Economics Bulletin

Volume 39, Issue 3

Modeling Consumers' Confidence and Inflation Expectations

Ashima Goyal
IGIDR

Prashant Mehul Parab
PhD Research Scholar - Indira Gandhi Institute of Development Research

Abstract

This study analyzes the socio-economic factors that influence inflation expectations of Indian households. Using Consumer Confidence Survey data we discover that inflation expectations of households depend largely on inflation perceptions, income, education of the respondents, and outlook on economy, employment and spending. Women, lower income individuals and less educated persons tend to have higher inflation expectations. Macroeconomic variables like inflation, repo rate and GDP growth rate influence inflation expectations positively. Along with these variables, inflation projections by the Reserve Bank of India play a pivotal role in influencing inflation expectations of households. A significant role of the Reserve Bank in anchoring inflation expectations via communications is visible from this analysis.

The authors would like to thanks Dr. Sudha Narayanan and Dr. Taniya Ghosh, professors at Indira Gandhi Institute of Development Research for their inputs.

Citation: Ashima Goyal and Prashant Mehul Parab, (2019) "Modeling Consumers' Confidence and Inflation Expectations", *Economics Bulletin*, Volume 39, Issue 3, pages 1817-1832

Contact: Ashima Goyal - ashima@igidr.ac.in, Prashant Mehul Parab - prashant@igidr.ac.in.

Submitted: June 20, 2019. **Published:** August 11, 2019.

1. Introduction:

Well anchored inflation expectations indicate the credibility of an inflation targeting central bank. Clear communication helps to anchor inflation expectations of economic agents. Understanding the characteristics of inflation expectations formation helps to develop appropriate communications. Survey-based inflation expectations have been analyzed in the recent macroeconomic literature to draw implications for monetary policy. Surveys across different classes of economic agents like households, professional forecasters, firms, business houses, etc. contribute to understanding perceptions and outlook of consumers and their diversity. The Consumer Confidence Survey (CCS) conducted by the Reserve Bank of India (RBI) is one such survey with rich socio-economic detail.

Household inflation perceptions and expectations are influenced by household specific characteristics like age, gender, educational qualification, income etc. of the respondent. Studies reveal that these demographic characteristics have a larger effect on how households perceive inflation (Raynard, 2008; Del Giovanne et al, 2009). Ehrmann et al (2017) discover a significant influence of consumer attitudes on inflation expectations. Apart from demographic characteristics, consumer inflation expectations also depend upon how individuals perceive current macroeconomic situations as well as their spending on various items.

The novel dataset from the CCS allows us to analyze the effect of various socio-economic characteristics and macroeconomic variables on inflation expectations and perceptions of households. Although the time series is short the rich unit level data allows these questions to be addressed, in a time period coinciding with a major policy change—the introduction of inflation targeting (IT) in India. Using ordered logit and ordered probit models, we discover a significant influence of inflation perceptions on inflation expectations. In addition other demographic characteristics have a decisive effect on inflation expectations of consumers. Women, young people, less educated persons, people with low incomes and few earning members in a family have higher inflation expectations. Differences in occupations of respondents do not significantly influence inflation expectations. Their perceptions and outlook on other macroeconomic situations as well as their own income and expenditure have a significant effect on inflation expectations. Consumers with a positive outlook for employment and on general macroeconomic conditions have lower inflation expectations. Households with a positive outlook on spending (on both essential as well as non-essential commodities) have higher inflation expectations.

Using the Inflation Expectations Survey of Households (IESH) Goyal and Parab (2019) find macroeconomic variables like food inflation, core inflation, fuel inflation, Repo rate, output gap measured using gross domestic product (GDP), petrol prices as well as inflation projections by RBI influence inflation expectations of households. We examine if similar effects hold in this dataset. Repo rate, output gap, food price inflation and RBI inflation projections are found to have a positive and significant effect on inflation expectations of households. RBI communications to households are captured using their inflation projections. These are published in newspapers and other media sources. Their significant effect on household expectations formation suggests the communications channel of monetary policy transmission is effective and can contribute to anchoring inflation expectations.

Rest of the paper is structured as follows: Section 2 gives a brief description of the data used for analysis. Section 3 deals with data and methodology. Empirical analysis is given in Section 4. Section 5 provides conclusions of the study.

2. Descriptive Statistics:

The RBI conducts a Consumer Confidence Survey since June 2010 on a quarterly basis. It covered 6 cities till June 2017, but was extended to 13 cities from September 2017. Our time period for analysis is 2015 Q1 to 2018 Q2. Every survey has around 5000 to 5500 respondents who are asked questions on household characteristics like gender of the respondent, age, occupation, educational qualification, income, number of earning members and total number of family members. They are also asked to express their views on the macroeconomic situations like general price level, inflation and employment scenario as well as their own perceptions and outlook on their income and spending.

This is a richer dataset than the IESH with respect to socio-economic characteristics of households. The dataset contains total of 72,000 respondents across time. Every quarter has around 5000 respondents, of which 52% are males. The respondents are equally divided across all the cities unlike the IESH data where four major metropolitan cities comprise around 40 percent of the total respondents. They are divided across 4 age groups namely "22-29 years", "30-39 years", "40-59 years" and "60 years & above". The first three age groups have almost 30 percent of respondents each whereas the last category has only 10 percent of the total.

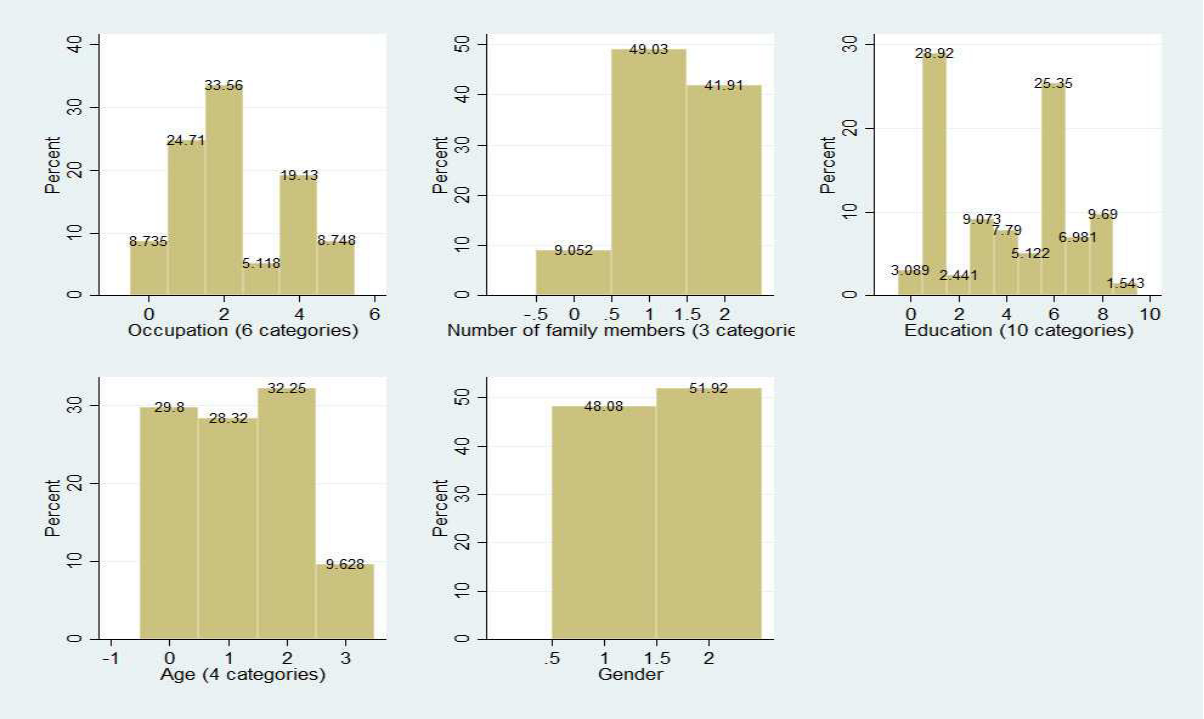
They are also divided in four categories based on their annual income: "Less than 1 Lakh", "1-3 Lakhs", "3-5 Lakhs" and "5 Lakhs and above". Almost 90 percent of the respondents belong to the first two income categories. There are 6 categories of occupation across which the respondents are classified namely "Housewife", "Self-employed", "Daily Workers", "Employed", "Unemployed" and "Retired". Housewife, Employed and Self-employed constitute a major share of respondents. Based on the number of family members, there are 3 categories namely "1-2", "3-4" and "5 or more". Almost 50 percent of households surveyed have 3 to 4 members in their family while almost 40 percent of them have 5 or more. Across respondents, there is a minimum of 1 earning member and maximum of 16.

Based on the educational qualification, there are 10 categories starting from "Illiterate" going up to "Post Graduate". Majority of the respondents lie in the "Primary Education" and "Below Graduate" categories. Responses of the remaining questions regarding perceptions (outlook) of employment, inflation, general price level, household spending and spending on essentials and non-essentials are classified into 3 namely "Increased" ("Will increase"), "Decreased" ("Will decrease") and "Remained the same" ("Remain the same").

Figure 1 gives a summary of the above classifications. In context of family members, education and age, a lower number implies that the respondents belong to the lower quantile of that category. For instance, 0 in education is assigned for illiterate, 1 for primary education and so on. In context of gender, value 0 is assigned to women and 1 to men. The values assigned for occupation are: 0- Daily workers, 1- Employed, 2- Housewife, 3- Retired persons/Pensioners, 4-Self-employed and 5- Unemployed. Almost 79 percent of the respondents believe that the inflation perceptions (expectations) increased (will increase). Across gender this bifurcation is 77 percent for males and 81 percent for females. A greater percentage of respondents belonging to lower income category have higher inflation perceptions (expectations). Inflation perceptions (expectations) are more or less similar across the occupational categories but a greater percentage of daily workers perceive (expect) higher inflation whereas this percentage is the lowest for the self-employed category.[1]

[1] Figures A1 to A6 in the Appendix give a graphical representation of the descriptive statistics.

Figure 1- Classification of respondents based on demographic characteristics



Source: Consumer Confidence Surveys, RBI

Coming to the employment scenario, almost equal percentage of respondents believe that the employment has worsened, improved and remained the same, whereas when it comes to expectations, more than 50 percent of them believe that there would be an improvement in the employment scenario. Similar situation is observed in the case of perceptions and outlook on general macroeconomic conditions. Though equal percentage of consumers perceive macroeconomic conditions to have worsened, improved and remained the same; more than 50 percent respondents expect the conditions to improve. With regards to the household spending, almost 80 percent of the respondents perceive (expect) the spending to have increased (to increase). Classifying spending based on essentials and non-essentials gives a better picture where almost 83 percent of respondents perceive (expect) an increase in the essential spending whereas this number is only 50 percent for non-essential commodities.

3. Data and Methodology:

Apart from the unit level CCS data available from March 2015, this study also uses macroeconomic controls namely headline inflation, food inflation, fuel price inflation and core inflation (all estimated using the new Consumer Price Index-Combined {base 2012}), Repo rate, output gap, petrol prices and inflation projections by the RBI. Variables are described in Table I. Section 2 has a detailed discussion of the CCS data.

Table I – Variables used for analysis

Variables	Description	Source
INF_PER	Inflation perceptions of households – 3 ordinal responses ("Increase", "Decrease" & "Remain the same")	CCS
INF_EXP	Inflation expectations of households – 3 ordinal responses ("Increase", "Decrease" & "Remain the same")	CCS
CPI_C	Inflation measured using All India Consumer Price Index Combined	RBI DBIE
CPI_FOOD	Food Inflation measured using All India Consumer Price Index Combined	RBI DBIE
CPI_FUEL	Fuel Inflation measured using All India Consumer Price Index Combined	RBI DBIE
CPI_CORE	Core Inflation measured using All India Consumer Price Index Combined	RBI DBIE, Authors' calculations
PETROL_CHG	Year-on-year growth rate of petrol prices. Combined petrol prices are obtained using Principal Component Analysis	PPAC, Authors' calculations
REPO	Repo rate given by the RBI	RBI HBS
HP_GDP	Output gap measured using Hodrick Prescott Filter	CSO, Authors' calculations
RBI_PROJ	Annual inflation projections by RBI, obtained in bi-monthly monetary policy speeches	RBI

Since the dependent variable is ordinal, this study uses ordered response models. Ordered logit models are preferred based on maximum log likelihood. The analysis is conducted using inflation perceptions (expectations) and price perceptions (expectations). Y_{jt}^{*} is the latent variable of interest (inflation expectations) for every individual 'j' at time 't'. y_{jt} is the observed variable which takes 'm' ordinal values (m = 0, 1, 2). The econometric specification of the models is given in equations (1) to (5).

$$Y_{jt}^{*} = X_{jti}'\beta_i + DEM_{jtk}'\mu_k + Z_{jtl}'\gamma_l + \varepsilon_{jt} \quad (1)$$

$$y_{jt} = \begin{cases} 0 \; if E(\pi_{j,t+1|t}) < \pi_t \\ 1 \; if \; E(\pi_{j,t+1|t}) = \pi_t \\ 2 \; if \; E(\pi_{j,t+1|t}) > \pi_t \end{cases} \quad (2)$$

Where $P(y_{jt} = 0) = P(\varepsilon_{jt} \leq -\{X_{jti}'\beta_i + DEM_{jtk}'\mu_k + Z_{jtl}'\gamma_l\})$ (3)

$$P(y_{jt} = 1) = P(\varepsilon_{jt} \leq \alpha_1 - \{X_{jti}'\beta_i + DEM_{jtk}'\mu_k + Z_{jtl}'\gamma_l\}) - P(\varepsilon_{jt} \leq -\{X_{jti}'\beta_i + DEM_{jtk}'\mu_k + Z_{jtl}'\gamma_l\}) \quad (4)$$

$$P(y_{jt} = 2) = P(\varepsilon_{jt} \leq \alpha_2 - \{X_{jti}'\beta_i + DEM_{jtk}'\mu_k + Z_{jtl}'\gamma_l\}) - P(\varepsilon_{jt} \leq \alpha_1 - \{X_{jti}'\beta_i + DEM_{jtk}'\mu_k + Z_{jtl}'\gamma_l\}) \quad (5)$$

The probability equations in case of logit and probit are logistic and normal functions respectively. The observed dependent variable y_{jt} assumes values 0, 1 and 2 when inflation expectations decrease, remain the same and increase respectively. α_1, α_2 determine the cut points that divide the probability. For instance, if α_1 = -2.00, the model assumes that households will expect inflation to decrease for all the values of the latent variable below -2.00. If α_2 = -0.65, then households expect inflation to remain the same for all the values of the latent variable between -2.00 and -0.65. Households will expect inflation to increase for all the values of latent variable above -0.65. Z_{jtl} is a matrix of macroeconomic controls namely CPI-C inflation, GDP growth rate and Repo rate. X_{jti} is a matrix of cardinal

responses of the households with regards to the macroeconomic conditions like general economic conditions, employment and inflation perceptions as well as their outlook on their own income and spending (essential and non-essential commodities). DEM_{jtk} includes all the demographic characteristics like age, education, gender, number of earning members in a family, occupation of the respondent and income bracket they belong to. The values of $\beta_i's, \mu_k's \; and \; \gamma_l's$ do not give a direct effect of the explanatory and control variables on inflation expectations. Direct impact is obtained using marginal effects for every response of y_{jt}.

The marginal effect of a particular variable on Y_{jt}^* is obtained using equation (6):

$$\frac{\partial Y_{jt}^*(y_{jt}=m|x_i)}{\partial x_i} = \left[f\left(y_{jt}=m-1\right) - f\left(y_{jt}=m\right)\right]\beta_i \quad (6)$$

where f (.) is a probability density function of 'Y_{jt}^*' which follows logistic distribution in case of a logit model and normal distribution in case of a probit model. 'm' denotes different values taken by the observed dependent variable (0, 1 and 2 for our analysis).

For instance, when considering an ordered probit model, we get

$$\frac{\partial Y_{jt}^*(y_{jt}=1|x_i)}{\partial x_i} = \left[\phi(\varepsilon_{jt} \leq \alpha_1 - \{X_{jti}'\beta_i + DEM_{jtk}'\mu_k + Z_{jtl}'\gamma_l\}) - \phi(\varepsilon_{jt} \leq -\{X_{jti}'\beta_i + DEM_{jtk}'\mu_k + Z_{jtl}'\gamma_l\})\right]\beta_i \quad (7)$$

This gives the probability that the response y_{jt} is equal to one after an infinitesimal change in the x_i variable.

4. Empirical Analysis:

In earlier analysis on household inflation expectations (Goyal and Parab, 2019), some key findings are: (1) Inflation expectations are adaptive or naïve (2) Long run influence of core inflation on inflation expectations is greater than that of food inflation (3) Households do not overreact to new information in the short run (4) RBI plays a crucial role in influencing households expectations through communication. Now we further test the validity of these findings using CCS data and ordered logit models selected on the basis of maximum log likelihood. Inflation expectations - the dependent variable, takes ordinal values- 0 for "Decrease", 1 for "Remain the same" and 2 for "Increase".

Analysis of demographic characteristics shows that females have higher inflation expectations than their male counterparts. Inflation expectations tend to be lower with higher age, education, income and number of earning members. This is in line with the literature for a majority of European nations. With regards to the overall macroeconomic situations, inflation expectations are negatively related to the outlook on general economic conditions and employment scenario. With a positive outlook for both the above variables, households expect inflation to decline in the future. The result with regard to household spending is positive. An anticipated increase in spending (on both essentials and non-essentials) increases the inflation expectations of households. Higher inflation, Repo rate and a positive output gap are associated with higher inflation expectations of households. These results point to the significance of consumers' attitudes regarding the economy during inflation expectation formation. Occupation does not have any significant influence on inflation expectations. Incorporation of inflation perceptions in the analysis renders the effect of number of earning members in the family and outlook of income on the expectations insignificant.

The literature posits that inflation perceptions are an important driver of inflation expectations (Benford and Driver, 2008; Easaw et al, 2013). We test for the role of inflation perceptions in influencing inflation expectations of households. As a robustness check, to see whether households are able to clearly distinguish between price perceptions and inflation perceptions, we run the same regressions with price perceptions as one of the explanatory variables instead of inflation perceptions (Table II – Column 3). The results show that in line with the literature, inflation perceptions play a significant role in influencing inflation expectations of consumers. Pseudo R-squared value increases from 0.02 to 0.2 indicating the significance of inflation perceptions. The high and positive coefficient indicates greater importance given to price perceptions while forming expectations. However, there is a minimal change observed in Pseudo R-squared. Consumers thus are able to distinguish between prices in general and inflation. This forms a robustness check suggesting that the questionnaire is well framed. We have incorporated time dummies for the analyses in Table II to control for structural changes over time. Columns 4-6 estimate the same equations controlling for time. The variables in these equations vary across individuals as well as time. Hence, controlling for time adds to the robustness of the analysis.

Table II – Determinants of inflation expectations

DEPENDENT VARIABLE: INFLATION EXPECTATIONS						
VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
INF_PERCEPTIONS		1.95***			1.89***	
		(0.02)			(0.02)	
PRICE PERCEPTIONS			0.72***			0.72***
			(0.02)			(0.03)
AGE	-0.02**	-0.03**	-0.03**	-0.02**	-0.03**	-0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
GENDER	-0.11***	-0.03	-0.09***	-0.09***	-0.03	-0.06***
	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)
INCOME	-0.08***	-0.05***	-0.07***	-0.13***	-0.08***	-0.13***
	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
EDUCATION	-0.03***	-0.02***	-0.03***	-0.01***	-0.01**	-0.01***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)
EARNING MEMBERS	-0.03***	-0.02	-0.03**	-0.02**	-0.02	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
OCCUPATION	-0.00	-0.01	-0.00	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
ECONOMIC OUTLOOK	-0.06***	-0.03*	-0.04***	-0.05***	-0.03*	-0.03**
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
INCOME OUTLOOK	0.03*	0.02	0.03**	0.02	0.01	0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
ESSENTIAL SPENDING	0.45***	0.37***	0.39***	0.44***	0.37***	0.38***
	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)
NON-ESSENTIAL SPENDING	0.20***	0.14***	0.19***	0.29***	0.19***	0.28***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
EMPLOYMENT OUTLOOK	-0.07***	-0.05***	-0.06***	-0.08***	-0.06***	-0.07***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
α1	-2.00***	0.54***	-0.74***	-2.33***	0.12	-1.07***
	(0.06)	(0.08)	(0.08)	(0.07)	(0.09)	(0.09)
α2	-0.65***	2.34***	0.63***	-0.95***	1.94***	0.33***
	(0.06)	(0.08)	(0.08)	(0.07)	(0.10)	(0.09)
R-Squared	0.02	0.2	0.03	0.02	0.2	0.03

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Authors' calculations

Next we introduce macroeconomic variables. One of the primary goals of this study is to test for the importance of central bank communications in influencing inflation expectations of households. This is captured by the inflation projections made by the RBI during every monetary policy meeting. RBI projections can be expected to play an important role in influencing inflation expectations, especially in an emerging economy like India where news is thin and people depend more on official sources while forming expectations.

Table A.I in the Appendix presents results of regressing inflation expectations on disaggregated macroeconomic indicators along with demographic characteristics. The additional variables are food inflation (CPI_FOOD), core inflation (CPI_CORE), fuel inflation (CPI_FUEL), RBI inflation projections (RBI_PROJ), Repo rate (REPO) and output gap (HP_GDP). Petrol prices (year-on-year – PETROL_CHG) and fuel prices (CPI_FUEL) are used interchangeably for robustness. Time dummies cannot be used for these estimations as the macroeconomic variables vary only over time. Use of time dummies creates problems of multi-collinearity.

Headline CPI inflation has an insignificant effect on inflation expectations. On breaking it into its disaggregate components, however, food inflation and fuel prices have a significant positive effect on inflation expectations. Petrol prices also positively influence inflation expectations. These positive effects are nullified by a negative impact of core inflation on inflation expectations. In Goyal and Parab (2019) contemporaneous effect of core inflation on inflation expectations is found to be subdued and on the negative side, but it has a positive and significant lagged effect. Repo rate and output gap have a positive and significant effect on inflation expectations. These results are similar to Goyal and Parab (2019). A positive influence of Repo rate indicates a price puzzle. In the context of the survey data it suggests that households view an interest rate hike as an increase in the cost of interest payments on loans.

The variable signifying communications, RBI projections, has a negative effect on inflation expectations in contradiction to the theory. This could be due to high multi-collinearity between the explanatory variables, especially RBI projections, Repo rate and output gap. The Repo rate can be expected to rise with RBI projections and the output gap. To tackle this issue we regress Repo rate and output gap individually on RBI projections and obtain residuals. Since residuals are uncorrelated with RBI projections, using them as explanatory variables resolves the multi-collinearity. Table A.II in the Appendix gives the results using these residual variables.

Inflation perceptions also tend to be influenced by other explanatory variables. We deal with this problem also on similar lines. Regressing inflation perceptions on the other explanatory variables gives residuals, which are then used as explanatory variables in place of inflation perceptions. Table III gives final results with all these corrections. After controlling for all these multi-collinearity issues, we obtain a positive and significant influence of RBI projections on inflation expectations. The influence of headline inflation on inflation expectations also becomes positive and significant. The coefficients of all the residual variables are higher. The price puzzle of a positive Repo coefficient persists, however.

The influence of some of the demographic characteristics like age, gender, income, education, etc. is significant but magnitudes are low. The introduction of macroeconomic variables does not, however, reduce the coefficients of socio-demographic variables, although macroeconomic variables tend to have a higher effect. The findings support Goyal and Parab

(2019) results on the importance of macroeconomic factors in influencing inflation expectations.

Table III – Determinants of inflation expectations (adjusted for multi-collinearity)

DEPENDENT VARIABLE: INFLATION EXPECTATIONS			
VARIABLES	**(1)**	**(2)**	**(3)**
INF PER_RESIDUALS	1.92***	1.91***	1.92***
	(0.02)	(0.02)	(0.02)
AGE	-0.04***	-0.03***	-0.03***
	(0.01)	(0.01)	(0.01)
GENDER	-0.08***	-0.08***	-0.08***
	(0.03)	(0.03)	(0.03)
INCOME	-0.12***	-0.12***	-0.12***
	(0.02)	(0.02)	(0.02)
EDUCATION	-0.02***	-0.02***	-0.02***
	(0.01)	(0.01)	(0.01)
EARNING MEMBERS	-0.03*	-0.03*	-0.03*
	(0.01)	(0.01)	(0.01)
OCCUPATION	-0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.01)
ECONOMIC OUTLOOK	-0.07***	-0.07***	-0.07***
	(0.02)	(0.02)	(0.02)
INCOME OUTLOOK	0.03	0.03	0.03
	(0.02)	(0.02)	(0.02)
ESSENTIAL SPENDING	0.52***	0.52***	0.53***
	(0.03)	(0.03)	(0.03)
NON-ESSENTIAL SPENDING	0.27***	0.27***	0.27***
	(0.02)	(0.02)	(0.02)
EMPLOYMENT OUTLOOK	-0.08***	-0.09***	-0.08***
	(0.02)	(0.02)	(0.02)
CPI_C	0.07***		
	(0.02)		
CPI_FOOD		0.03***	0.03***
		(0.01)	(0.01)
CPI_CORE		-0.06***	-0.09***
		(0.02)	(0.02)
CPI_FUEL		0.04***	
		(0.01)	
PETROL_CHG			0.01***
			(0.00)
RBI_PROJ	0.18***	0.13***	0.22***
	(0.02)	(0.02)	(0.03)
REPO_RBI_RESIDUALS	1.49***	1.46***	1.49***
	(0.08)	(0.08)	(0.09)
HP_GDP_RBI_RESIDUALS	0.59***	0.57***	0.53***
	(0.05)	(0.05)	(0.05)
α1	-1.34***	-1.82***	-1.71***
	(0.11)	(0.15)	(0.15)
α2	0.47***	-0.01	0.10
	(0.11)	(0.15)	(0.15)
R-Squared	0.3	0.3	0.3

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Authors' calculations

4.1 Robustness:

Omitted variable bias is an important issue usually observed with panel or repeated cross section data. There can be many time variant factors that influence the dependent variable as well as the key explanatory variables, biasing other estimated effects. This issue can be examined using the techniques of Altonji et al (2005), Oster (2019) and Mukhopadhyay et al (2016), as explained below:

$$Y = \alpha + \beta X + \delta Z + U \quad (8)$$

Where X is the variable of interest, Z consists of other explanatory variables and U is the vector of unobserved components. The presence of U in equation (8) can lead to biased estimated of β. This bias can be estimated using the following representation:

$$\frac{Cov\ (X,U)}{Var\ (U)} = \gamma \frac{Cov\ (X,\delta Z)}{Var\ (\delta Z)} \tag{9}$$

The relation between X and the explanatory variables is proportional to the relationship between X and the error components by a factor of proportionality termed γ. This technique helps to attain a consistent estimate for the effect of X on the dependent variable. In our case, X is denoted by RBI projections, Z is a matrix of all other explanatory variables. A consistent estimator of β can be obtained using γ and R_{max}. Here, R_{max} is the maximum R-squared that can be achieved by the model in a hypothetical scenario where all the explanatory variables, observed and unobserved are included. Since it is extremely difficult to incorporate all possible explanatory variables, we obtain R_{max} by incorporating time and cross sectional dummies. Our analysis is based on a repeated cross section, implying that every variable in the sample is unique. So R_{max} is obtained using only time dummies and the variable of interest. R_{max} obtained for our regression is 0.31.

We make an assumption stating that the observable variables are at least as important as the omitted variables. Following Altonji et al (2005) and Mukhopadhyay and Saha (2016), we estimate the values of β for γ ϵ [-1, 1]; γ = 1 (γ = -1) implies that the effect of observables is in the same direction (opposite direction) as compared to the omitted variables. If | γ |>1 then the effect of omitted variables on β is higher than that of explanatory variables; the relative effect of omitted variables on β is so large that it renders β = 0. A large value of γ suggests that the effect of omitted variables is so high that it renders the joint influence of all the explanatory variables zero. This is an unlikely situation and hence suggests an omitted variable bias does not exist. If | γ |<1, there would be a chance that we might have missed out upon some variable that explains the dependent variable. These results are provided in Table IV.

Table IV – Test for potential omitted variable bias

	(1)	(2)	(3)	(4)
	Uncontrolled (R^2)	Controlled (R^2)	Identified (Estimated bias in parentheses)	
			R_{max}=0.31	
			β for γ ϵ [-1, 1]	γ for β=0
RBI_PROJ	0.038	0.049	[0.039, 0.057]	21.06
	(0.003)	(0.304)	(0.0000006)	
INFLATION PERCEPTIONS	0.526	0.527	[0.516,0.539]	14.44
	(0.28)	(0.304)	(0.000000001)	
CPI_C	0.04	0.02	[0.015,0.026]	28.51
	(0.003)	(0.304)	(0.00000004)	
REPO	0.15	0.33	[0.30,0.36]	-298.46
	(0.003)	(0.304)	(0.0000506)	

Source: Authors' calculations

We have estimated β and γ values individually for RBI projections, inflation perceptions, CPI inflation and Repo rate. All the variables display a sharp rise in controlled R-squared. All the estimated variables (Column 2) lay within the confidence band (Column 3) of the actual estimates of β. Estimated biases given in parentheses in Column 3 are small in size. Most

important result is presented in Column 4 which gives values of γ to make $\beta = 0$. For instance, omitted variables need 21.06 times higher the joint effect of all the explanatory variables to render the coefficient of RBI projections to zero. A similar story follows with other variables. This suggests omitted variables are not a problem, adding to the robustness of our results.

5. Conclusion:

Goyal and Parab (2019) discover an important role played by RBI communications in guiding household inflation expectations. This study obtains a similar result using the CCS dataset, suggesting the result is robust. When people are uncertain about the price level in the economy, they tend to anchor their inflation expectations to the data published in newspapers or any information from TV news or other media, which in an economy like India is heavily influenced by official sources. RBI inflation projections are one such source. A positive and significant coefficient of RBI projections implies RBI communication has been successful in affecting inflation expectations of households during a low inflation regime.

Among other results, we find inflation perceptions have a large effect on inflation expectations. Income of the respondent, education level and their outlook on economic conditions in general, employment and spending on both essential and non-essential commodities also display a significant influence on inflation expectations. In line with the literature, women, young people, less educated persons and lower income individuals have higher inflation expectations. Individuals who expect economic conditions and employment situation to worsen have higher inflation expectations. Individuals with higher spending outlook expect higher inflation in the future. A positive attitude towards future economic outlook in the form of lower unemployment and higher income leads to lower inflation expectations.

Repo rate and output gap have a consistent positive effect on inflation expectations. Households expect inflation to be pro-cyclical with the business cycle. A booming economy would lead to increase in the costs of living. A positive influence of Repo rate on inflation expectations is also obtained by Goyal and Parab (2019). It implies that consumers may be looking at changes in policy rate from the cost of borrowing perspective. An interest rate hike would possibly increase the cost of borrowings and interest payments. As a result, households would expect an increase in inflation. This price puzzle persists even after controlling for possible multi-collinearity. Robustness exercises suggest the absence of any omitted variable bias, strengthening the findings.

This study brings out the influence of central bank communications on inflation expectations. RBI inflation projections are an important part of its communication. Our analysis reveals that inflation projections play a significant role in influencing inflation expectations formation of households. Although the period of analysis is restricted to 2015Q1 to 2018Q2 due to data availability, use of unit level data allows robust analysis. Since this period coincides with the new flexible inflation targeting regime, our study supports the notion that inflation expectations can be well anchored if RBI communicates clearly. It must, however, also give weight to growth since a rise in the Repo rate, as well as lower growth, is found to raise household inflation expectations.

References

Altonji, J. G., Elder, T. E., and Taber, C. R. (2005). Selection on Observed and Unobserved variables: Assessing the Effectiveness of Catholic Schools. *Journal of Political Economy,* 113 (1), 151-184.

Benford, J., and Driver, R. (2008). Public Attitudes to Inflation and Interest Rates. *Bank of England, Quarterly Bulletin*. Q2, 148-156.

Del Giovanne, P., Fabiani, S., and Sabbatini, R. (2009). What's Behind "Inflation Perceptions"? A Survey-Based Analysis of Italian Cconsumers' Expectations. *Giornale degli Economisti e Annali di Economia*, 25-52.

Easaw, J., Golinelli, R., and Malgarini, M. (2013). What Determines Households Inflation Expectations? Theory and Evidence from Household surveys. *European Economic Review*, 61, 1-13. July.

Ehrmann, M., Pfajfar, D., and Santoro, E. (2017). Consumer Attitudes and Their Inflation Expectations. *International Journal of Central Banking*, 13 (1), 225-259. February.

Goyal, A., and Parab, P. (2019). Modeling Heterogeneity and Rationality of Inflation Eexpectations Across Indian Households. *Indira Gandhi Institute of Development Research, Working Paper* no. WP-2019-002.

Mukhopadhyay, A., and Saha, S. (2016). Does Access to Secondary Education Affect Primary Schooling? Evidence from India. *Economics of Education Review*, 54, 124-142. October.

Oster, E. (2019). Unobservable Selection and Coefficient Stability: Theory and Evidence. *Journal of Business & Economic Statistics*. 37 (2), 187-204.

Raynard, R., Del Missier, F., Bonini, N., Duxbury, D., and Summers, B. (2008). Perceptions and Expectations of Price Changes and Inflation: A Review and Conceptual Framework. *Journal of Economic Psychology*, 29 (4), 378-400. August.

RBI. (2010). Inflation Expectations Survey of Households. *RBI Monthly Bulletin*. May.

Appendix:

Figure A1– Inflation expectations and perceptions based on gender

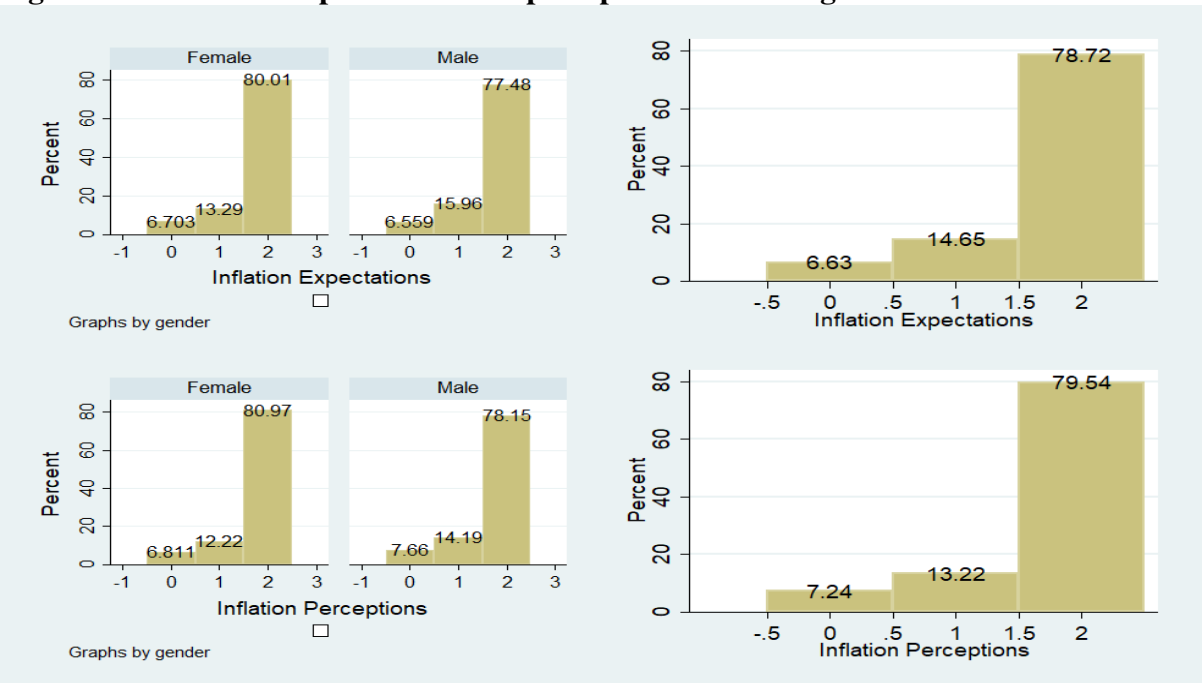


Figure A2 – Inflation expectations based on occupation

Figure A3 – Inflation expectations and perceptions based on income

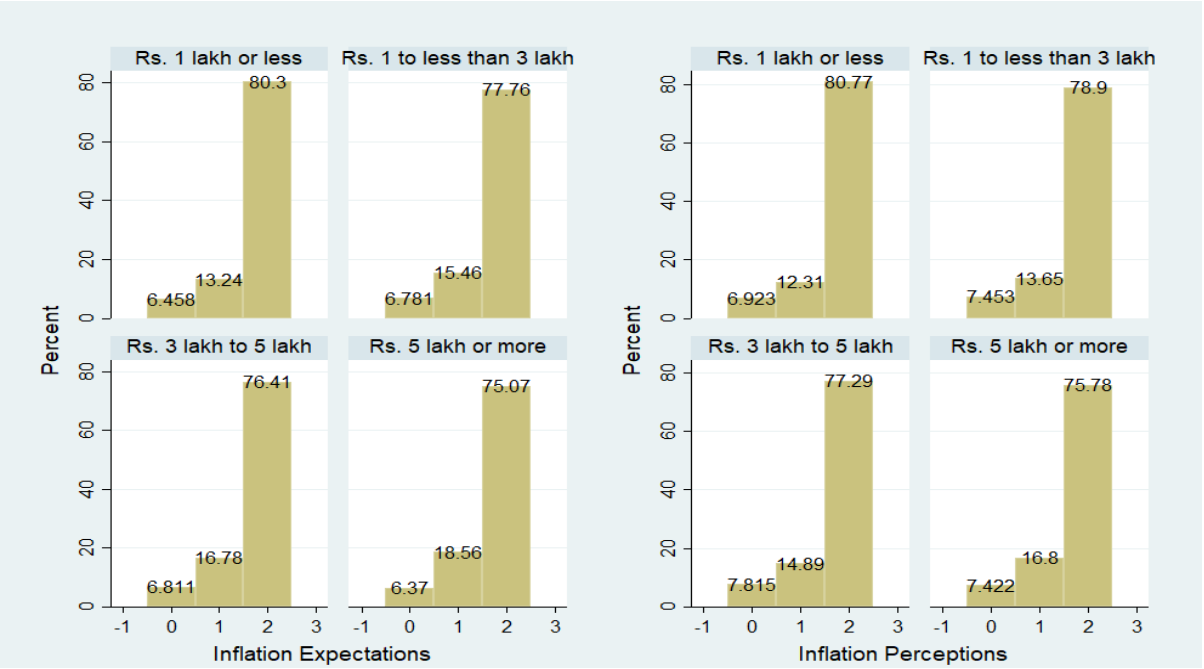


Figure A4 – Perceptions and outlook on spending

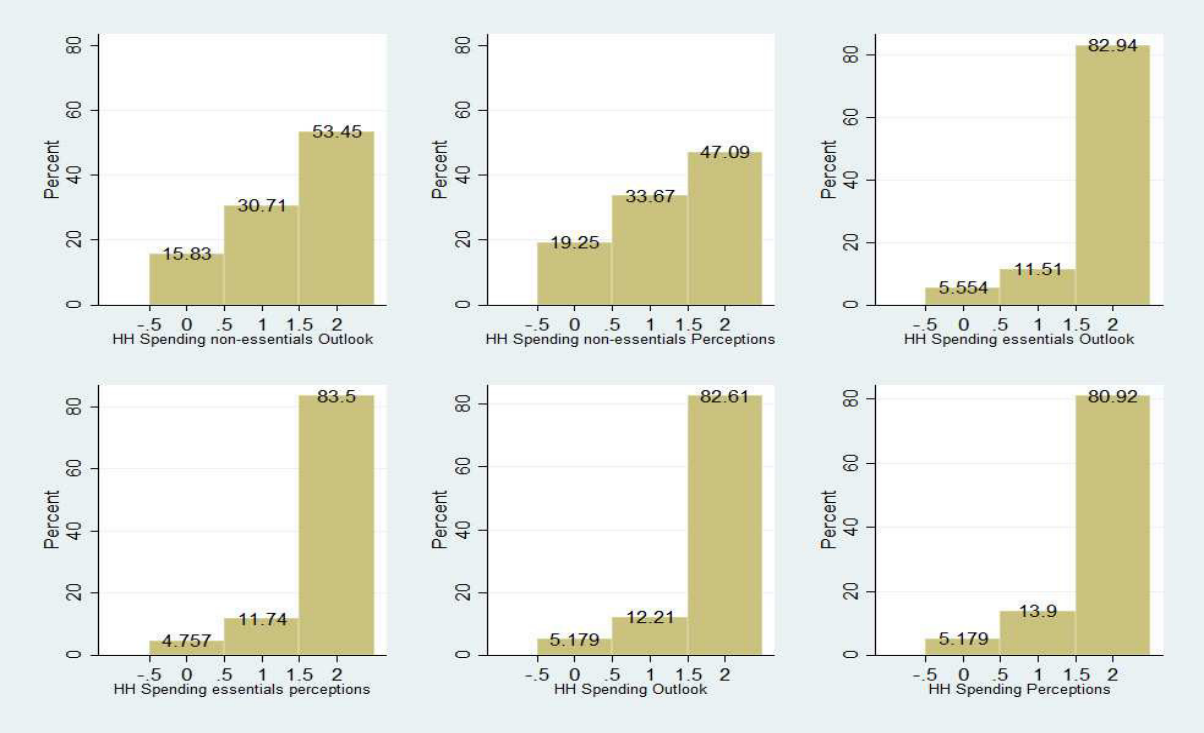


Figure A5 – Perceptions and outlook on employment

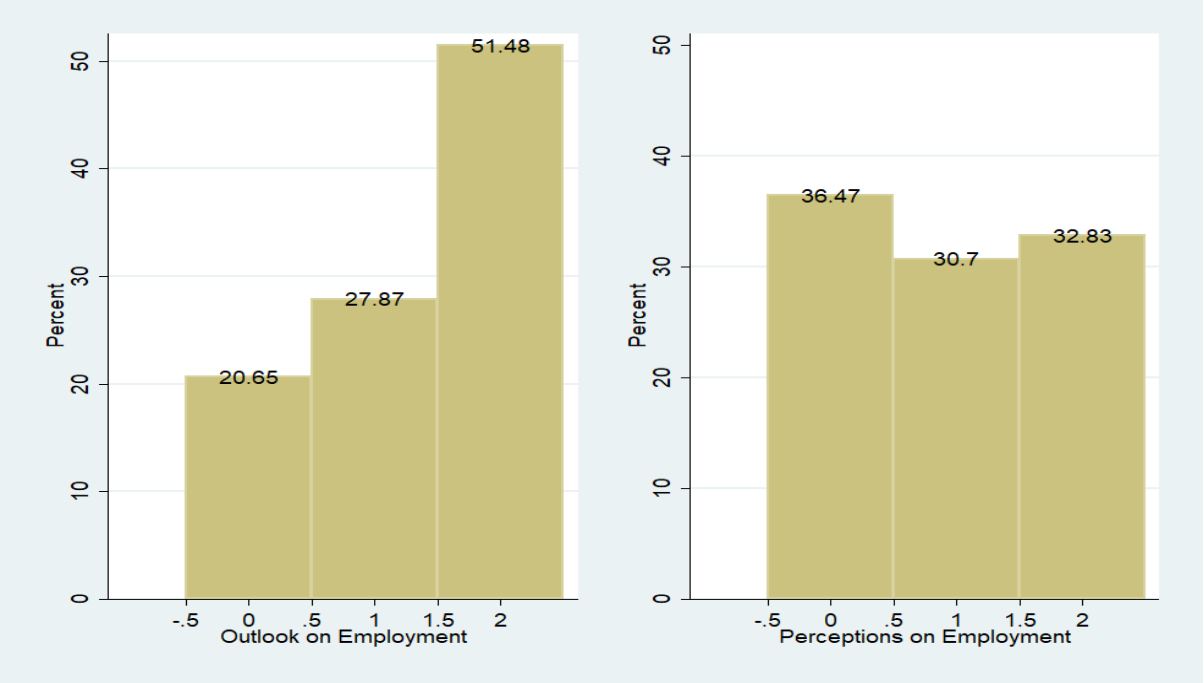
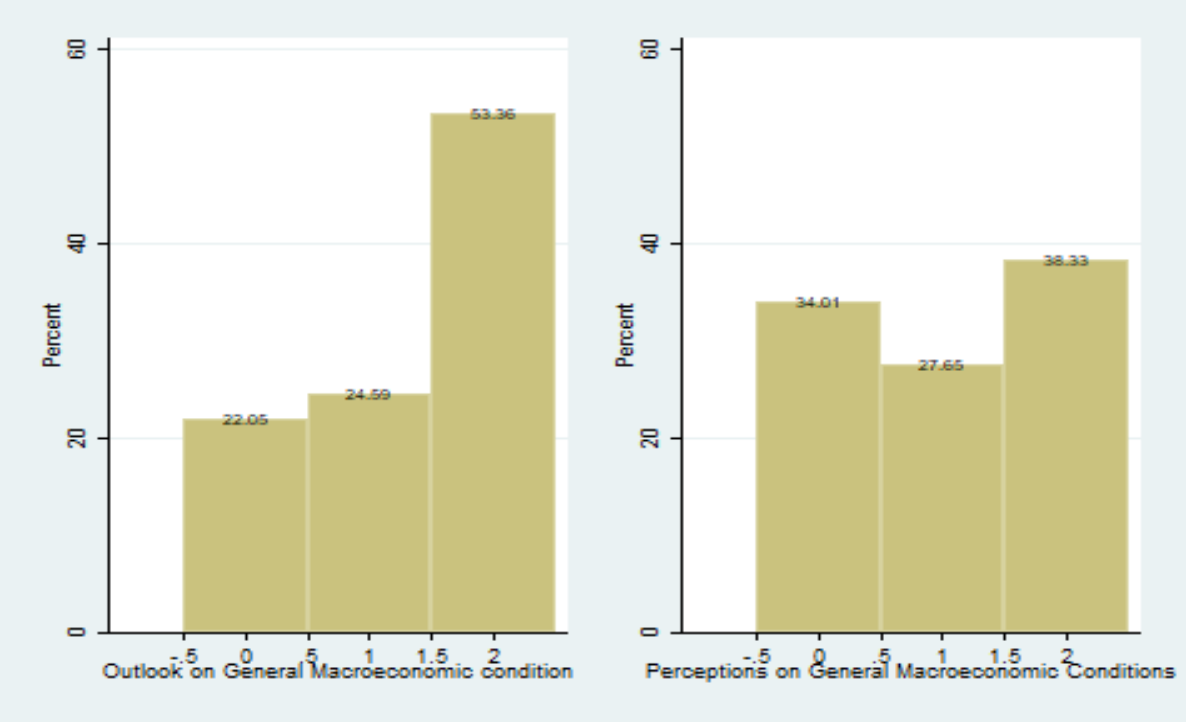


Figure A6 – Perceptions and outlook on general macroeconomic conditions



Source: Consumer Confidence Surveys, RBI

Table A.I – Determinants of inflation expectations

DEPENDENT VARIABLE: INFLATION EXPECTATIONS			
VARIABLES	**(1)**	**(2)**	**(3)**
INFLATION PERCEPTIONS	1.92***	1.91***	1.91***
	(0.02)	(0.02)	(0.02)
AGE	-0.03**	-0.03**	-0.03**
	(0.01)	(0.01)	(0.01)
GENDER	-0.03	-0.03	-0.03
	(0.03)	(0.03)	(0.03)
INCOME	-0.08***	-0.08***	-0.08***
	(0.02)	(0.02)	(0.02)
EDUCATION	-0.01***	-0.01***	-0.01***
	(0.01)	(0.01)	(0.01)
EARNING MEMBERS	-0.02	-0.02	-0.02
	(0.01)	(0.01)	(0.01)
OCCUPATION	-0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.01)
ECONOMIC OUTLOOK	-0.04**	-0.04**	-0.04**
	(0.02)	(0.02)	(0.02)
INCOME OUTLOOK	0.01	0.01	0.01
	(0.02)	(0.02)	(0.02)
ESSENTIAL SPENDING	0.37***	0.37***	0.37***
	(0.03)	(0.03)	(0.03)
NON-ESSENTIAL SPENDING	0.17***	0.18***	0.18***
	(0.02)	(0.02)	(0.02)
EMPLOYMENT OUTLOOK	-0.06***	-0.06***	-0.06***
	(0.02)	(0.02)	(0.02)
CPI_C	0.00		
	(0.02)		
CPI_FOOD		0.01*	0.01
		(0.01)	(0.01)
CPI_CORE		-0.10***	-0.13***
		(0.02)	(0.02)
CPI_FUEL		0.04***	
		(0.01)	
PETROL_CHG			0.01***
			(0.00)
RBI_PROJ	-0.08***	-0.12***	-0.06*
	(0.03)	(0.03)	(0.03)
REPO	0.80***	0.76***	0.79***
	(0.08)	(0.08)	(0.09)
HP_GDP	0.36***	0.33***	0.30***
	(0.05)	(0.05)	(0.05)
α1	5.34***	4.62***	4.85***
	(0.45)	(0.48)	(0.49)
α2	7.15***	6.43***	6.66***
	(0.45)	(0.48)	(0.49)
R-Squared	0.3	0.3	0.3

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Authors' calculations

Table A.II– Determinants of inflation expectations (with Repo and output gap residuals)

DEPENDENT VARIABLE: INFLATION EXPECTATIONS			
VARIABLES	**(1)**	**(2)**	**(3)**
INFLATION PERCEPTIONS	1.92***	1.91***	1.91***
	(0.02)	(0.02)	(0.02)
AGE	-0.03**	-0.03**	-0.03**
	(0.01)	(0.01)	(0.01)
GENDER	-0.03	-0.03	-0.03
	(0.03)	(0.03)	(0.03)
INCOME	-0.08***	-0.08***	-0.08***
	(0.02)	(0.02)	(0.02)
EDUCATION	-0.01***	-0.01***	-0.01***
	(0.01)	(0.01)	(0.01)
EARNING MEMBERS	-0.02	-0.02	-0.02
	(0.01)	(0.01)	(0.01)
OCCUPATION	-0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.01)
ECONOMIC OUTLOOK	-0.04**	-0.04**	-0.04**
	(0.02)	(0.02)	(0.02)
INCOME OUTLOOK	0.01	0.01	0.01
	(0.02)	(0.02)	(0.02)
ESSENTIAL SPENDING	0.37***	0.37***	0.37***
	(0.03)	(0.03)	(0.03)
NON-ESSENTIAL SPENDING	0.17***	0.18***	0.18***
	(0.02)	(0.02)	(0.02)
EMPLOYMENT OUTLOOK	-0.06***	-0.06***	-0.06***
	(0.02)	(0.02)	(0.02)
CPI_C	0.00		
	(0.02)		
CPI_FOOD		0.01*	0.01
		(0.01)	(0.01)
CPI_CORE		-0.10***	-0.13***
		(0.02)	(0.02)
CPI_FUEL		0.04***	
		(0.01)	
PETROL_CHG			0.01***
			(0.00)
RBI_PROJ	0.14***	0.08***	0.16***
	(0.02)	(0.02)	(0.03)
REPO_RBI_RESIDUALS	0.80***	0.76***	0.79***
	(0.08)	(0.08)	(0.09)
HP_GDP_RBI_RESIDUALS	0.36***	0.33***	0.30***
	(0.05)	(0.05)	(0.05)
α1	1.21***	0.72***	0.83***
	(0.11)	(0.15)	(0.15)
α2	3.02***	2.53***	2.64***
	(0.11)	(0.15)	(0.16)
R-Squared	0.3	0.3	0.3

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Authors' calculations