecasts are largely interpreted as institutions' view rather than individuals' own projections, changes in the specific survey representatives should have limited impact on the behavior of the institutions' forecasts. Still, the turnovers may have some effect on the behavior of forecasts, as each individual is likely to add his/her own judgment in forming expectations. Nonetheless, this effect is likely to be small on average, because in our sample only one-tenth of the survey respondents change institutions per year.

One of the strengths of the Survey is that it has quantitative fixed horizon inflation forecasts along with monetary policy expectations matched at the individual level. This unique feature enables us to explore the response of inflation expectations to the monetary policy surprises without imposing model-dependent identifying assumptions. As shown in Figure 2, the distribution of the monetary policy surprises is quite dispersed across participants except the periods of sharp and unpredicted movements in the policy rate during extreme market volatility. It is also interesting to observe that the cross sectional dispersion have increased considerably after 2010 with the implementation of the unconventional interest corridor policy. This picture suggests that exploiting the variation in surprises across forecasters may provide additional insights into the existing literature on estimating the impact of monetary policy surprises. Substantial variation in both cross sectional and time series dimensions facilitate the identification of the impact of policy shocks even in narrow moving window estimates.

#### *Evolution of Inflation Expectations*

A cursory look at the historical plot of average inflation expectations reveals that expectations have been below the realized inflation but above the targets most of the time (Figure 3). Moreover, inflation turned out to be consistently higher than expectations during the past decade (Figure 4). The gap between inflation and the target has widened markedly at the end of the sample, which is likely to have affected the expectations formation process due to weaker anchoring role of the targets. In fact, inflation expectations have drifted upwards and moved closer to realized inflation after 2013, possibly related with persistent overshoots of the inflation targets. These observations suggest that

anchoring power of the targets may have waned through time—a recurrent theme that will be investigated throughout the paper.

### **3. Formation of inflation expectations**

This section employs empirical specifications to explore the behavior of inflation expectations and their evolution through time. Deciding on the set of explanatory variables in an empirical model governing expectation dynamics is not a trivial task because inflation expectations of the professional agents may respond to a large array of variables affecting inflation outlook. Recent literature has suggested that, because of the reasons such as limited capacity for processing information, agents may choose a small set of variables to form their information set (Sims, 2003). Existing studies on emerging economies typically adopt some version of an open economy Phillips curve to explore the formation of inflation expectations, augmented by country-specific explanatory variables (Celasun et al., 2004; Carvalho and Minella, 2012). In this paper, we pursue a novel approach by utilizing the results of a direct “feedback survey” to determine the set of candidate explanatory variables, where the survey participants are asked to reveal the variables they use in constructing inflation forecasts. Doing so allows us to pursue a more tailored approach in choosing the variables of interest used in the main regressions, addressing possible endogeneity issues that may originate from omitted variables and/or common factor problems.

*A survey of survey respondents: Which variables are important in the conduct of inflation forecasts?*

Before turning to the empirical model, we summarize the results of the direct feedback from survey participants.<sup>8</sup> The feedback is collected by simply asking the Survey participants to fill out the degree of importance they attach to certain variables when they forecast annual inflation at one and two-year horizons. Specifically, we have provided the participants with a list of macro variables and made the following request: *“Please mark the variables you use when constructing your (one and two-*

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<sup>8</sup> The Survey was designed and conducted in June 2019 jointly with the Statistics Department of the CBRT. The questions were distributed to around 80 people which constitutes the whole sample, and 50 of the respondents have provided direct feedback on the variables they use in forecasting inflation.

*year) inflation forecasts and their degree of importance.*” The participants are asked to choose among four options: “high”, “medium”, “low”, and “no” importance. Next, the feedbacks are quantified and aggregated for each variable by assigning grades to individual responses from 3 to 0, representing the range from high importance to no importance, respectively.

Figure 5 summarizes the results. The horizontal axis depicts the variables that appeared in the list provided to the participants as candidate variables having the potential to influence inflation forecasts. The vertical axis shows the score of each variable averaged across all participants. The quantitative scores provide a metric to assess the degree of relative importance of each variable in driving inflation forecasts.<sup>9</sup> The closer is the score to 3, the more important is the variable in shaping overall inflation expectations. For example, nominal exchange rate depreciation (USD/TL) makes the top among all variables with a value of 2.63 out of 3, whereas inflation target gets the lowest score with 0.96.<sup>10</sup>

Feedback results from the survey respondents show that the top six variables driving inflation forecasts of the professionals are exchange rates, inflation outturn, monetary policy stance, oil prices, economic activity, and near term historical average of inflation. Each of these variables has an average score of more than 2 out of 3. These variables will constitute the base for the regressor set in our empirical models. Note that the participants attach high score to various forms of exchange rate variables (nominal, real, and expected); but given the possible collinearity between these variables, we decided to use only one of the exchange rate variables, namely the nominal depreciation, which has the highest rank among the whole list.

Interestingly, the survey respondents seem to assign a very low weight to the inflation target when forming their inflation expectations. This observation suggests that the inflation target does not serve as an anchor among the survey respondents. We should note that the reported direct feedback is very recent, which represents the expectation formation process at the end of the sample period. Whether

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<sup>9</sup> We have tried different specifications in quantifying the feedback responses, but the ranking of the variables did not change in any meaningful way.

<sup>10</sup> Participants were also asked to state other relevant variables (not listed in the feedback forms) used in forecasting inflation, but they have not revealed any significantly important variable that would change the ranking in Figure 5.

the targets had a low weight in shaping the expectations during the (relatively more successful) initial periods of the inflation targeting period is an important question to be explored. Therefore, we will include the targets in our empirical specifications to assess the changing nature of expectations and their interaction with the background policy setting. The evolution of the estimated coefficients and the results of the feedback survey will be jointly used for crosscheck purposes to support our main hypothesis.

### *The Empirical Model*

Our aim is to explain the movements in inflation expectations at the individual level. The cross-sectional dimension of our data set captures around 70 participants per month, while the time dimension is about 150 months, which includes a rich panel of forecasters to identify some of the key factors driving inflation expectations. The empirical strategy will be running panel regressions of expectations on the relevant macroeconomic and policy variables and tracking the evolution of the key coefficients through rolling windows.

In light of the feedbacks from the survey participants and considering the related empirical literature, we construct the following model to explain inflation expectations:

$$\begin{aligned} \pi_{i,t|t+k}^e = & \beta_1 \pi_{t-1} + \beta_2 \pi_{t-1}^{MA12} + \beta_3 \pi_{t|t+k}^{target} + \beta_4 MP_{i,t-1}^{surprise} + \beta_5 \Delta basket_{t-1} \\ & + \beta_6 ipi_{t-2} + \beta_7 \Delta oil_{t-1} + \beta_8 D_{Target Revision} + \mu_i + \varepsilon_{it} \end{aligned} \quad (1)$$

The dependent variable  $\pi_{i,t|t+k}^e$  shows *k-month* ahead inflation forecast (expectation) of participant *i* at time *t*.<sup>11</sup> The specific lag structure chosen for the explanatory variables reflect the information set available to the survey participants when constructing the forecasts.<sup>12</sup> The first two variables on the right hand side pertain to observed levels of past inflation:  $\pi_{t-1}$  is the annual inflation rate of the previous month, which is the latest inflation figure observed by the time of the survey.

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<sup>11</sup> During the initial years of the Survey, the longest term inflation forecast was one year. After the introduction of explicit inflation targeting regime in 2006, the survey questions were further expanded to include medium term (2-year ahead) inflation forecasts. In order to incorporate the 2-year ahead inflation forecasts, we start the sample at year 2006.

<sup>12</sup> Using lagged variables may also help to address potential endogeneity issues between expected inflation and other macro variables as argued by Mehrotra and Yetman (2018).

$\pi_{t-1}^{MA12}$  is moving average of the annual inflation rate of the previous 12 months. Note that we use both previous month's inflation and last 12 months' average inflation to capture the sensitivity to past inflation components. The idea is that survey participants attach some weight to the most recent level of inflation but they also consider the history of inflation in forming their forecasts.<sup>13</sup> Adding this latter variable to the set of regressors is also justified by the direct feedback from the survey respondents (see Figure 5).  $\pi_{t|t+k}^{target}$  represents the CBRT's  $k$ -month ahead inflation targets known to the forecaster at time  $t$ , which is constructed by interpolating the end-year inflation targets.

$MP_{i,t-1}^{surprise}$  denotes individual level monetary policy surprise variable. This variable is constructed by taking into account the changes in the CBRT's operational framework. For April 2006-May 2018 period, the policy surprise variable is calculated as the difference between participant  $i$ 's end-of-month expectation and the realization for the interbank market rate. During this period, overnight interbank rate is used to represent the monetary policy stance, rather than the official policy rates, because interbank rates have occasionally deviated from the official policy rates during the implementation of unconventional interest rate corridor policy. Related research shows that the de-facto policy stance has been represented by the interbank rates during this period (Binici et al, 2019). Since June 2018, the CBRT reverted back to a relatively more conventional interest rate corridor system in which one-week repo auction rate represents the policy rate. Therefore, after this period, we use survey expectations on one-week repo rate to calculate monetary policy surprises. Positive (negative) value of  $MP_{i,t-1}^{surprise}$  implies monetary policy surprise on the tightening (easing) side. The coefficient of this variable in the rolling regressions will be of particular interest, as part of our aim will be to track the interaction of monetary policy framework with the expectation behavior. Having individual level measure of the policy surprise is a valuable feature of the data set. To our knowledge, CBRT Survey is

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<sup>13</sup> In fact,  $R^2$  of a simple OLS regression of actual 12-month ahead inflation to one-month lagged and MA(12) inflation is 0.75, where most of the variation is explained by the MA(12) term. Therefore, past inflation variables we use in the regressions have strong predictive power for future inflation.

the only official broad-coverage survey asking the expectations of policy rates jointly with fixed horizon inflation forecasts for a reasonably long period (13 years) at the monthly frequency.

$\Delta basket_{t-1}$  is the annual percentage change in the monthly average currency basket (representing euro and US dollar in equal weights). A positive value in this variable indicates depreciation of Turkish lira. We use  $ipi_{t-2}$  as a measure of economic activity, which is constructed using 3-month moving average of annual percentage change of seasonally and calendar adjusted industrial production index. This variable is lagged two months because industrial production data is publicly available with a two-month lag.<sup>14</sup> We apply 3-month moving average transformation to smooth excessive volatility in the monthly industrial production. Moreover,  $\Delta oil_{t-1}$  shows 6-month percentage change of monthly average crude oil price in US dollars.<sup>15</sup>

$D_{Target Revision}$  is a dummy variable controlling for the announcement effect of the target revision in June 2008. The dummy variable takes the value of 1 for June 2008 and 0 otherwise. Finally,  $\mu_i$  represents individual fixed effects, used to avoid any bias due to time invariant individual characteristics that may be correlated with the independent variables. We use Driscoll and Kraay (1998) standard errors to account for cross-sectional and time correlation in the errors.

The use of forecaster level micro data helps to address some of the endogeneity issues related to reverse causality problems in the empirical models using aggregate data, as discussed in Boneva et al. (2016). Individual expectations are affected by the inflation and other macro variables but cannot significantly influence these variables. Therefore, employing forecaster level dependent variable eases the simultaneity problems inherent in macro relationships. While this addresses the reverse causality issue, expectations and the explanatory variables may still be driven by a common factor, which may be another source of endogeneity. Controlling for all the relevant variables on the right hand side alleviates the common factor issue, but this is not a trivial task. Relative strength and the novel feature

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<sup>14</sup> We have also used one month lagged or contemporaneous values of the industrial production for robustness purposes but the results remained intact.

<sup>15</sup> We use different data transformations for oil and exchange rates (six months and one year percentage change, respectively) in order to avoid possible collinearity between the US dollar and oil prices.



of our approach compared to similar studies is that we are able to relate the choice of explanatory variables to direct evidence, thanks to the availability of feedback from the survey respondents, which should minimize the omitted variable problem.

Our particular focus when interpreting the empirical results will be on the role of inflation target, past inflation, exchange rates, and monetary policy in driving inflation expectations, as well as their changing nature through time. Table 1 shows panel regression results of the baseline empirical model for one-year and two-year inflation expectations. The high  $R^2$  values, which is 0.8 for 12-month and 0.7 for 24-month expectations, suggest that the model is able to explain a sizeable portion of the variations in inflation expectations. Moreover, both the sign and the magnitude of the coefficients on the explanatory variables are reasonable in economic terms. Inflation expectations have a positive and strongly significant relationship with the past inflation terms and the targets. The coefficients on the economic activity, exchange rates and oil prices are positive and significant. The coefficient on the monetary policy surprise has a negative and significant sign, implying that tighter-than-expected monetary policy is associated with lower inflation expectations.<sup>16</sup> Although the coefficients on policy surprises seem to be in line with the textbook response, this may not reflect the expectations behavior for all episodes, given that the interest setting framework has shown considerable shifts during our sample period. In the next section, we will run moving window estimates to understand if the response of the expectations to the interest rate decisions have shown behavioral shifts through time.

Empirical results in Table 1 suggest that agents pay significant attention to past inflation terms, represented by the latest inflation print and the near history (as represented by the MA12 term). The coefficient on inflation targets may be interpreted as a measure of the degree of anchoring in inflation expectations. For one-year ahead inflation expectations, the coefficient on the inflation target is

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<sup>16</sup> Note that, under a completely credible inflation target, expectations of inflation at long enough horizons should not respond to shocks, including policy surprises. In our case, we use one and two-year expectations due to data limitations for longer term expectations. One or two year ahead inflation may be within the horizon where policy is perceived to be effective, but not enough to fully offset the impact of shocks and bring inflation back to target at all times.

smaller than the sum of the coefficients on the past inflation variables.<sup>17</sup> Regarding two-year ahead expectations, coefficient of the target is higher than the sum of the coefficients on past inflation terms. The finding that longer-term expectations are more sensitive to inflation targets makes sense, given the role of inflation targets in the policy regime. These findings are in line with Mehrotra and Yetman (2018) who argue that, as the forecast horizon shortens, newly arriving public information such as past inflation realizations become more relevant in driving inflation expectations. Overall, full sample results suggest that inflation targets on average seem to have served at least as a partial anchor for medium term expectations.

Recall that our direct evidence extracted from the feedback survey indicated that the survey participants do not rank the inflation target as a significant variable in forming their inflation forecasts as of the end of the sample period. On the other hand, the empirical results in Table 1 suggest that agents attach a reasonable and highly significant weight to inflation targets for the whole sample period. Taken together, these observations suggest that the role of targets in anchoring expectations may have changed through time, which will be further explored in the upcoming sections.

One candidate explanation for the changing weight of the inflation targets may be related to the sizeable and persistent deviations of inflation from the targets, which may have undermined the anchoring role of the targets. In order to further investigate this hypothesis, in the last two columns of Table 1, we explore whether the anchoring degree of the targets depends on the past performance in meeting the targets. To this end, we ask the following question: Does the inflation targeting performance –measured by the gap between inflation realizations and the target—affect the sensitivity of expectations to the targets? In order to test this hypothesis, we interact the inflation targets with the difference between realized inflation and the target in the baseline specification averaged over the past year (Table 1, Columns III and IV). The answer is a clear yes, as depicted by the highly significant negative coefficient of the interaction terms shown at the last row. The results reveal

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<sup>17</sup> Although inflation target has a relatively large coefficient in the baseline regression (especially for two-year expectations), its partial  $R^2$  in explaining inflation expectations (reported in Table B1 of the Appendix B) is relatively small due to low variation of the targets.

that the higher is the gap between inflation and the target, the lower is the weight attached to targets. Sensitivity of expectations to the inflation targeting performance seems to be higher for medium term expectations (last column of Table 1). These results support the view that persistent upside breaches of the inflation targets weaken the anchoring power of the targets through time. This finding is also consistent with the direct evidence obtained from the survey participants, who have ranked the inflation target as the least important variable in driving their forecasts in a recent feedback survey (Figure 5).

#### *The interaction between exchange rates and the expectation formation process*

We now turn to the interaction of inflation expectations behavior with the movements in exchange rates (Table 2). Table 2 runs the baseline regressions by interacting key variables with an “exchange rate depreciation dummy”, which takes the value of 1 for the periods where the exchange rate depreciated in the past 12 months and 0 otherwise. The coefficient of the interaction term is significant and positive for the past inflation and negative for the inflation targets. In other words, during depreciation episodes, the weight attached to past inflation is higher and the weight on the inflation target is lower, compared to appreciation periods. These results reveal that the targets might be perceived less of an anchor during depreciation episodes, possibly pointing to some interaction between the credibility of the inflation targets and the exchange rate depreciation. Expectations seem to be more sensitive to exchange rate movements during depreciation periods. These findings suggest that exchange rate depreciation periods coincide with weaker anchoring of inflation expectations. Overall, the behavior of inflation expectations seems to be sensitive to exchange rate movements, suggesting a strong interaction between the exchange rate movements and the expectations formation process. This result may reflect that exchange rates may play a more important role in driving inflation expectations, beyond the dimension of pass-through to domestic prices. In fact, Coibion and Gorodnichenko (2015) argue that in countries with high inflation, economic agents could routinely use exchange rates as a statistic summarizing the stance of monetary and fiscal policies as well as other macroeconomic conditions to infer the rate of inflation.

In order to further explore the behavioral asymmetry with respect to the exchange rate movements, we look at how the relation between realized and expected exchange rate changes differs during appreciation and depreciation episodes. Figure 6 depicts the scatterplot of past 12-months' exchange rate (USD/TL) depreciation rate versus expected depreciation rate in the next 12 months by survey participants. The dots at the right side of the vertical axis indicate that weaker TL observed in the past year prompts expectations of further depreciation in the next twelve months, as most of the observations are in the first quadrant. On the other hand, as depicted by the dots at the left side of the vertical axis, survey respondents expect past appreciation periods to be somewhat reversed by future depreciation periods. These observations may help to explain why the relation between exchange rate movements and inflation expectations exhibit asymmetry. To the extent that the actual behavior of price setters mimic survey participants, such an asymmetric pattern in the expectation behavior may also lead to asymmetry in the realized exchange rate pass-through to inflation.

#### *Formation of expectations: Do financial and real sector differ?*

Next, we investigate whether expectation formation of real and financial participants differ from each other (Table 3). This question is addressed by estimating the baseline empirical model separately for financial and real sector participants.<sup>18</sup> Coefficients for both groups seem to be similar, although there are slight differences. Financial sector puts relatively more weight on inflation targets for the medium term horizon. The sign of the dummy variable coefficient for the target change (last row of Table 3) reveals additional information on the behavioral differences between the two groups. Response of two year-ahead financial sector forecasts to the target revision in June 2008 is highly significant, while those of real participants do not reveal any significant sensitivity. Moreover, for the medium term horizon, financial sector participants' inflation expectations display a highly significant response to monetary policy surprises, whereas real sector participants' response coefficient shows a weaker significance. These results suggest some differences between financial and real sector

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<sup>18</sup> The real sector participants are typically CFO's or chief economists of large conglomerates.

regarding their attentiveness to new information released by the central bank, which echoes the point made by Blinder et al. (2008): Central banks, which largely focus on the financial markets in designing their communication strategy, need to develop alternative tools in communicating with the general public.

#### *Has the behavior of inflation expectations changed through time?*

As explained in Section 2, Turkish inflation dynamics and monetary policy framework has gone through significant changes during the past decade, especially after the global financial crisis, which might have significant implications for the inflation expectations formation process. We will seek to identify the changes in the behavior of inflation expectations by estimating moving windows regressions and tracking the relevant coefficients in time.

We modify the baseline model (Equation 1) slightly to conduct the rolling regressions. The reason for using a different setup is the lack of variation in inflation targets since 2012. In other words, in our baseline model, one of the explanatory variables is constant during the last six years of the sample period. While this may not be a problem for the entire sample, it creates complications with short-horizon moving window estimates. In order to circumvent this problem, we employ a modified version of the baseline model in Equation 1, by simply replacing the inflation *level* variables with the “gap” terms. Accordingly, our modified empirical model takes the following form:

$$\begin{aligned}
 (\pi_i^e - \pi^{target})_{t|t+k} = & \alpha_1(\pi - \pi^{target})_{t-1} + \alpha_2(\pi - \pi^{target})_{t-1}^{MA12} + \alpha_3 MP_{i,t-1}^{surprise} \\
 & + \alpha_4 \Delta basket_{t-1} + \alpha_5 \Delta ipi_{t-2} + \alpha_6 \Delta oil_{t-1} + \mu_i + \varepsilon_{it}
 \end{aligned} \tag{2}$$

Our transformed dependent variable is now  $k$ -month ahead inflation expectations minus the corresponding inflation target, which we denote as  $(\pi_i^e - \pi^{target})_{t|t+k}$ . We call this variable as “the credibility gap”, representing the gap between central bank’s  $k$ -period ahead inflation target and private agents’ forecasts of inflation for the same horizon. Past inflation terms on the right hand side are also transformed into the gap form. Instead of inflation levels, we use the gap between realized inflation and the target as explanatory variables. Accordingly,  $(\pi - \pi^{target})_{t-1}$  shows the deviation of previous month’s inflation rate from the corresponding target and  $(\pi - \pi^{target})_{t-1}^{MA12}$  denotes past

12-month moving average of this deviation. Here, once again we assume that survey participants, when constructing their forecasts, not only consider the most recent inflation figures, but also take into account an average of near history performance (represented by the MA12 term). Other explanatory variables are exactly in the same form as in Equation 1, except that we dropped the target change dummy as the new form of the dependent variable makes it redundant.

Table 4 shows the regression results for the credibility gap. As expected, the findings for the whole sample are similar to the results of the baseline specification. Inflation expectations respond significantly to past inflation terms, monetary policy surprises, exchange rates, economic activity, and oil prices. The sign and the magnitude of corresponding coefficients are close to the baseline model estimations in the previous subsection.

In order to track the time varying behavior of inflation expectations, we run five-year moving-window regressions. Figure 7 shows the evolution of coefficients on (a) the sum of past inflation terms (previous month's inflation and twelve month average inflation), (b) exchange rate depreciation, and (c) central bank policy surprises at the individual level.

Several implications emerge from the rolling regression results. The sum of the coefficients on past inflation components exhibit a marked upward movement towards the end of the sample period (Figure 7a). In other words, survey participants tend to attach increasingly higher weight on the previous inflation figures when forming expectations. Considering the significant upside breaches towards the end of the sample period, this finding is consistent with the negative sign of the interaction term in Table 1. The anchoring role of inflation targets seems to have weakened as the gap between inflation and targets has widened.

Private forecasters attach higher weights on the past inflation in recent years, and the shift has become more noticeable after 2017—a period marked by persistent double-digit inflation. Given the sharp exchange rate depreciation of the Turkish lira towards the end of the sample period, these results are also consistent with the findings presented in Table 2, which implies higher sensitivity of expectations to past inflation during depreciation periods.

The results depicted in Figure 7b reveal that the relationship between exchange rate and inflation expectations has strengthened after 2013, which coincides with the persistent depreciation in the Turkish lira during this period. Higher inflation and inflation volatility, combined with the asymmetric pass-through effects may have altered the observed relationship between exchange rates and inflation expectations. Although the causality may run in both directions, this finding is notable as it implies a stronger feedback between exchange rates and inflation expectations in driving the inflation process.

On the other hand, it is interesting to note that the upward trend in the sensitivity of expectations to past inflation and exchange rates seems to have partly reversed course towards the end of the sample period, as depicted by the decline in the coefficients in Figure 7a and 7b during the recent period. These changes broadly coincide with a tighter monetary policy stance (central bank increased the base policy rate sharply in September 2018) and the adoption of a more conventional policy framework by mid-2018, although more observation is needed to make a firmer assessment on the drivers and significance of this behavioral shift.

Evolution of the coefficients on the monetary policy surprises across time provides useful insights regarding how monetary policy interacts with expectations under different policy frameworks. Under a conventional framework, a positive monetary policy shock would lower medium term inflation expectations by signaling a tighter than expected policy stance. In fact, the whole sample estimations shown in Table 1 and 4 reveal a negative and significant coefficient for the policy surprises. However, moving window estimates depicted in Figure 7c reveal that, the coefficients showing the impact of monetary policy surprises on the inflation expectations vary across time, and these changes largely coincide with the shifts in the monetary policy framework. Adoption of an unconventional interest rate corridor policy in 2011 and the gradual exit from this framework after 2016 may explain some of the changing relationships. Between 2011 and 2015, CBRT used a relatively complicated and high frequency interest rate policy to smooth exchange rate fluctuations (Kara, 2015). Moving window regression coefficients suggest that, during this period, the response of the medium term (two-year) inflation expectations to monetary policy surprises are insignificant and short-term (one-year)

expectations respond with a wrong (positive) sign. This result make sense because during this period, monetary policy surprises are likely to be perceived as short-term reactions to exchange rate volatility rather than a response to medium term inflationary pressures. On the other hand, the sign of the policy surprise coefficient turns negative after 2016, following the attempts of gradually reverting to a more conventional monetary policy framework (Figure 7c). With the normalization of monetary policy strategy towards the end of the sample period, a surprise tightening (easing) seems to be associated with a decrease (increase) in medium term inflation expectations, as predicted by the conventional theory. Our unique data set including matched forecasts for inflation and the policy rate at the individual level, as well as the frequently changing nature of the background monetary policy framework, enables us to make these assessments with a reasonable precision.

The finding of an upside response of inflation expectations to tightening surprises in some occasions is not specific to our study. For example, Andrade and Ferroni (2018) argue that the “wrong sign” of the policy surprise coefficients in the case of ECB is due to the fact that policy surprises are perceived as news about future macroeconomic conditions, rather than a stronger or weaker commitment for the price stability objective. In our case, the economic agents may have perceived the high frequency interest rate hikes as a signal of future exchange rate pressures during the period of unconventional interest rate corridor framework, which may have contaminated the relationship between policy surprises and inflation expectations.

Overall, the results suggest that the expectation dynamics have exhibited notable changes throughout the sample period, possibly associated with the underlying policy and economic performance.

One important question is whether the change in the actual inflation process mimicked the changes in the expectation dynamics. In order to contrast the pattern of changing expectation behavior with the inflation process itself, we have regressed actual inflation on lagged inflation and exchange rates along with similar control variables used in the empirical model for inflation expectations. The regression results are reported in Figure 8 with five-year rolling windows. The coefficients on past



inflation and the exchange rate depreciation in this regression rise sharply after 2017.<sup>19</sup> More interestingly, a comparison of Figure 7b with Figure 8b suggests that, the sensitivity of inflation expectations to exchange rates started to increase before the rise in the estimated exchange rate pass-through.<sup>20</sup>

Our analysis so far suggests that the behavioral shift in inflation expectations might be attributed to the performance of achieving the inflation objectives. A complementary possible explanation for the increased prominence of past inflation and exchange rates in driving inflation expectations in recent years may be related with higher attentiveness to these variables with the heightened volatility during the corresponding period (Coibion and Gorodnichenko, 2015). In fact, Figure 9 reveals that the individual level correlation between expected exchange rate depreciation and expected inflation at one-year horizon have strengthened considerably towards the end of the sample period.

### *Robustness Analysis*

In this subsection, we present some modifications and extensions to our baseline empirical model to see whether main findings remain robust against different specifications. To this end, we modify the main model in two dimensions: First, we use alternative definitions for key variables of interest, also considering the results of the direct feedback from participants. To this end, we add core inflation (instead of headline inflation), 24 months moving average of past inflation (instead of 12 months moving average), real effective exchange rate (instead of nominal exchange rate), import prices (instead of oil prices). Second, we use additional explanatory variables that may be important in driving expectations dynamics implied by our feedback survey from respondents. Accordingly, we conduct alternative regressions by adding the following variables: (i) risk premium (monthly change in EMBI spread), (ii) fiscal balance (primary budget balance to GDP ratio), (ii) money supply (rate of annual

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<sup>19</sup> A recent CBRT Inflation Report Box presents similar findings using a Time Varying Parameter model of the inflation process developed in Kara, Ögünç, and Sarıkaya (2017). For details, see CBRT (2019).

<sup>20</sup> The structural break dates based on Supremum Wald and LM tests suggest that a significant shift in inflation dynamics have materialized around June 2016.

change in M1), and (iv) wage inflation (annual growth in hourly labor cost index).<sup>21</sup> Table A1 and A2 at the Appendix summarizes the robustness results for one year and two year ahead inflation expectations, respectively. Despite some minor discrepancies regarding the size of coefficients, our main conclusions are robust to all alternative specifications. The coefficients and the signs of the variables in the baseline model remain broadly the same. We also conduct moving window estimates to see whether the main findings on the behavioral changes in expectations stay robust against alternative specifications. Moving window estimates of the key parameters (past inflation, exchange rate and policy surprise) are depicted in Figures A1 and A2 of Appendix A for the baseline and eight alternative models, with each column corresponding to a different specification. Although the size of the coefficients varies across models, their pattern and the evolution remain broadly robust. We still see parameters changing significantly through time associated with the background macroeconomic conditions and policy setting. The role of exchange rates and the past inflation terms seem to have strengthened through time. Policy rate surprises become insignificant during the implementation of the unconventional interest rate corridor between years 2011-2015, slightly gaining significance towards the end of the sample period.

Overall, our main results hold firmly across different specifications. Moreover, the robustness exercises show that direct feedback provided by the survey participants (summarized in Figure 5) is highly consistent with the empirical results, confirming the usefulness of such feedback in supporting empirical research.

#### **4. Concluding Remarks**

We have investigated time varying aspects of inflation expectation dynamics, seeking to explore how the behavior of expectations interact with the policy setting and the macroeconomic performance. With its rapidly evolving macroeconomic and external conditions and highly volatile

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<sup>21</sup> Money supply series start from December 2006. Wage data is available at quarterly frequency, and starts from the first quarter of 2008; which is transformed into monthly series by assuming constant annual growth within the quarter.

inflation process, the Turkish economy provides a genuine laboratory for exploring this question. Using individual level data on a new survey of private forecasts, we document the changing dynamics of inflation expectations in response to the macroeconomic and policy environment. Our empirical model, which is built on direct feedback from survey participants, reflects a novel contribution to the related literature. The results imply that monitoring not only the *level* but also the *behavior* of inflation expectations may provide valuable insights for the formulation and the design of monetary policy.

An important feature of our work is employing a unique monthly survey containing matched forecasts for both the policy rate and fixed-horizon inflation at the micro level. Previous studies looking at the impact of policy rates have used market-based or other indirect aggregate policy surprise measures, which may not necessarily represent the surprises faced by individual survey participants. Thanks to the peculiar content of our data set, we are able to assess the reaction of inflation expectations to the monetary policy surprises at the individual level. Our findings suggest that the effectiveness of monetary policy in controlling inflation expectations depends on the operational framework.

The empirical evidence we provide on the expectations dynamics reveal that the behavior of inflation expectations may be highly sensitive to the underlying policy performance. Our results suggest that Turkish inflation expectations have been increasingly associated with the movements in exchange rates and past inflation through time, possibly associated with changing macroeconomic landscape and the weakened anchoring power of the official targets through time. We support these findings by direct evidence from a recent feedback study conducted to the survey respondents, which reveals that towards the end of the sample period inflation target ceases to serve as an anchor in driving private inflation forecasts. These results indicate that the anchoring role of inflation targets can weaken through time if the targets are breached for a considerable period.

Overall, the Turkish experience offers important insights for other countries. The long-achieved credibility and strong anchoring of inflation targets across many emerging and advanced economies during the past decades should not be taken for granted. Credibility and the ability to shape

expectations may shift quickly depending on the policy performance. The world experience and the literature so far has been on the examples, where central banks gained credibility and inflation expectations became more anchored. Our study indicates that credibility may be gained, yet lost quickly if promises are not delivered. The Turkish case, which shows that this may revert even after a period of successful inflation targeting, yields an important lesson for developing economies, which seem to be reverting to their previous ailments, and for developed economies, which face difficulties in raising inflation to their targets but have not suffered major credibility losses, yet.

Although our findings suggest that changes in the expectations formation process are related to the policy performance, we do not attempt to provide concrete evidence on why the performance of inflation targeting was far from stellar. Explaining the fundamental factors driving the inflation target overshoots or exchange rate depreciations during our sample period are beyond the scope of this paper. It should be noted that for the Turkish case, the significant changes in the behavior of inflation expectations coincided with a period of heightened concerns on central bank instrument independence, which may have accelerated the behavioral shift in inflation expectations. In that sense, deeper research is needed to unveil the specific underlying mechanisms leading to changes in the expectation behavior. It would be particularly an interesting extension for future work to explore to what extent the changes in the expectation dynamics are driven by the perceptions of sliding external outlook as opposed to domestic factors including macro policy setting and the role of strong institutions.

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## TABLES

**Table 1: Drivers of Survey Based Inflation Expectations (April 2006 - April 2019)**

Dependent Variable: $k$ -month ahead annual inflation expectations of participant $i$ at time $t$ ( $\pi_{i,t t+k}^e$ )					
	(I)	(II)	(III)	(IV)	
	k=	12-month	24-month	12-month	24-month
CPI Inflation <sub>t-1</sub>		0.335*** (0.029)	0.205*** (0.042)	0.366*** (0.037)	0.259*** (0.035)
MA12 Inflation <sub>t-1</sub>		0.371*** (0.042)	0.229*** (0.080)		
Inflation Target <sub>t t+k</sub>		0.358*** (0.098)	0.665** (0.282)	1.087*** (0.197)	1.482*** (0.320)
Policy Surprise <sub>i,t-1</sub>		-0.025* (0.014)	-0.042** (0.021)	-0.040*** (0.009)	-0.057*** (0.020)
Nom. Depreciation <sub>t-1</sub>		0.034*** (0.002)	0.025*** (0.007)	0.036*** (0.003)	0.025*** (0.006)
IPI Growth <sub>t-2</sub>		0.039*** (0.013)	0.030*** (0.008)	0.042*** (0.013)	0.024*** (0.009)
Oil Price Growth <sub>t-1</sub>		0.010*** (0.002)	0.008*** (0.003)	0.006*** (0.002)	0.005** (0.003)
Dummy <sub>Target Revision</sub>		-0.087 (0.177)	-1.090* (0.606)	-0.269** (0.112)	-1.102** (0.428)
MA12 Target Deviation <sub>t-1</sub>				1.229*** (0.328)	1.229** (0.478)
MA12 Target Dev. <sub>t-1</sub> * Inflation Target <sub>t t+k</sub>				-0.186*** (0.051)	-0.222** (0.091)
Observations		8,182	7,943	8,182	7,943
R <sup>2</sup>		0.799	0.688	0.803	0.695

Notes: MA12 Target Deviation<sub>t-1</sub> shows the 12-month moving average of the deviation of annual inflation rate from the inflation target. (\*), (\*\*) and (\*\*\*) represent statistical significance at levels of 10, 5 and 1 percent, respectively. Driscoll and Kraay (1998) standard errors are given in parentheses.



**Table 2: Exchange Rate Movements and the Behavior of Expectations (April 2006 - April 2019)**Dependent Variable:  $k$ -month ahead annual inflation expectations of participant  $i$  at time  $t$  ( $\pi_{i,t|t+k}^e$ )

	(I)	(II)
<b>k=</b>	<b>12-month</b>	<b>24-month</b>
CPI Inflation <sub>t-1</sub>	0.047 (0.034)	-0.017 (0.068)
CPI Inflation <sub>t-1</sub> * Depr. Dummy	0.272*** (0.056)	0.215*** (0.078)
MA12 Inflation <sub>t-1</sub>	0.405*** (0.038)	0.238*** (0.051)
Inflation Target <sub>t t+k</sub>	0.840*** (0.049)	1.080*** (0.079)
Inflation Target <sub>t t+k</sub> * Depr. Dummy	-0.647*** (0.146)	-0.588*** (0.161)
Policy Surprise <sub>i,t-1</sub>	-0.026* (0.015)	-0.043*** (0.010)
Nom. Depreciation <sub>t-1</sub>	0.012*** (0.005)	0.010* (0.006)
Nom. Depreciation <sub>t-1</sub> * Depr. Dummy	0.020*** (0.006)	0.017** (0.007)
IPI Growth <sub>t-2</sub>	0.033** (0.015)	0.026*** (0.005)
Oil Price Growth <sub>t-1</sub>	0.011*** (0.002)	0.008*** (0.002)
Depr. Dummy	1.237 (1.127)	1.120 (1.410)
Observations	8,182	7,943
R <sup>2</sup>	0.809	0.695

Notes: Depr. Dummy is a dummy variable that takes 1 for the periods of Turkish lira depreciation, i.e., Nom. Depreciation<sub>t</sub> is positive. (\*), (\*\*) and (\*\*\*) represent statistical significance at levels of 10, 5 and 1 percent, respectively. Driscoll and Kraay (1998) standard errors are given in parentheses.

**Table 3: Financial and Real Sector Expectations (April 2006 - April 2019)**Dependent Variable:  $k$ -month ahead inflation expectations of participant  $i$  at time  $t$  ( $\pi_{i,t|t+k}^e$ )

	(I)	(II)	(III)	(IV)
	Financial Sector		Real Sector	
k=	12-month	24-month	12-month	24-month
CPI Inflation <sub>t-1</sub>	0.336*** (0.028)	0.206*** (0.020)	0.342*** (0.049)	0.215*** (0.043)
MA12 Inflation <sub>t-1</sub>	0.372*** (0.047)	0.235*** (0.055)	0.364*** (0.074)	0.219** (0.085)
Inflation Target <sub>t t+k</sub>	0.364*** (0.108)	0.722*** (0.148)	0.347*** (0.083)	0.484*** (0.160)
Policy Surprise <sub>i,t-1</sub>	-0.021 (0.019)	-0.036*** (0.011)	-0.030 (0.026)	-0.048* (0.028)
Nom. Depreciation <sub>t-1</sub>	0.034*** (0.003)	0.027*** (0.004)	0.028*** (0.005)	0.020*** (0.007)
IPI Growth <sub>t-2</sub>	0.037*** (0.013)	0.031*** (0.005)	0.044*** (0.014)	0.018* (0.010)
Oil Price Growth <sub>t-1</sub>	0.010*** (0.003)	0.008*** (0.002)	0.010*** (0.003)	0.007*** (0.002)
Dummy <sub>Target Revision</sub>	-0.094 (0.190)	-1.336*** (0.275)	-0.154 (0.216)	-0.520 (0.430)
Observations	6,319	6,109	1,393	1,364
R <sup>2</sup>	0.795	0.691	0.807	0.639

Notes: (\*), (\*\*) and (\*\*\*) represent statistical significance at levels of 10, 5 and 1 percent, respectively. Driscoll and Kraay (1998) standard errors are given in parentheses.

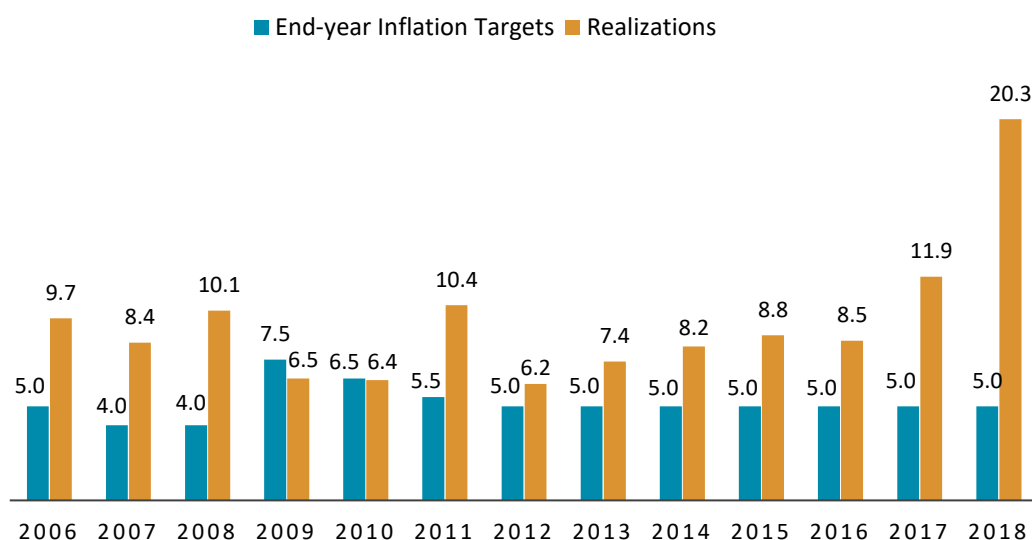
**Table 4: Drivers of Credibility Gap (expected deviation from the inflation targets) (April 2006-April 2019)**Dependent Variable: Credibility gap for participant  $i$  at time  $t$  ( $(\pi_i^e - \pi^{target})_{t|t+k}$ )

	(I)	(II)
k=	12-month	24-month
Target Deviation <sub>t-1</sub>	0.362*** (0.065)	0.217*** (0.038)
MA12 Target Deviation <sub>t-1</sub>	0.179*** (0.068)	0.078 (0.075)
Policy Surprise <sub>i,t-1</sub>	-0.064*** (0.021)	-0.077*** (0.019)
Nom. Depreciation <sub>t-1</sub>	0.037*** (0.008)	0.028*** (0.008)
IPI Growth <sub>t-2</sub>	0.040** (0.019)	0.017* (0.010)
Oil Price Growth <sub>t-1</sub>	0.013*** (0.003)	0.010*** (0.002)
Observations	8,182	7,943
R <sup>2</sup>	0.759	0.632

Notes: (\*), (\*\*) and (\*\*\*) represent statistical significance at levels of 10, 5 and 1 percent, respectively. Driscoll and Kraay (1998) standard errors are given in parentheses.

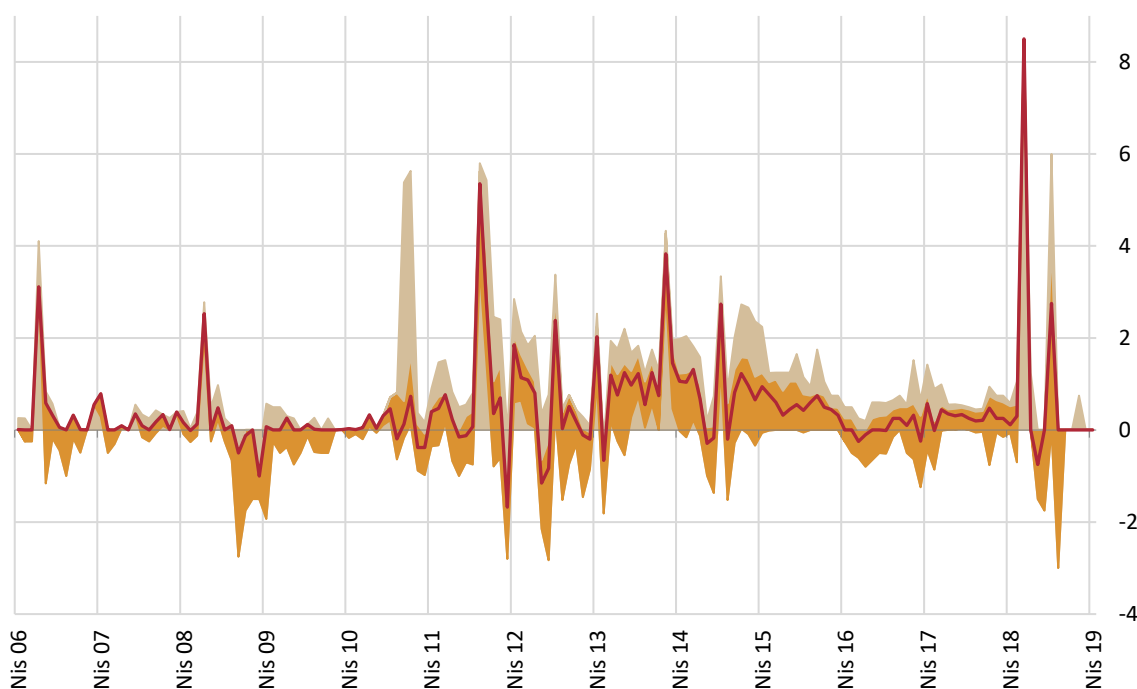
## FIGURES

**Figure 1. End-year inflation targets and realization, 2006-2018**



Source: CBRT, TurkStat.

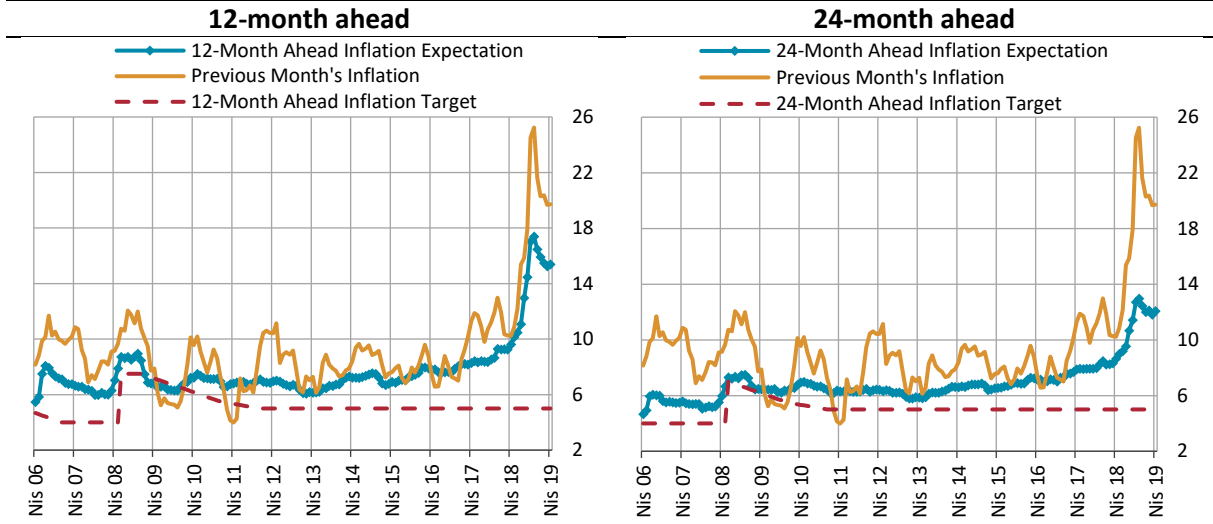
**Figure 2: Distribution of monetary policy surprises**



The vertical axis reports the distribution of monetary policy surprises across survey respondents. For April 2006-May 2018 period, individual level monetary policy surprise is calculated as the difference between survey participant's end-of-month expectation and the realization for interbank market rate for the corresponding month. Since June 2018, survey expectations on one-week repo rate are used to calculate monetary policy surprises. A positive (negative) value for the surprise implies monetary policy is tighter (easier) than expected.

The solid line is the median of the monetary policy surprise distribution for each month. The shaded areas comprise 50% and 90% of the cross sectional distribution.  
Source: CBRT.

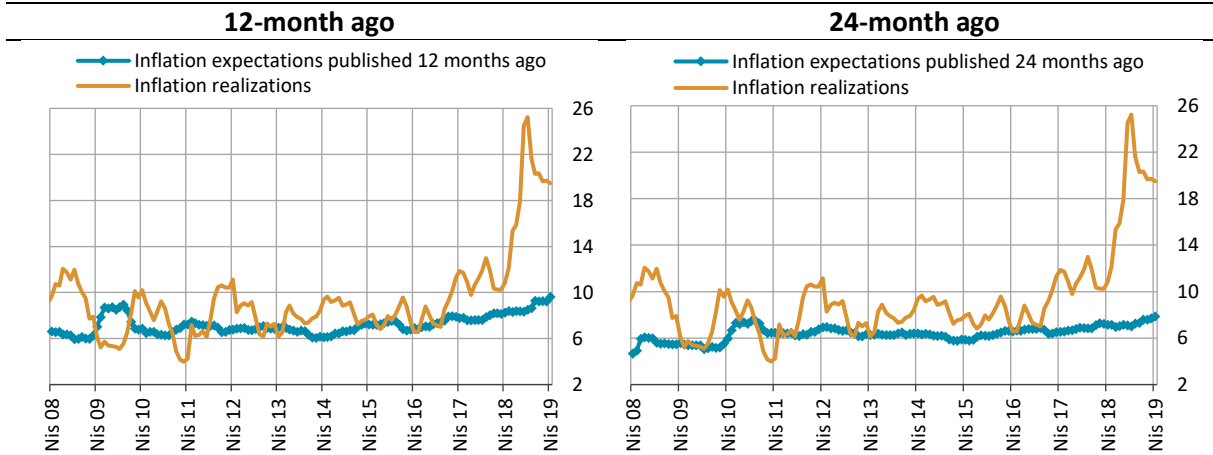
**Figure 3. Inflation, expectations, and targets**



All the inflation, target, and corresponding expectations series reflect annualized figures. Blue line shows mean inflation forecasts by participants in the CBRT's Survey of Expectations. Until 2013, the survey was conducted twice a month. Starting from January 2013, participants are surveyed once a month. We use second half of the month results before January 2013. Monthly inflation target series are computed by linear interpolation of the year-end inflation targets.

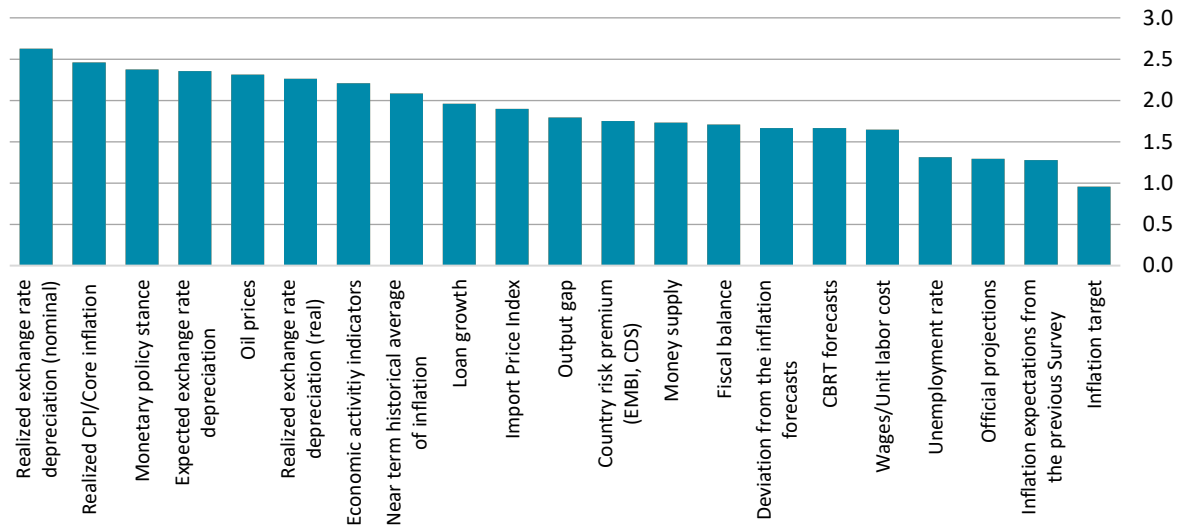
Source: CBRT, TurkStat.

**Figure 4. Forecast performance of the Survey: Inflation expectations and realizations**



Source: CBRT, TurkStat.

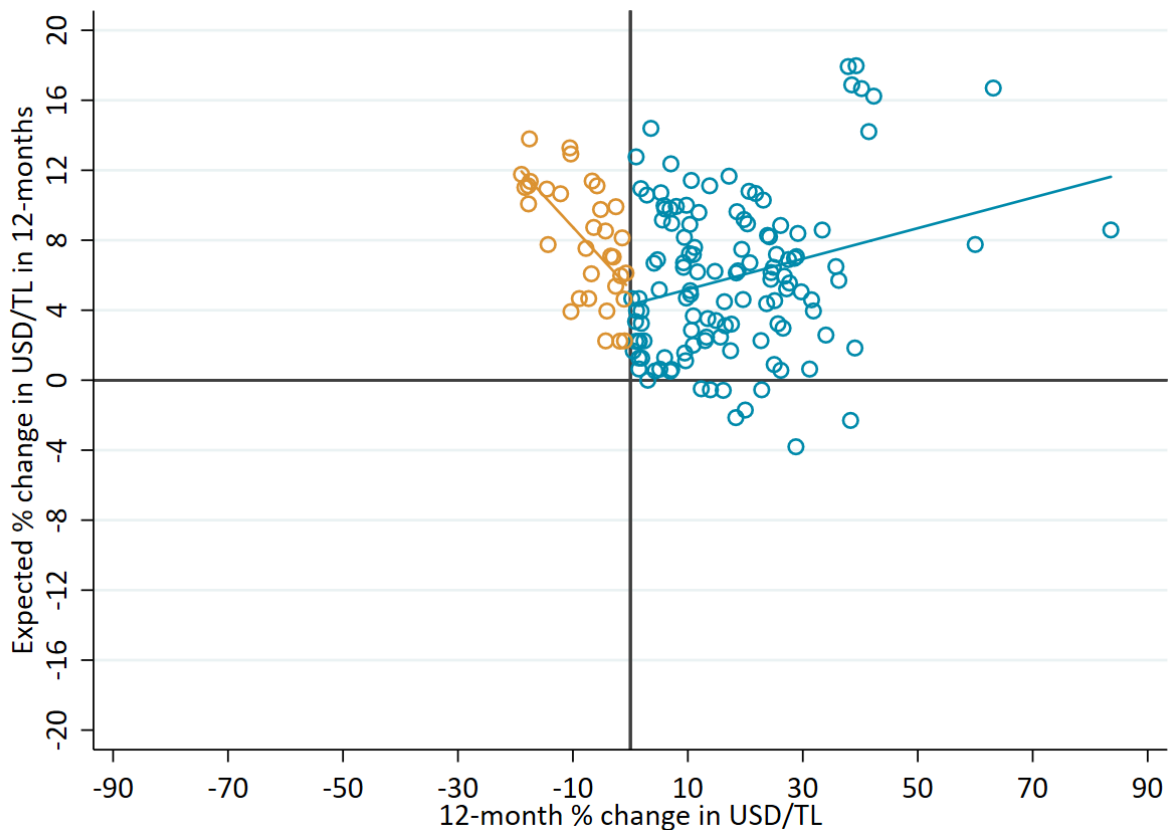
**Figure 5: Importance of variables driving inflation forecasts: Survey participants' scores (out of 3)**

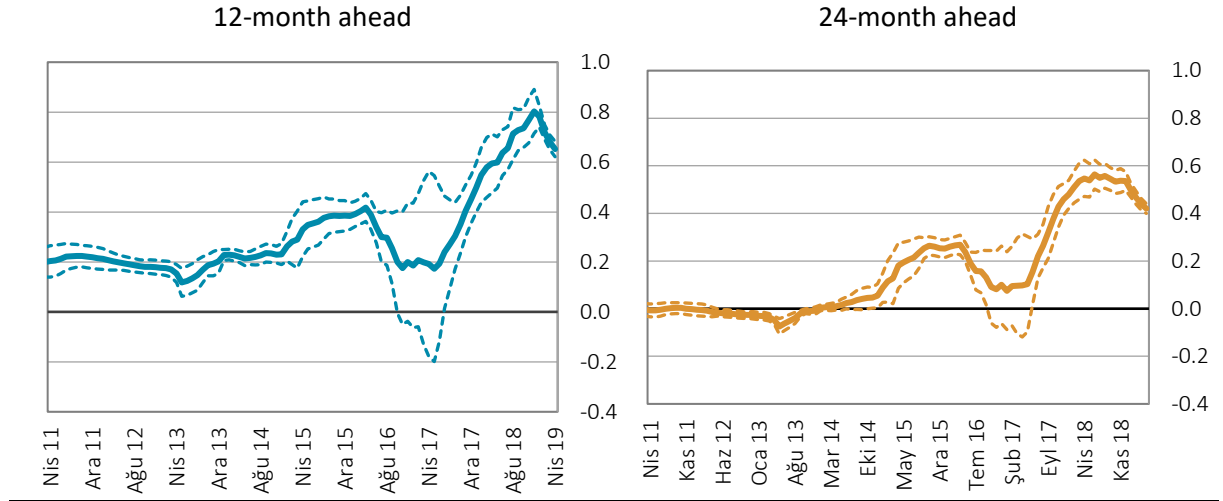
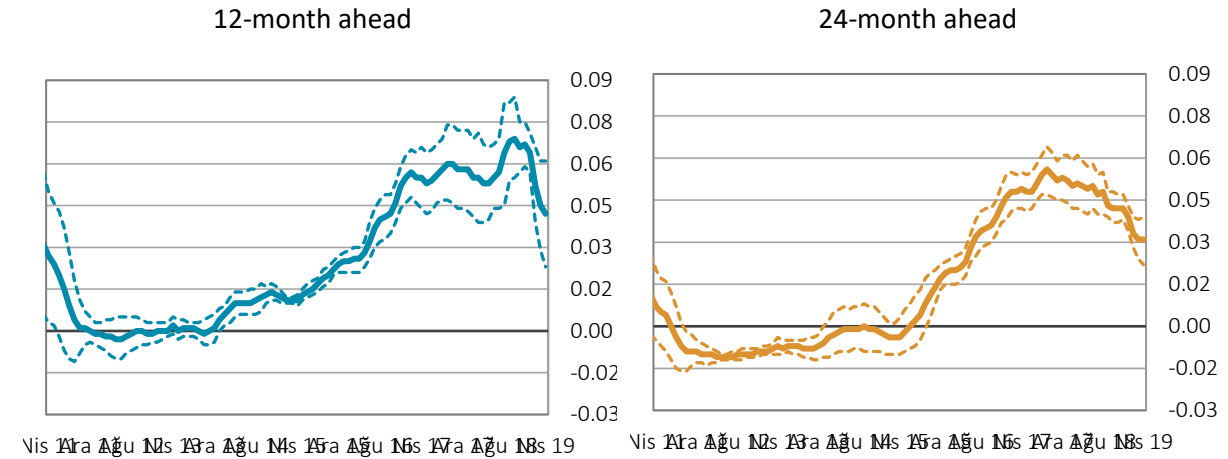
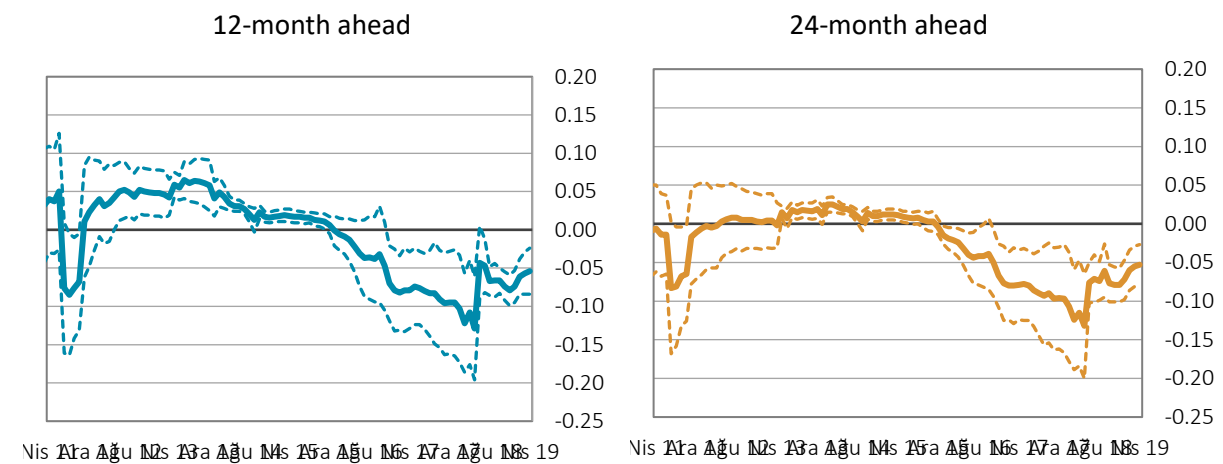


Values in the vertical axis show the average score of the corresponding variable in driving inflation forecasts across survey participants. The responses of survey participants are quantified by assigning grades from 3 to 0, for “high importance”, “medium importance”, “low importance”, and “no importance” respectively.

Source: CBRT.

**Figure 6. Realized vs Expected Exchange Rate Movements (April 2006 - April 2019)**



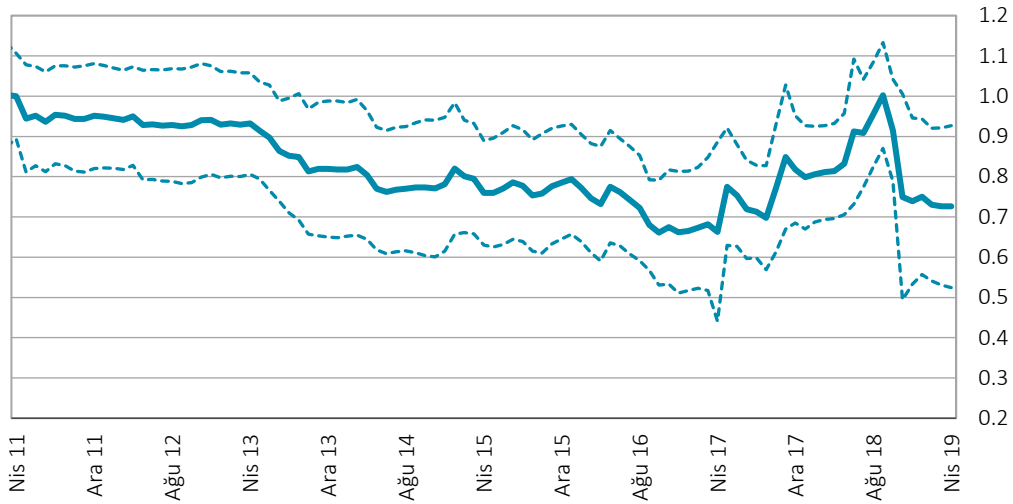
**Figure 7. 5-year Rolling Regressions for the Credibility Gap***7.a. Sum of coefficients on past inflation terms ( $\alpha_1 + \alpha_2$ )**7.b. Coefficient on the exchange rate ( $\alpha_4$ )**7.c. Coefficient on the policy surprise ( $\alpha_3$ )*

Dates in the x-axis show the last month of the 60-month (5-year) rolling windows. Dashed lines show 90 percent confidence intervals with Driscoll and Kraay (1998) standard errors.

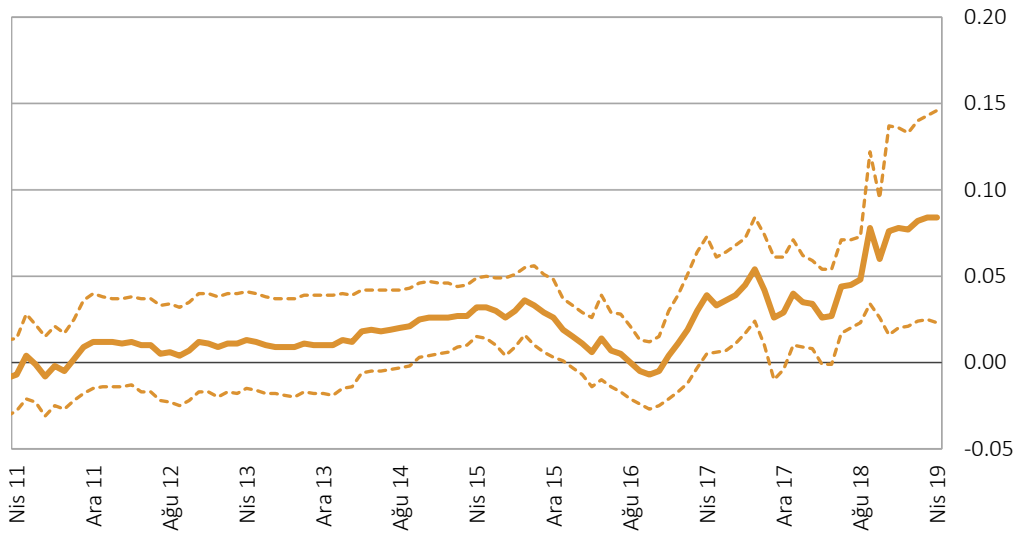
**Figure 8: Coefficient of Lagged Inflation and Exchange Rate Depreciation in Explaining Annual Inflation (5-year Rolling Regressions )**

$$\pi_t = \beta_1 \pi_{t-1} + \beta_2 \Delta basket_{t-1} + \beta_3 ipi_{t-2} + \beta_4 \Delta oil_{t-1} + \varepsilon_t$$

8.a. Coefficient of Lagged Inflation ( $\beta_1$ )

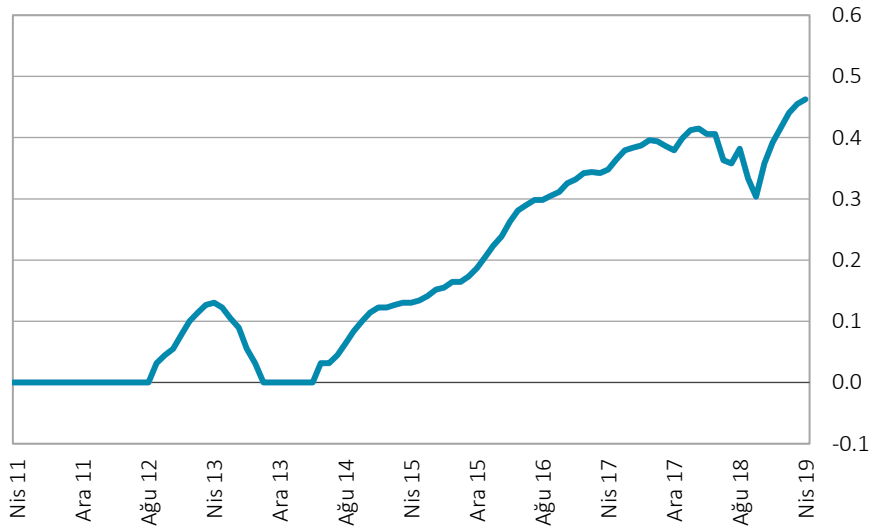


8.b. Coefficient of Exchange Rate Depreciation ( $\beta_2$ )



Dates in the x-axis show the last month of the 60-month (5-year) rolling windows. Dashed lines indicate 95 percent confidence intervals.

**Figure 9: Co-movement of Individuals' 12-month ahead Inflation Expectations and Expected TL depreciation in 12-months (5-year Rolling Correlation Coefficients )**



Source: CBRT.



## APPENDIX A: ROBUSTNESS REGRESSIONS

**Table A1: Robustness Analysis for 12 month ahead inflation expectations (Full Sample Regressions)**

Dependent Variable: 12-month ahead annual inflation expectations of participant $i$ at time $t$ ( $\pi_{i,t t+12}^e$ )									
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
CPI Inflation <sub>t-1</sub>	0.335*** (0.029)		0.293*** (0.026)	0.387*** (0.035)	0.306*** (0.028)	0.335*** (0.029)	0.336*** (0.030)	0.348*** (0.026)	0.331*** (0.033)
Core Inflation <sub>t-1</sub>		0.426*** (0.058)							
MA12 Inflation <sub>t-1</sub>	0.371*** (0.042)	0.125** (0.055)		0.350*** (0.039)	0.378*** (0.033)	0.370*** (0.041)	0.358*** (0.034)	0.377*** (0.033)	0.354*** (0.032)
MA24 Inflation <sub>t-1</sub>			0.675*** (0.063)						
Inflation target <sub>t t+12</sub>	0.358*** (0.098)	0.573*** (0.120)	0.274** (0.107)	0.340*** (0.106)	0.373*** (0.099)	0.351*** (0.102)	0.217*** (0.076)	0.296*** (0.082)	0.289*** (0.108)
Policy Surprise <sub>i,t-1</sub>	-0.025* (0.014)	-0.083*** (0.012)	-0.038** (0.016)	-0.009 (0.018)	-0.026 (0.018)	-0.028 (0.017)	-0.024* (0.012)	-0.030** (0.014)	-0.021* (0.011)
Nom. Depreciation <sub>t-1</sub>	0.034*** (0.002)	0.019*** (0.006)	0.035*** (0.004)		0.039*** (0.002)	0.033*** (0.002)	0.028*** (0.003)	0.027*** (0.003)	0.022*** (0.003)
Real Depreciation <sub>t-1</sub>				-0.033*** (0.003)					
IPI Growth <sub>t-2</sub>	0.039*** (0.013)	0.022 (0.017)	0.047*** (0.014)	0.027** (0.013)	0.029*** (0.010)	0.037** (0.015)	0.030** (0.014)	0.029*** (0.010)	0.051*** (0.010)
Oil Price Growth <sub>t-1</sub>	0.010*** (0.002)	0.016*** (0.001)	0.007*** (0.001)	0.009*** (0.002)		0.010*** (0.002)	0.008*** (0.002)	0.010*** (0.002)	0.011*** (0.003)
Import Price Growth <sub>t-1</sub>					0.037*** (0.008)				
Dummy <sub>Target Revision</sub>	-0.087 (0.177)	-1.263*** (0.396)	-0.341*** (0.113)	-0.315** (0.156)	-0.233 (0.183)	-0.060 (0.194)	0.518** (0.203)	0.032 (0.126)	-0.438** (0.176)
$\Delta$ EMBI <sub>t-1</sub>						0.001 (0.001)			
Prim. Balance (%GDP) <sub>t-2</sub>							-0.212*** (0.016)		
Money Growth <sub>t-1</sub>								0.024* (0.012)	
Wage Growth <sub>t-3</sub>									0.078*** (0.015)
Observations	8,182	8,182	8,182	8,182	8,182	8,182	8,182	7,738	7,029
R <sup>2</sup>	0.799	0.739	0.800	0.790	0.800	0.800	0.816	0.813	0.838

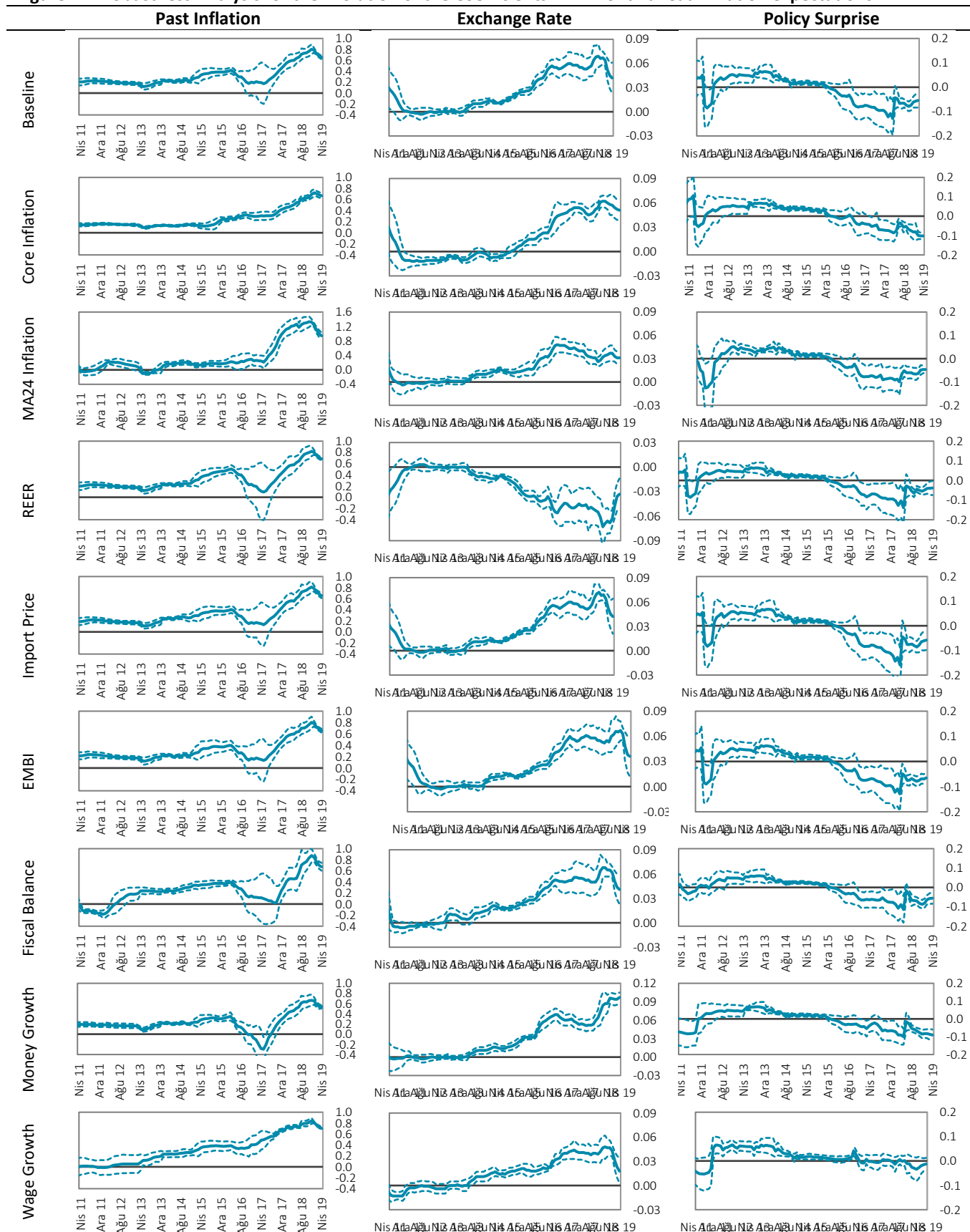
Notes: \*, \*\* and \*\*\* represent statistical significance at levels of 10, 5 and 1 percent, respectively. Driscoll and Kraay (1998) standard errors are given in parentheses.

**Table A2: Robustness Analysis for 24 month ahead inflation expectations (Full Sample Regressions)**

Dependent Variable: 24-month ahead annual inflation expectations of participant $i$ at time $t$ ( $\pi_{i,t t+24}^e$ )									
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
CPI Inflation <sub>t-1</sub>	0.205*** (0.015)		0.181*** (0.014)	0.247*** (0.015)	0.184*** (0.012)	0.205*** (0.015)	0.205*** (0.015)	0.220*** (0.016)	0.210*** (0.017)
Core Inflation <sub>t-1</sub>		0.219*** (0.038)							
MA12 Inflation <sub>t-1</sub>	0.229*** (0.049)	0.110 (0.070)		0.213*** (0.039)	0.232*** (0.046)	0.229*** (0.048)	0.207*** (0.018)	0.227*** (0.042)	0.216*** (0.029)
MA24 Inflation <sub>t-1</sub>			0.419*** (0.059)						
Inflation target <sub>t t+12</sub>	0.665*** (0.108)	0.659*** (0.083)	0.647*** (0.113)	0.672*** (0.120)	0.678*** (0.113)	0.666*** (0.111)	0.296*** (0.059)	0.503*** (0.087)	0.076 (0.077)
Policy Surprise <sub>i,t-1</sub>	-0.042*** (0.008)	-0.082*** (0.009)	-0.049*** (0.009)	-0.026*** (0.010)	-0.043*** (0.010)	-0.042*** (0.009)	-0.035*** (0.006)	-0.044*** (0.008)	-0.041*** (0.006)
Nom. Depreciation <sub>t-1</sub>	0.025*** (0.003)	0.021*** (0.006)	0.026*** (0.003)		0.029*** (0.003)	0.025*** (0.003)	0.020*** (0.002)	0.019*** (0.003)	0.016*** (0.003)
Real Depreciation <sub>t-1</sub>				-0.023*** (0.003)					
IPI Growth <sub>t-2</sub>	0.030*** (0.004)	0.017** (0.009)	0.037*** (0.006)	0.021*** (0.004)	0.022*** (0.004)	0.030*** (0.005)	0.015*** (0.005)	0.018*** (0.004)	0.021*** (0.006)
Oil Price Growth <sub>t-1</sub>	0.008*** (0.002)	0.011*** (0.001)	0.007*** (0.001)	0.008*** (0.002)		0.008*** (0.002)	0.006*** (0.001)	0.008*** (0.001)	0.008*** (0.001)
Import Price Growth <sub>t-1</sub>					0.027*** (0.004)				
Dummy <sub>Target Revision</sub>	-1.090*** (0.197)	-1.366*** (0.248)	-1.329*** (0.227)	-1.311*** (0.221)	-1.160*** (0.227)	-1.093*** (0.201)	0.076 (0.182)	-0.790*** (0.153)	-0.410*** (0.125)
$\Delta$ EMBI <sub>t-1</sub>						-0.000 (0.001)			
Prim. Balance (%GDP) <sub>t-2</sub>							-0.287*** (0.018)		
Money Growth <sub>t-1</sub>								0.024** (0.011)	
Wage Growth <sub>t-3</sub>									0.038*** (0.012)
Observations	7,943	7,943	7,943	7,943	7,943	7,943	7,943	7,531	6,849
R <sup>2</sup>	0.688	0.644	0.688	0.677	0.685	0.688	0.734	0.704	0.721

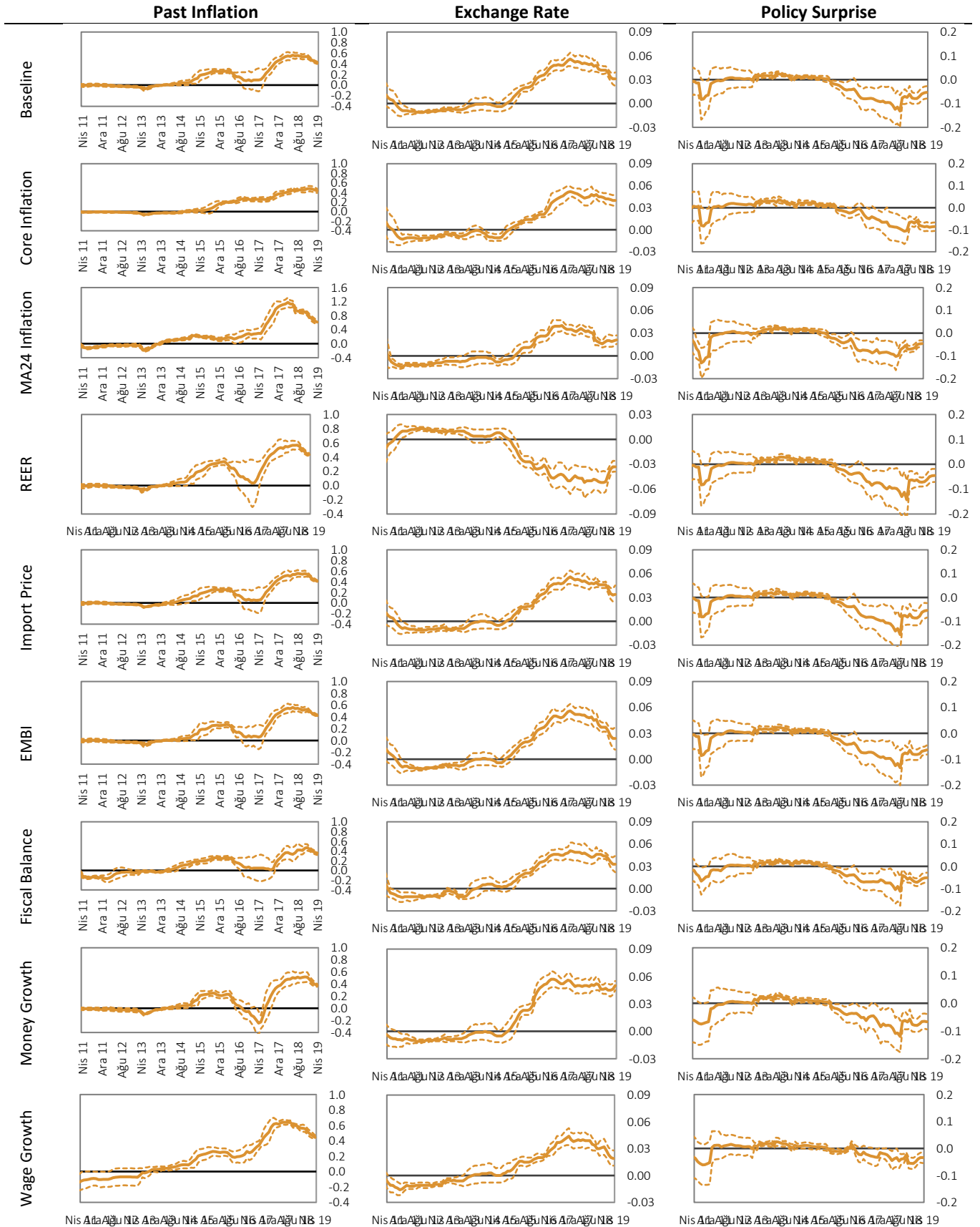
Notes: \*, \*\* and \*\*\* represent statistical significance at levels of 10, 5 and 1 percent, respectively. Driscoll and Kraay (1998) standard errors are given in parentheses.

**Figure A1. Robustness Analysis for the Evolution of the Coefficients – 12 month ahead inflation expectations**



The graphs show 5-year rolling window estimates of the coefficients on past inflation, exchange rate, and policy surprises for the baseline model in (Eq.2) and its modifications with additional variables listed in the first column. Dashed lines show 90 percent confidence intervals with Driscoll and Kraay (1998) standard errors.

**Figure A2. Robustness Analysis for the Evolution of the Coefficients – 24 month ahead inflation expectations**



The graphs show 5-year rolling window estimates of the coefficients on past inflation, exchange rate, and policy surprises for the baseline model in (Eq.2) and its modifications with additional variables listed in the first column. Dashed lines show 90 percent confidence intervals with Driscoll and Kraay (1998) standard errors.

## APPENDIX B: MEMORANDUM ITEMS

**Table B1: Partial R<sup>2</sup>s for the Covariates in the Baseline Model of Table 1  
(April 2006 - April 2019)**

	(I)	(II)
	$\pi_{i,t t+12}^e$	$\pi_{i,t t+24}^e$
$\pi_{t-1}$	0.201	0.078
$\pi_{t-1}^{MA12}$	0.110	0.049
$\pi_{t t+k}^{\text{target}}$	0.043	0.071
$MP_{i,t-1}^{\text{surprise}}$	0.002	0.003
$\Delta \text{basket}_{t-1}$	0.106	0.070
$\text{ipi}_{t-2}$	0.034	0.023
$\Delta \text{oil}_{t-1}$	0.040	0.026
Number of Observations	8207	7947

Notes: Values in column (I) and column (II) show the square of partial correlation coefficients of the corresponding variable with the 12-month ahead and 24-month ahead inflation expectations, respectively. Partial correlation coefficients measures the strength of a relationship between the corresponding variable and inflation expectations, while controlling for the effect of other variables. All the correlation coefficients are significant at 1 percent significant level.