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Households' Inflation Perceptions and Expectations: Survey Evidence from New Zealand

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Households' Inflation Perceptions and Expectations: Survey Evidence from New Zealand*

Abstract

In this paper, we study how inflation is viewed by the general population of New Zealand. Based on unique representative survey data collected in 2016 and using descriptive statistics and multivariate regressions, we explore various aspects of how laypersons perceive inflation and form inflation expectations. We focus on how an individual's economic situation, information search and interest in inflation, economic knowledge, and attitudes and values are related to inflation perception and expectation, as well as the individual's reaction to them. We interpret our findings as a clear indication that laypersons' knowledge about inflation is much better described by the imperfect information view prevailing in social psychology than by the rational actor view typically assumed in economics.

JEL code: E52, E58, Z1.
Keywords: Inflation perception, inflation expectation, New Zealand, monetary policy, household survey.

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1. Introduction

In macroeconomics and financial economics, inflation is perceived as playing an important role in saving and spending decisions and studying this role is a lively field of research. However, most of the extant economics literature focuses on how inflation is viewed by professional observers, such as financial market participants. Findings from this literature frequently are generalised to nonprofessional economic actors, particularly consumers. For instance, rational expectation formation can rarely be rejected using financial data (see, e.g., Capistran and Timmermann 2009) and it is then often assumed to hold for private households, too. However, standing in the shadow of this dominating approach in mainstream economics is a small, but active, strand of research that explicitly investigates how inflation is viewed by laypersons. Researchers working in this domain address fundamental questions such as whether and how laypersons actually know about price changes, whether their perception of the inflation rate is confounded by other variables, for example, income, or how they store information about past prices in their long-term memories. This alternative stream of research is interdisciplinary in that relevant work can also be found in the fields of psychology, marketing, learning and information processing, and media studies.

Instead of providing a systematic survey of the relevant literature, we direct the interested reader to two special issues of the *Journal of Economic Psychology*, the first of which was published in the mid-1980s and the second roughly 20 years later. Wärneryd's (1986) description of the findings from the seven papers in the earlier special issue, as well as his summary of them and the conclusions he draws, leave little doubt that there was a large gap between the way economists thought about inflation compared to the way psychologists viewed it. In contrast, the four papers in the later special issue, briefly summarised by Ranyard (2008), suggest that the field has converged over time, with authors from different fields becoming more open to research conducted outside their usual area of expertise.

Based on the discussion in these survey papers and considering various aspects from the broader interdisciplinary literature, we study perceptions and expectations about inflation using unique representative survey data collected about the New Zealand population in 2016. On the one hand, our investigation is explicitly explorative, as we believe that having a better sense of the patterns present in household data is an important undertaking by itself. Using descriptive statistics and data mining, we highlight notable associations in our dataset and uncover potentially interesting relationships. Since our data are exceptionally detailed in terms of the dimensions covered, such as (i) economic situation, (ii) objective and subjective economic knowledge, (iii) institutional and general trust, (iv) interest in and information search on monetary policy, (v) attitudes towards politicians and government, and (vi) socio-demographic and psychological variables, we believe this to be a useful undertaking.

On the other hand, we empirically test some of the hypotheses put forward in the extant literature. Ranyard et al. (2008) provide an extensive survey of the literature dealing with laypersons' perceptions and expectations of price changes. Integrating the results from many studies, they propose a conceptual framework for understanding perceived and expected inflation. We consider this framework a useful starting point for testing some of the proposed relationships using our survey data on New Zealanders. Specifically, we study

the impact of variables that are characterised by variation across individuals, as we have only a cross-section of data. Figure 1 takes into account the specific information in our dataset and extends Ranyard's et al. (2008) conceptual framework.

Figure 1: Extended conceptual framework based on Ranyard et al. (2008)

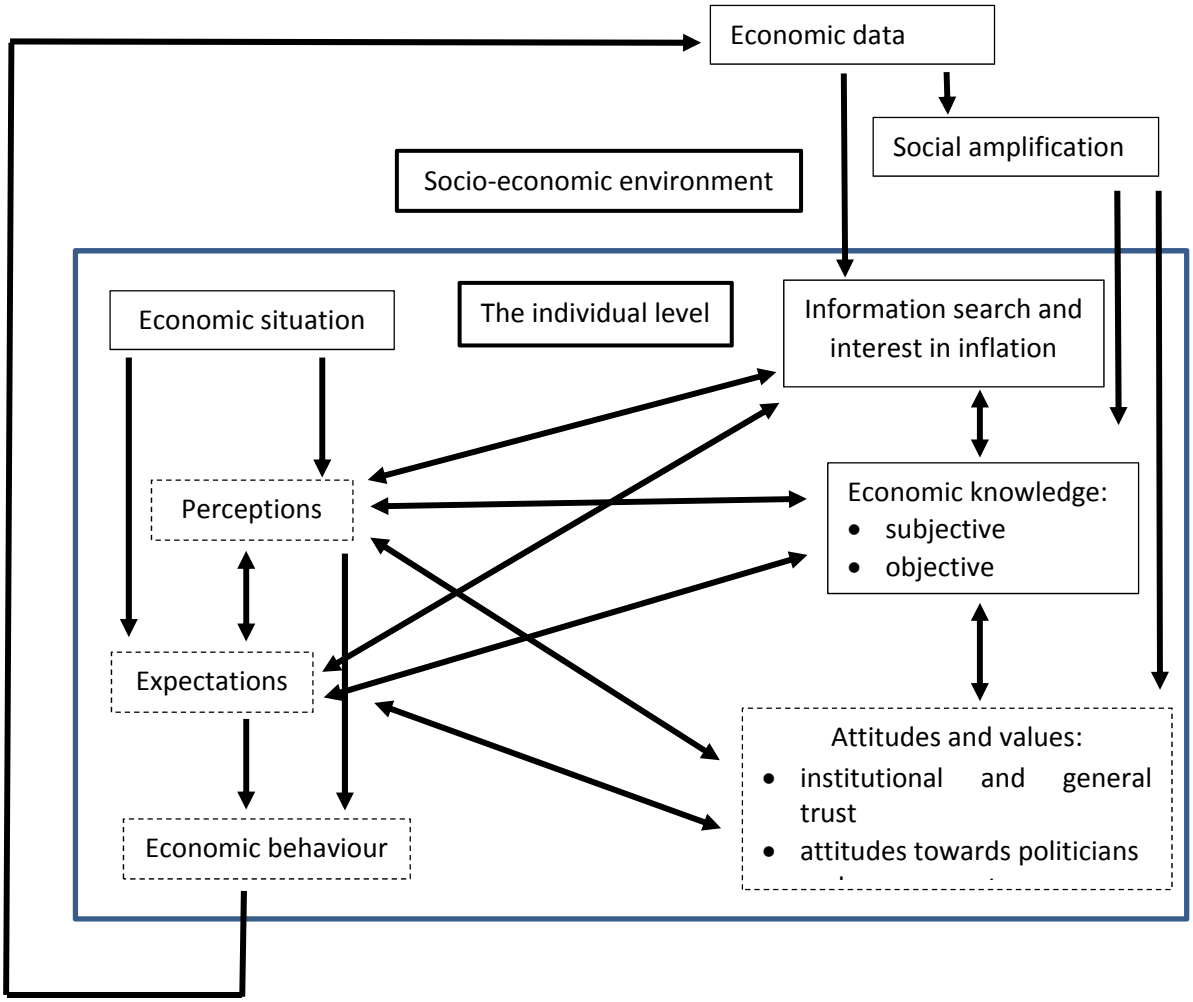


Figure 1 differentiates two different levels of analysis. One level deals with the macroeconomic environment, consisting of people's impression of the macroeconomy, called 'economic data' here. In addition, we take into account social amplification, particularly through the media, which helps transmit news about the macroeconomy to the individual level. Lamla and Lein (2014) discuss the media's role in consumers' inflation expectation formation. In our framework, this effect would work through economic knowledge, an approach also taken by Hayo and Neuenkirch (2018).

The other level illustrated in Figure 1 is that of the individual, the level with which we are primarily concerned. Note that manifold socio-demographic and psychological influences are associated with the individual level, but, to preserve readability, we focus on what we believe to be the most important ones. We distinguish between perceptions and expectations using the time dimension: the former are defined as retrospective, that is, they involve the individual's impression of price changes that have already occurred, whereas the latter are defined as prospective, that is, they involve price changes that may or may not occur in the future. Dräger (2015) studies the relationship between inflation perceptions and

expectations in Sweden. However, to complicate matters, there is empirical evidence that expectations may feed back into an individual's perception of current or past inflation (Traut-Mattausch et al. 2004).

Compared to Ranyard et al. (2008), we enlarge the number of channels that have the potential to affect inflation expectations. Here, expectations are influenced by the individual's perception of price changes, economic situation, subjective and objective economic knowledge, information search, and interest in inflation and attitudes. The first two aspects are discussed by Ranyard et al. (2008) and the references therein, whereas the latter three channels are new and are empirically analysed in this paper. The concept of economic knowledge can be linked to that of economic literacy (Jappelli 2010). The general idea is that the level of economic knowledge is important for both perception and expectations formation. A better state of actual knowledge about the subject matter implies that the individual is more likely to make rational decisions. Such knowledge depends on the individual's information search for and interest in the economic subject matter (Blinder and Krueger 2004; Hayo and Neuenkirch 2018). On average, a more intensive information search yields more knowledge. Knowledge about the relationship between a policy interest rate and inflation (Carvalho and Nechio 2014), and knowledge about the ECB's policy objectives (van der Cruijsen et al. 2015), as well as knowledge about its transparency practices (van der Cruijsen and Eijffinger 2010), is found to affect inflation expectations. However, there may also be a direct relationship between 'information search and interest in inflation', on the one hand, and 'perceptions' and 'expectations' on the other hand. A major driving force would be that the latter is influenced through the process of looking for information, whereas an influence in the opposite direction could be initiated through a specific inflation perception or expectation that leads the individual to acquire more information.

Additionally, we study the impact of knowledge on the perception and expectation of inflation. The literature also investigates the relationship between knowledge and attitudes (for a general discussion, see Walstad 1997; for an application to central bank trust, see Hayo and Neuenkirch 2014). Although rare in economics, consumer research explicitly distinguishes between actual or objective knowledge, defined as accurate stored information, and persons' subjective knowledge or their belief about that state of knowledge (e.g., Hadar et al. 2013; Moorman et al. 2004). A situation where subjective knowledge deviates from objective knowledge can lead to decision biases, such as over- or underconfidence. Hayo and Neuenkirch (2018) and Hayo and Neumeier (2017) differentiate between the impact of subjective as well as objective knowledge on trust in the central bank.

Inflation perceptions have been studied in various contexts. Of special interest to researchers is the natural experiment of introducing the euro as a new currency, which, on average, led laypersons to overestimate the inflation rate (see, e.g., Greitemeyer et al. 2005; Traut-Mattausch et al. 2004). However, the reverse is found in laboratory experimental evidence based on Swedish students, which suggests that in the case of day-to-day transactions, probands underestimate the actual inflation rate (Gärling and Gamble 2008). Also using the introduction of the euro as a sample period and reflecting the interaction between socioeconomic environment and the individual level, Gamble (2006) investigates

factors affecting individual perceptions of inflation. The literature contains various interpretations of the differences between laypersons and economists in how they understand inflation. The more social-science-oriented literature is extremely doubtful that there is any similarity between the two groups on this issue. Behrend (1977) suggests that people have an extremely limited understanding of inflation, but other researchers find more encouraging results (e.g., Williamson and Wearing 1996).

The economics literature is also concerned with perceptions of inflation. For example, Dias et al. (2010) discuss the relationship between actual and perceived inflation during the euro changeover. However, there is perhaps a stronger focus on expectations formation. Theoretical models frequently employ the assumption of rational expectations, but the empirical literature is less than sanguine about how rational these expectations really are (see, e.g., Thomas 1999; Berge 2017). For example, there is a notable tendency to underestimate inflation when it is relatively high and to overestimate inflation when it is low. A large part of the literature studies expectation formation by professional forecasters, for example, using the US-based Survey of Professional Forecasters. However, even for these professionals, questions arise with regard to the rational expectations assumption. For instance, Coibion and Gorodnichenko (2015) show that forecast errors made by participants in the Survey of Professional Forecasters underreact to incoming information. Household expectation formation is even less rational, as it changes very sluggishly. This finding is consistent with the view that laypersons do not regularly monitor inflation news (Carroll 2003). Malmendier and Nagel (2016) argue that individuals rely on their own experience with inflation, which implies an overweighting when compared to the available information set on inflation. Thus, age plays a role in expectation formation, as recent inflation experiences will have a relatively greater influence on younger persons' total lifetime inflation experience. However, some researchers claim that people do have an understanding of macroeconomic issues that is broadly consistent with economic theory. For example, Carvalho and Nechio (2014) report evidence that laypersons behave in line with a Taylor rule, which is a specific type of interest rate rule under which the central bank sets rates conditional on the deviation of the inflation rate from its target and the state of the business cycle.

Figure 1 illustrates how attitudes and values influence inflation perception and expectation. For instance, the literature notes that the design and policy of national monetary institutions, and thereby inflation rates, are affected by cultural differences (see Hayo 1998; De Jong 2002). These cultural differences manifest themselves in varying national attitudes and values towards price stability. This literature focuses on comparing countries; here, we are concerned with the influence of individual attitudes and values. Individual-level studies typically focus on preferences regarding inflation-unemployment trade-offs; for instance, Fischer and Huizinga (1982) study the United States and van Lelyveld (1999) investigate the issue for EU member countries. Ehrmann et al. (2015) show that households' purchasing attitudes matter for the precision of their inflation expectations. Allowing for a broader range of different attitudes and looking at New Zealand, Hayo and Neumeier (2017) find that the belief that politicians are long-term oriented is positively related to trust in the Reserve Bank (RBNZ), whereas other potentially relevant attitudes, for example, with regard to the

income distribution, have no significant influence. In Figure 1, such attitudes are affected by other factors, too, particularly individual (personal knowledge) and social factors.

Expectations and perceptions are thought to influence economic behaviour. This is a standard assumption in economics and is implemented, for instance, in various specifications of the Phillips curve (see, e.g., Mankiw 2015). The Philipps curve in the context of New Zealand is discussed in Hargreaves et al. (2006). A recent paper by McDonald (2017) empirically shows that, at least in recent years, non-tradable inflation is better forecast by an adaptive version of expectation formation compared to a forward-looking one. Reflecting these considerations when making its inflation forecasts, the RBNZ now places a greater weight on past inflation (RBNZ 2017, 23). Similar observations are made for other countries; for example, Ehrmann (2015) presents evidence that price-setting behaviour appears to be more backward looking in times of persistently low inflation. This suggests that economic behaviour is not simply driven by forward-looking expectations, as is sometimes assumed in the literature (see, e.g., Woodford 2003), but that perceptions of current and past inflation may play an important role, too. Thus, it is not only important to understand individual formation of inflation expectations, but also that of inflation perceptions.

In this paper, we utilise representative survey data collected in 2016 on our behalf by Research New Zealand. The data are extensively described in Hayo and Neumeier (2016) and we do not duplicate that description here. The emphasis in this paper is on generating stylised facts about how laypersons think about inflation. As illustrated in Figure 1, the paper is more closely linked to the psychological literature than to the typical economics literature. We are trying to understand more about how laypersons perceive past and future inflation, how they learn about inflation, and how they respond to it.

Designing specific surveys has both advantages and disadvantages. One advantage is that we can ask specific questions pertaining to our research agenda. Moreover, we have an exceptionally broad range of variables at our disposal, which allows controlling for many potentially important influences to an extent far beyond what other studies in the literature have been able to do. A major disadvantage of our dataset is that we do not have a time-dimension at our disposal, implying that we cannot control for the specific economic environment present at the time of data collection. In our case, the survey was conducted at a time of unusually low inflation. A general problem with this type of survey-based approach is that it is based on stated, not actual, behaviour and does not easily allow drawing causal conclusions.

In Section 2, we study people's perceptions of last year's inflation rate. Whether respondents actually keep an eye on the inflation rate and their economic response to inflation is analysed in Section 3. Section 4 is concerned with investigating people's inflation expectations; Section 5 concludes.

2. Perceptions of Last Year's Inflation Rate

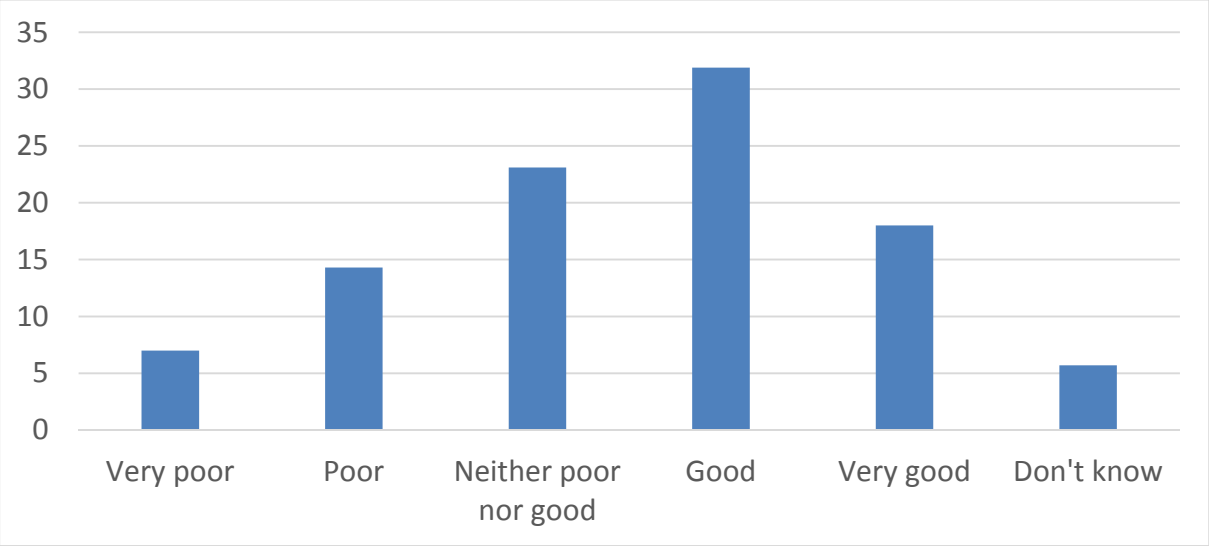
First, we analyse the question of how New Zealanders perceive their own knowledge about the inflation rate. In terms of the framework sketched in Figure 1, we study which variables

are associated with the 'perceptions box'. The main influences are the individual's economic situation, economic knowledge, and attitudes and values. Definitions and descriptive statistics of all variables employed here can be found in the Appendix. We measure subjective knowledge about the inflation based on answers to the question:

How would you rate your level of knowledge of each of these terms?: Inflation rate

Figure 2 shows the resulting distribution of answers.

Figure 2: New Zealanders' subjective knowledge about the inflation rate (in %)



Thus, our respondents seem to be aware of the issue and about 50 per cent say that their knowledge is good or very good; only about 20 per cent feel that it is poor or very poor. We would interpret these results as indicating that the concept of inflation is not foreign to New Zealanders.

It is interesting to compare people's subjective knowledge with their objective knowledge. We do that by checking whether our probands can remember last year's inflation rate. Specifically, we asked the following question and code it as a variable called 'Inflation rate last year':

The rate of inflation measures the rate at which the price of goods and services is increasing/decreasing and, therefore, the purchasing power of money. Do you remember what New Zealand's rate of inflation was in 2015? Please write the percentage here

☐ *% ___*
☐ *Don't know*

The question is asked in a way that requires a quantitative answer. Moreover, there is no other guidance for the respondents as to what a reasonable inflation rate might be, which makes our question much more demanding than the one often asked in household surveys,

namely, whether prices are decreasing or increasing.[1] Thus, our approach of asking for an explicit number likely leads to more missing answers than questions of the usual type. However, a major disadvantage of the qualitative type of question is that one needs strong assumptions to translate the answers into numbers. In our case, to make sure that we do not collect 'non-attitudes' (Norpoth and Lodge 1985), we give respondents the option of choosing 'don't know'. Table 1 shows that a majority of our respondents cannot remember the inflation rate or do not feel confident enough to voice an opinion.

Table 1: Remembering 'Inflation rate last year' (absolute and relative number of respondents)

Provided an answer	Don't know
436 (44%)	564 (56%)

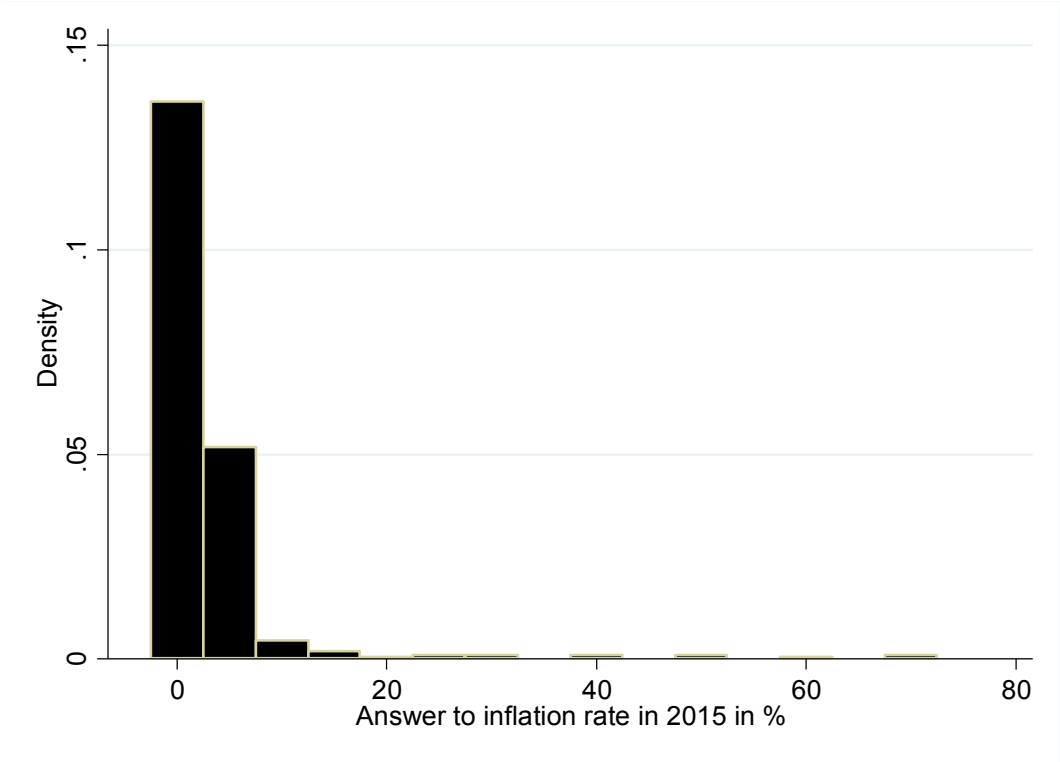
The share of 'don't know' answers in our survey is much higher than the approximately 10 per cent reported in the Michigan Surveys of Consumers in answer to a question about inflation expectations.[2] One reason for this might be that the Michigan questionnaire contains a sequence of follow-up questions and probes to reduce the number of 'don't knows'. However, such an approach increases the danger that more observations reflecting 'non-attitudes' are collected.

The distribution of answers from those respondents who stated a value for last year's inflation rate is given in Figure 3. In 2015, the official inflation rate in New Zealand was 0.3 per cent. Thus, our specific findings may be driven by this situation of very low inflation rates, a situation for which it has been shown that backward-looking behaviour becomes relatively more important than forward-looking behaviour (Ehrmann 2015; McDonald 2017).

[1] For instance, the first question asked about US inflation in the Surveys of Consumers (conducted by the University of Michigan) is: 'During the next 12 months, do you think that prices in general will go up, or go down, or stay where they are now?' (Question A12 in the recent version of the questionnaire; see https://data.sca.isr.umich.edu/fetchdoc.php?docid=24776).

[2] See Table 32: 'Expected Change in Prices During the Next Year' (https://data.sca.isr.umich.edu/data-archive/mine.php).

Figure 3: Distribution of answers of 'Inflation rate last year' (436 observations)



Most answers are relatively close to zero and thus roughly in line with the actual inflation rate. However, there are notable outliers, for example, stating a rate of 70 per cent. Even ignoring these outliers, many numbers are not very close to the actual inflation value. Figure 4 provides a summary of the distribution, which makes this point more apparent.

Figure 4: Summarised distribution of 'Inflation rate last year' (answers in per cent)

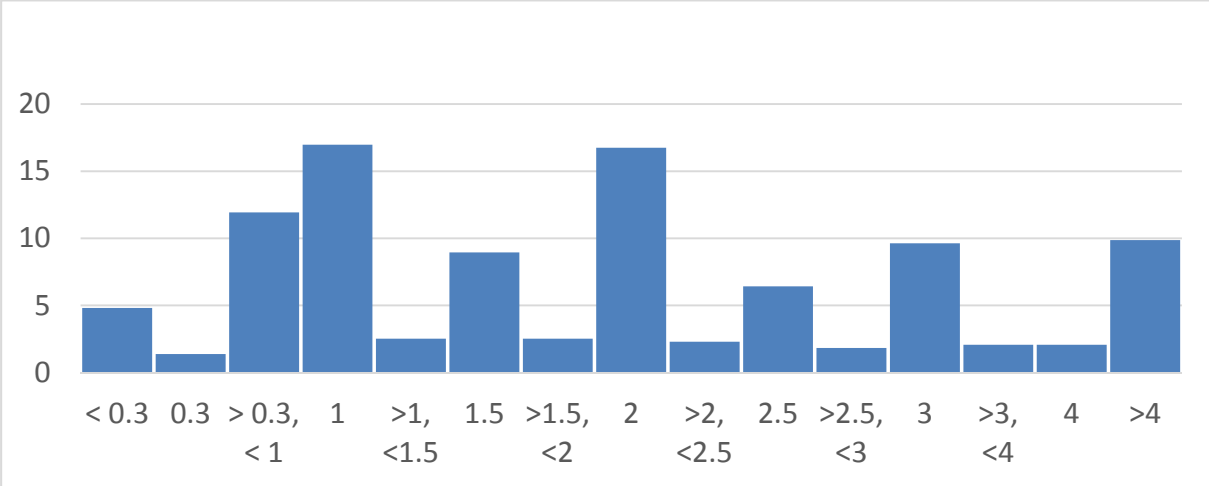


Figure 4 reveals several interesting findings. First, whole numbers work as attractors, which is in line with the concept of mental shortcuts (see, e.g., Higbee 2001). Second, in contrast, the official rate of inflation does not work as an attractor. We think there are two explanations for this: (i) respondents simply do not know the official inflation rate or (ii) they do not refer to it when answering the question. Put differently, there may be a marked difference between the official inflation rate and the one experienced by an individual

respondent. Third, more than two-thirds of the respondents providing a remembered inflation rate chose a number between 1 and 3 per cent, which reflects the range for the inflation rate as agreed to in the Policy Targets Agreement (PTA). The PTA is a unique monetary policy institution and is the result of negotiations between the government and the central bank governor. Does that inflation range being selected by our respondents reflect a conscious or an unconscious choice? In our survey, we have a question asking whether New Zealanders have heard of the PTA: only 15 per cent answer in the affirmative. Thus, it appears rather unlikely that people cannot remember the official inflation rate but consciously believe that it is still within the target range agreed to in the PTA. In our view, the large share of answers between 1 and 3 per cent can be explained by (i) an unconscious reflection of the PTA range, (ii) a diffuse memory of inflation rates experienced in the past, or (iii) coincidence. Given our dataset, we cannot discriminate between these potential explanations.

What is the average value for last year's inflation rate when using remembered rates? The arithmetic average is about 4 per cent, which is 13 times larger than the official value. We showed above that this value is partially driven by large outliers. Using the median instead of the mean halves the inflation rate, that is, we now observe a value of 2 per cent. This value is right in the middle of the PTA range but it is still almost seven times larger than the official inflation rate in 2015. Finally, using the mode as a measure of the average inflation rate, we obtain a value of 1 per cent, which is still three times larger than the official value.

However, we are not convinced that removing such outliers, directly or indirectly, is scientifically sound. We believe that there must be a sound justification for the systematic exclusion of data; otherwise, the sample becomes a biased representation of the underlying population. A strong justification for excluding outliers would be that they are the result of respondents' coding mistakes, possibly due to too quickly filling out the questionnaire. When investigating this possibility, however, we do not find a noteworthy correlation between the time respondents spent on answering the survey and the value they recorded for 'Inflation rate last year' (correlation coefficient: –0.01).[3] Moreover, when correlating the remembered inflation rate with other socio-demographic and attitudinal variables from our survey, the strongest relationship is between people's objective knowledge about macroeconomic developments ('Macroeconomic knowledge': correlation coefficient = –0.27) and their subjective knowledge ('Feels informed about inflation': (correlation coefficient = –0.26), or, in other words, their own impression of how much they know about the inflation rate. These results suggest reporting a high inflation rate is caused by personal misinformation rather than measurement error.

Due to collinearity between the variables, focusing on bivariate correlations can be highly misleading. Thus, we study the question of whether there are systematic and interpretable factors associated with 'Inflation rate last year' in a multiple regression model. Another approach would be to study the *absolute* deviations between the remembered inflation rate and the official inflation rate in 2015. This series would look different if a notable share of

[3] Neither taking logs of time spent on completing the survey nor including an additional squared term of the survey time in a regression leads to a significant relationship.

respondents underpredicted the inflation rate. However, this is not the case. The correlation coefficient between this variable and 'Inflation rate last year' is 0.99 and estimation results are virtually identical.

As building blocks for a general model, we include indicators covering all the influences on the 'perceptions box' in Figure 1, namely:

(i) 'Economic Situation' (measured by: Income, Net personal wealth, Saver, Debtor, Satisfaction with financial situation, Self-employed full time, Self-employed part time, Employed full time, Employed part time, Homemaker, Student, Retired, Unemployed, Beneficiary);

(ii) 'Economic Knowledge' (measured by: Macroeconomic knowledge, Feels informed about RBNZ, Feels informed about inflation, Feels informed about OCR, Heard of PTA);

(iii) 'Information Search' (measured by: Desire to be informed about RBNZ, Information through newspaper, Information through radio, Information through TV, Information through Internet, Information through friends, Information through colleagues, Information through own bank, Information through financial sector, Does not keep up with RBNZ);

(iv) 'Attitudes and Values' (measured by: Institutional trust, General trust, Politicians act in public's best interest, Politicians long-term oriented, Politicians fiscally competent, Confidence in politicians, Egalitarian attitude, National Party, Labour Party, Green Party, New Zealand First).

(v) We also include socio-demographic and psychological indicators, which control for a number of other influences (Female, Age, Children, Married, Secondary school qualification, Polytechnic qualification or trade certificate, Bachelor's degree or higher, Town, Rural, North Island, Auckland, NZ European, Maori, Asian, Time spent on survey, Risk propensity, Future-oriented time preference, Short-run impatience).

Descriptive information about these variables can be found in the Appendix. Starting with a model containing these 59 potentially relevant variables, we use general-to-specific modelling to derive the reduced model displayed in Table 3.[4]

[4] To save space, we omit the table showing the estimates for the general model. Since we find strong evidence of heteroscedasticity (White (1980) heteroscedasticity test for the reduced model: Chi2(5) = 132***), we use robust standard errors (White 1980) throughout the testing-down process. All omitted results are available on request.

Table 3: Explaining 'Inflation rate last year'

	Coefficient	SE	Coefficient by standard deviation
Married	- 2.2**	0.89	n.a.
Residing in town	3.0**	1.19	n.a.
Desire to be informed about RBNZ	1.5**	0.61	1.5
Feels informed about inflation	- 1.7**	0.72	- 1.9
Macroeconomic knowledge	- 0.8***	0.19	- 1.5
Constant	8.3	2.56	n.a.
R^2 = 0.18; F(5, 386) = 4.8***; Regression SE = 6.7; testing-down restriction: F(52, 330) = 0.58; number of observations: 392.			

Notes: Estimated using OLS. SE = standard error. White (1980) robust SEs are used. For dummy variable reference values, see list of variables in the Appendix. *, **, and *** indicate significance at a 10%, 5%, and 1% level, respectively.

Re-estimating the model with 38 additional observations, which have become available as a result of using fewer variables, we find that all the qualitative results remain in place.[5] However, even though the economic interpretation is not affected much, the magnitude of all five coefficients changes in a statistically significant way. We base our interpretation on the results in Table 3, as it is unclear whether the testing-down process would have resulted in the same reduced model if these observations had been available when estimating the general model.

We discover that 'Married', 'Residing in town', 'Desire to be informed about RBNZ', 'Feels informed about inflation', and 'Macroeconomic knowledge' survive the testing-down process. Married persons report roughly 2 percentage points (pp) lower values for last year's inflation rate and respondents living in a town with between 10,000 and 100,000 inhabitants tend to state 3 pp larger values. We can only speculate about why these two variables are significant predictors of the remembered inflation rate. One possibility is that the official inflation rate does not well describe the actual inflation rate for specific groups of people. In this case, our results would suggest that married persons perceive inflation to be relatively lower, whereas those living in mid-sized towns find inflation to be relatively higher than the official figures.

We also find that respondents who are more interested in the RBNZ recall a higher inflation rate. To obtain a more precise insight as to the magnitude of the effect, we multiply the estimated coefficient by its respective sample standard deviation. When 'Desire to be informed about RBNZ' increases by one standard deviation, 'Inflation rate last year' increases by about 1.5 pp. Again, interpretation is not straightforward. Note, however, that the effect is conditional on the inclusion of subjective and objective knowledge indicators. Our conjecture is that these are respondents who wished they knew more about monetary policy, given that they find the inflation rate to be relatively high.

[5] Coefficients estimated using 428 observations: 'Married' (–1.7**), 'Residing in town' (3.3***), 'Desire to be informed about RBNZ' (–1.4**), 'Feels informed about inflation' (1.2**), and 'Macroeconomic knowledge' (–0.9***). Test results available on request.

Interpretation of the last two significant explanatory variables is easier. They are similar to what we already found when computing correlation coefficients: both subjective and objective knowledge matter for recalling the previous year's inflation rate. A one standard deviation hike in 'Macroeconomic knowledge' decreases the remembered inflation rate by 1.5 pp, which means it moves closer to the actual rate. The impact in the case of 'Feels informed about inflation' is even higher: a one standard deviation increase leads to an almost 2 pp lower reported inflation value. Thus, our findings clearly suggest that having good objective or subjective economic knowledge leads to a more precise recall of the past inflation rate.

Returning to the issue of how to deal with outliers in household inflation data, we think our findings emphasise that decision making in statistical modelling ought to be guided by the underlying question of interest. If it is our intention to provide good predictions of the actual inflation rate using survey data, then we should exclude outliers, as they only introduce additional noise. But our intent is to provide an accurate account of how people perceive the inflation rate, which implies that our sample needs to be representative of all types of people, including the misinformed. Thus, in light of our research focus, we are in favour of retaining such outliers in our sample. Put differently, our results raise doubts about whether filtering procedures, such as trimming, Winsorising, or even just taking a median, are justified when drawing conclusions about how inflation is perceived by economic agents. In our view, excluding outliers likely biases results toward finding evidence in support of rational economic behaviour.

3. Monitoring Inflation and Economic Consequences

Arguably, obtaining knowledge about the inflation rate requires some effort. Without some alertness to and interest in the development of inflation, it seems unlikely that economic agents will be able to accurately report its rate. Thus, we are interested in finding out whether New Zealanders make a conscious effort to learn the inflation rate. We asked our respondents about whether they monitor the rate of inflation. Table 4 shows that only 35 per cent of the population keeps an eye on the inflation rate, which does not bode well for assumptions of rational expectation formation based on the idea that people collect all available, or at least all easily available, information before making decisions.

Table 4: Do you monitor the rate of inflation? (absolute and relative number of respondents)

Yes	No	Don't know
352 (35%)	605 (61%)	43 (4%)

To learn more about the characteristics of respondents who either do or do not monitor the inflation rate, we compute associations between 'Monitoring the inflation rate' and our wide range of socio-demographic and attitudinal variables. We find five associations with correlation coefficients higher than 0.3: 'Subjective knowledge about RBNZ' (0.50), 'Subjective knowledge about inflation' (0.45), 'Subjective knowledge about OCR' (0.44), 'Desire to be informed about RBNZ' (0.34), and 'Objective macroeconomic knowledge'

(0.46). The first four variables reflect a consistent mindset, that is, these respondents coherently express interest and subjective knowledge about inflation, the central bank, and interest rate setting. It could be that this is just the perception of the respective respondents, unrelated to the actual state of affairs (see the seminal critique by Alwin 1973); however, the last variable shows that the subjective side is related to objective knowledge.

Do these results hold up in a multivariate setting? As a dependent variable in our logit regression, we use a dummy variable equal to 1 if a person monitors the inflation rate and 0 otherwise. Starting with 59 variables, we simplify the model without violating the testing-down restriction. Table 5 presents the estimation results for the reduced model.

Table 5: Explaining 'Monitoring the inflation rate'

	Coefficient	SE	Average marginal effects	Average marginal effects by standard deviation
Feels informed about inflation	0.84***	0.11	0.13	0.15
Feels informed about RBNZ	0.41***	0.14	0.06	0.06
Desire to be informed about RBNZ	0.31***	0.11	0.05	0.05
Does not keep up with RBNZ	- 1.18**	0.50	- 0.18	n.a.
Macroeconomic knowledge	0.32***	0.07	0.05	0.09
Egalitarian attitude	- 0.17**	0.08	- 0.03	- 0.04
Risk propensity	0.40***	0.15	0.06	0.04
Constant	- 5.95***	0.60		
Pseudo-R^2 = 0.32; $Chi^2(7)$ = 219***; Log pseudolikelihood = -366; testing-down restriction: F(52, 4.5E+07) = 1.14; number of observations: 808.				

Notes: Estimated using a logit model. White (1980) robust SEs are used. For dummy variable reference values, see list of variables in the Appendix. *, **, and *** indicate significance at a 10%, 5%, and 1% level, respectively.

The estimates for the reduced model shown in Table 5 are based on the same number of observations used in estimating the general model. Due to including fewer variables in the reduced model, we now have additional observations available for estimation. After increasing the sample size to 893, that is, extending it by more than 10 per cent, our results remain qualitatively robust, but in statistical terms they become significantly different.[6]

Seven variables survive the testing-down process and are significant at either the 1 or 5 per cent level of significance, the majority of which relate to subjective or objective economic knowledge. Regarding subjective knowledge, we discover that if people feel informed about inflation or RBNZ, then it is more likely that they monitor the inflation rate. Of course, causality may run the other way, but this is not the issue here. To get an idea about the magnitude of the estimated relationships, we compute average marginal effects and, for those variables that are not dummies, multiply these by the variables' standard deviation.

[6] Coefficients estimated using 893 observations: 'Feels informed about inflation' (0.85***), 'Feels informed about RBNZ' (0.39***), 'Desire to be informed about RBNZ' (0.33***), 'Does not keep up with RBNZ' (–1**), 'Macroeconomic knowledge' (0.31***), 'Egalitarian attitude' (–0.15**), 'Risk propensity' (0.36**). Test results available on request.

The result can be interpreted as the impact of a one standard deviation change of an explanatory variable on the likelihood that the dependent variable is equal to unity.

For subjective knowledge, we find a notable impact of 15 percentage points (pp) on the likelihood of monitoring the inflation rate. At 6 pp, the positive association between subjective knowledge about RBNZ and inflation monitoring is less than half as large. Respondents who desire to obtain information about the inflation rate are more likely to monitor it, whereas those who do not bother keeping up with the RBNZ are also less inclined to follow the development of inflation. The impact of a standard deviation change is about 5 pp in the case of the variable measuring information desire. Since the 'Does not keep up with RBNZ' variable is a dummy, we just look at a change from 0 to 1 and find that the likelihood of monitoring the inflation rate decreases by 18 pp.

The likelihood of 'Monitoring the inflation rate' is not only influenced by the various dimensions of subjective knowledge. A standard deviation change in our indicator for macroeconomic knowledge raises the likelihood of monitoring inflation by almost 10 pp. In addition, we find that respondents who are more concerned about equality are less interested in monitoring the inflation rate, whereas those who are less risk averse are significantly more interested. In both cases, the absolute effect of a standard deviation change is relatively small (4 pp). We interpret this finding as meaning that those who are more risk averse act more cautiously after investing in financial assets and feel a greater need to keep up to date with relevant economic developments. They thus may think that observing economic developments is important when making such decisions. Respondents interested in equality may not be very interested in financial market development, as they tend to disagree with organising the economy based on market principles.

Overall, the results are consistent with the notion that monitoring is a precondition for acquiring information about inflation. On average, respondents either make a conscious effort to collect information about inflation or they have sketchy objective and subjective knowledge. Put differently, there is a group of citizens who consciously and actively think about inflation and monetary policy and this group, at least to some extent, fulfils the rational expectations assumption often made by macroeconomists. However, in our sample, this group makes up only slightly more than 30 per cent of the population.

Many of our variables that could influence the likelihood of watching the inflation rate are not significant. For instance, after controlling for the remaining variables in the reduced model given in Table 5, it does not matter whether the respondent is a debtor/saver or rich/poor. When regressing these variables individually on 'Monitoring the inflation rate', we find that savers and the rich are significantly more likely to monitor the inflation rate. This suggests that models that include these economic variables, but do not control for the other variables discussed above, likely suffer from biased estimates.

We now proceed on the assumption that, at least on a conscious level, only those respondents who actually monitor the inflation rate will make economic adjustments in response to it. We believe this assumption to be plausible and extremely helpful with regard to avoiding non-attitudes, and designed the questionnaire accordingly, but one of the drawbacks is that our sample size shrinks considerably to 352 observations.

Table 6 summarises which economic activities are influenced by the inflation rate.

Table 6: New Zealanders' reaction to inflation (in per cent, multiple answers possible)

Question: 'Which of the following does the current rate of inflation influence, if any? Please select as many options as apply'	Share	Factor loadings
Your total spending on goods and services	51%	0.55
How much you spend on food and groceries, clothes, petrol, and other consumables	53%	0.73
How much you spend on white goods, televisions, cars, and other 'big ticket' items	47%	0.71
How much you spend on eating out, holidays, and other discretionary expenditure	43%	0.77
How much you save	46%	0.50
The rate of inflation does not influence how much I save or my spending	26%	-0.60

Note: Subsample of 352 observations.

Except for 'The rate of inflation does not influence how much I save or my spending', we find that most of the alternatives are chosen by roughly one-half of the respondents. However, statistically, there are a couple of significant differences. When computing t-tests of the average shares in Table 6 against 0.5, we find that we can reject the null hypothesis only at the 5 per cent level in the case of 'How much you spend on eating out, holidays, and other discretionary expenditure' and 'The rate of inflation does not influence how much I save or my spending'.[7] The former indicates that discretionary expenditure appears to be somewhat less affected by inflation, whereas the latter shows that only about a quarter of those monitoring the inflation rate do not report any economic reaction to inflation. Overall, at an aggregate level, we do not find notably different adjustment behaviour to inflation in terms of the type of goods bought or the decision to save.

To confirm whether this conclusion holds at the individual level, we apply factor analysis. With an average value of 0.8 and no individual value below 0.7, the Kaiser-Meyer-Olkin measure of sampling adequacy suggests that the precondition for conducting a factor analysis is fulfilled and we can reject the LR test of independence against the saturated model at all reasonable levels of significance ($Chi^2(15) = 675$ (p-value: 0.000)). The scree plot, as well as the difference between the two largest eigenvalues (first eigenvalue: 2.5; second eigenvalue: 0.24), suggest concentrating the analysis on the first component. Restricting the estimation to one factor, we obtain the factor loadings given in the last column of Table 6. Factor loadings on variables measuring the influence of inflation on specific consumer items are particularly high, whereas they are lower for the other items. Loadings range between 0.5 ('How much you save') and 0.8 ('How much you spend on eating out, holidays, and other discretionary expenditure'), which suggests that the factor for the underlying variables has

[7] Using t-tests to test whether the shares are different from 0.5, we obtain the following results: 'Your total spending on goods and services': p-value: 0.67, 'How much you spend on food and groceries, clothes, petrol, and other consumables': p-value: 0.24, 'How much you spend on white goods, televisions, cars, and other "big ticket" items': p-value: 0.24, 'How much you spend on eating out, holidays, and other discretionary expenditure': p-value: 0.001***, 'How much you save': p-value: 0.11, and 'The rate of inflation does not influence how much I save or my spending': p-value: 0.000***.

good explanatory power. The signs of the loadings are all positive, except for 'The rate of inflation does not influence how much I save or my spending'. Thus, we interpret the factor as people's degree of economic adjustment to inflation, with higher values indicating a stronger reaction. We call this factor 'Reaction to inflation'.

It is interesting to see whether particular characteristics of our respondents are correlated with the factor measuring people's degree of economic adjustment to inflation. As it turns out, none of the correlation coefficients reaches 0.15 in absolute terms. We then compute a general regression model for studying conditional correlations using the 59 variables listed above and impose a valid testing-down restriction. The testing-down restriction in Table 7 refers to the 313 observations available for estimating the general model. To increase estimation efficiency, we re-estimate the reduced model using more than 30 additional observations. Parameter estimates are almost unchanged and statistically indistinguishable, whereas standard errors are slightly lower.[8] Thus, in Table 7, we show the reduced model estimated using 347 observations.

Table 7: Explaining factor 'Reaction to inflation' (reduced model)

	Coefficient	SE	Coeff./stand. dev. of dependent variable
Polytechnic qualification or trade certificate	- 0.25**	0.12	- 0.28
Does not keep up with RBNZ	- 0.64***	0.24	- 0.70
Satisfaction with financial situation	- 0.11**	0.05	- 0.13#
Information through newspaper	0.19*	0.12	0.21
Constant	0.40**	0.17	
R^2 = 0.05; F(4, 342) = 5.9***; testing-down restriction: F(55, 251) = 1.14; number of observations: 347.			

Notes: Estimated using an OLS model. White (1980) robust SEs are used. # indicates a standardised regression coefficient. For dummy variable reference values, see list of variables in the Appendix. *, **, and *** indicate significance at a 10%, 5%, and 1% level, respectively.

While the reduced model is significant at a 1 per cent level, the coefficient of determination is small.

Compared to other educational levels, respondents with a polytechnic qualification or trade certificate report significantly less reaction to the inflation rate. To get an idea about the strength of this relationship for the dummy variables, we divide the coefficient by the standard deviation of the dependent variable (see last column of Table 7). This can be interpreted as the relative impact of the dummy moving from 0 to 1 on the dependent variable. Having a 'Polytechnic qualification or trade certificate' lowers reaction to the inflation rate by 28 per cent of the factor variable's standard deviation compared to all other educational achievements.

[8] For 'Satisfaction with financial situation' (0.12**), we find a statistically significant difference. Test results available on request.

Respondents who do not wish to keep up with RBNZ show a smaller reaction to the inflation rate, too. In terms of the economic impact, with 70 per cent of the dependent variable's standard deviation, the effect is much larger compared to the educational variable. Thus, one explanation for why these respondents are not interested in following monetary policy is that they are not sensitive to changes in the inflation rate.

Financial satisfaction has a negative influence on the inflation reaction indicator. Hence, people who feel financially well-off do not deem it necessary to react to inflation. To compute an interpretable effect, we rely on the standardised regression coefficient, that is, we multiply the estimated coefficient by its standard deviation before dividing by the dependent variable's standard deviation. The resulting value of 13 per cent is small compared to that of the other variables.

Finally, those respondents who obtain their information on monetary policy primarily through newspapers react more strongly to the inflation rate. At 21 per cent, the size of the effect is moderate. It could be that newspapers not only write more frequently and in more detail about inflation than other media channels, but that they often also provide advice on how to interpret and react to the inflation rate (Hayo and Neuenkirch 2014).

These are interesting findings, but the only strong finding in terms of both economic and statistical significance is with regard to those respondents who do not care about monetary policy. They likely have decided that it is not worthwhile to spend time on monetary policy issues and inflation. Overall, however, we would interpret the outcome of Table 7 as supporting the rather surprising view that the economic reaction to inflation is strongly determined by unobservable factors and/or mainly subject to idiosyncratic influences. This point is made more forcefully by emphasising which variables did *not* survive the testing-down process: income, wealth, saver/debtor, central bank trust, region, degree of urbanisation, objective or subjective monetary policy knowledge, labour market status, demographics (e.g., age or gender), or time spent on answering the survey.

It is not clear whether this is a generally valid finding or simply due to New Zealand's low inflation environment at the time of the survey. To discover whether the level of the inflation rate is important, we consider people's perception of the inflation rate, which should play an important role if the magnitude of inflation matters. Our hypothesis is that economic reactions become more important if the inflation rate is perceived to be high. We did not include recollection of last period's inflation rate in the regression underlying Table 7, as that would have resulted in a notable loss of observations. However, to gauge this variable's potential importance, we first compute a correlation coefficient, which is negative and small in absolute terms (–0.06). Thus, if respondents perceive the inflation rate to be high, their reaction to it is relatively less sensitive, which certainly does not match our expectations. Including the perceived inflation rate in the regression model displayed in Table 7, we find that it is not statistically significant.[9] We thus conclude that perception of the magnitude of inflation has no bearing on economic reactions.

[9] Results are available on request.

4. Household Inflation Expectations

We now turn to the formation of household inflation expectations. To discover whether expectation formation is a conscious process, we ask our respondents if they form opinions about what might be the rate of inflation in the future. Table 8 shows that only a quarter of the population appears to do so. The vast majority of our respondents do not think about the future inflation rate; 10 per cent are unsure about the answer to this question.

Table 8: Do you form opinions about what might be the rate of inflation in the future? (absolute and relative number of respondents)

Yes	No	Don't know
250 (25%)	650 (65%)	100 (10%)

In our view, this is strong evidence against the idea that people frequently update their beliefs about next year's inflation. Again, the result may be conditional on the low inflation situation present in New Zealand at the time our data were collected.

We would like to learn more about the characteristics of respondents who either do or do not form expectations about the future inflation rate. Computing correlation coefficients between 'Inflation expectation formation' and our wide range of socio-demographic and attitudinal variables, we find four correlation coefficients higher than 0.3: 'Subjective knowledge about RBNZ' (0.32), 'Subjective knowledge about inflation' (0.33), 'Subjective knowledge about OCR' (0.30), and 'Objective macroeconomic knowledge' (0.32). In terms of absolute magnitude, the next correlation coefficient is for 'Desire to be informed about RBNZ' (0.28), meaning that this is the same group of variables that were found to associate with 'Monitoring the inflation rate'. However, the correlations are weaker in the present case. Moreover, the association between 'Inflation expectation formation' and 'Monitoring the inflation rate' is 0.4, indicating that the two are positively related but not perfectly so.

Again, we investigate whether these results are maintained in a multivariate framework. As the dependent variable in our multivariate logit specification, we use 'Inflation expectation formation', which is equal to 1 if a person forms expectations about the inflation rate and 0 otherwise. Starting with our set of 59 variables, we reduce the model without violating the testing-down restriction. Table 9 presents the estimation results for the simplified model. Most of the effects are significant at a 1 per cent level, except for 'Feels informed about RBNZ', 'Does not keep up with RBNZ', and 'RBNZ knowledge from bank advisor'.

Table 9: Explaining who forms expectation about the future inflation rate

	Coefficient	SE	Average marginal effects	Average marginal effects by standard deviation
Feels informed about RBNZ	0.23*	0.13	0.04	0.04
Feels informed about inflation	0.52***	0.11	0.08	0.09
Desire to be informed about RBNZ	0.35***	0.10	0.05	0.06
Heard about PTA	0.64***	0.21	0.10	n.a.
Does not keep up with RBNZ	- 1.02**	0.51	- 0.16	n.a.
RBNZ knowledge from bank advisor	0.79**	0.34	0.12	n.a.
RBNZ knowledge from financial sector	0.93***	0.32	0.15	n.a.
Retired	- 0.67***	0.25	- 0.11	n.a.
Self-employed part time	- 1.01**	0.48	- 0.16	n.a.
Beneficiary	- 1.89***	0.73	- 0.30	n.a.
Homemaker	- 1.26**	0.62	- 0.20	n.a.
Constant	- 4.72***	0.51		
Pseudo-R^2 = 0.20; $Chi^2(11)$ = 130***; Log pseudolikelihood = -384; testing-down restriction: F(49, 2.2E+08) = 0.95; number of observations: 807.				

Notes: Estimated using a logit model. White (1980) robust SEs are used. For dummy variable reference values, see list of variables in the Appendix. *, **, and *** indicate significance at a 10%, 5%, and 1% level, respectively.

The first notable result from Table 9 is the association between the subjective knowledge indicators and forming inflation expectations. Those who feel well informed about inflation and the RBNZ are more likely to form expectations. Computing the strength of the relationship in the form of the product of average marginal effect and a one standard deviation change, we find that the former increases the likelihood of forming inflation expectations by almost 10 pp, whereas the latter effect is less than half as large. 'Desire to be informed about RBNZ' and 'Heard about PTA' are also positively associated. A one standard deviation change in the first variable makes it roughly 6 pp more likely to form inflation expectations and if respondents have heard about the PTA, the probability goes up by 10 pp. Except for the question on PTA, these variables clearly refer to the individual's subjective mindset; even 'Heard about PTA' contains important characteristics of subjective knowledge.

The next three significant variables refer to the acquisition of information. Individuals who answer 'Does not keep up with RBNZ' are, unsurprisingly, less likely to form inflation expectations. A change in this dummy variable decreases the likelihood of expectation formation by 16 pp. In contrast, those respondents who obtain their information about RBNZ from either their bank advisor or another financial sector source are 12 pp and 15 pp, respectively, more likely to form such expectations. This is in line with previous research finding that professional observers put a lot of emphasis on forming as accurate as possible inflation expectations and following forward guidance from a central bank (see Nautz and

Strohsal 2015; Hayo and Neuenkirch 2015). Hence, financial market actors seem to be able to impress upon those who seek their advice the importance of forward-looking behaviour, which can be interpreted as supporting the argument made by Carroll (2003). However, in line with findings reported by Johannsen (2014), we find the dispersion of inflation expectations decreases in step with decreases in income and education level, which is not consistent with Carroll's (2003) explanation.[10]

The last group of significant variables encompasses several groups with little labour market involvement. Respondents who fall into one of these categories—'Retired', 'Self-employed part time', 'Beneficiary', or 'Homemaker'—are less likely to form inflation expectations, with probabilities decreasing by 11 pp, 16 pp, 30 pp, and 20 pp, respectively. This finding suggests that people who are not the chief labour market earners in their household are not as interested in future inflation as are other groups in society. Arguably, this disinterest is not economically rational, as they would be at least as affected by a higher inflation rate as would most other groups. In fact, some of them may even be more vulnerable, as their income might not be tightly linked to wage growth, which tends to compensate workers for losses in purchasing power.

We are interested in discovering how those of our respondents who form inflation expectations react to the expected inflation rate (see Table 10).

Table 10: New Zealanders' reaction to *expected* inflation (in per cent, multiple answers possible)

Question: 'Which of the following does the expected rate of inflation influence, if any? Please select as many options as apply'	Share	Factor loadings
Your total spending on goods and services	52%	0.62
How much you spend on food and groceries, clothes, petrol, and other consumables	47%	0.74
How much you spend on white goods, televisions, cars, and other 'big ticket' items	45%	0.70
How much you spend on eating out, holidays, and other discretionary expenditure	39%	0.75
How much you save	47%	0.53
The rate of inflation does not influence how much I save or my spending	26%	-0.62

Note: Subsample of 250 observations.

With the exception of 'The rate of inflation does not influence how much I save or my spending', we find that the alternatives are chosen by at least 40 per cent of the respondents. When we calculate t-tests of the average shares in Table 10 against 0.5, we find that we can again reject the null hypothesis at the 5 per cent level in the case of 'How much you spend on eating out, holidays, and other discretionary expenditure' and 'The rate of inflation does not influence how much I save or my spending'.[11] As before, we do not find

[10] Results available on request.

[11] Using t-tests to test whether the shares are different from 0.5, we obtain the following results: 'Your total spending on goods and services': p-value: 0.61, 'How much you spend on food and groceries, clothes, petrol,

notably different adjustment behaviour to inflation in terms of the type of goods bought or the decision to save.

We employ factor analysis to investigate whether this conclusion holds at the individual level. The Kaiser-Meyer-Olkin measure of sampling adequacy supports our choice (average value of 0.8 and no individual value below 0.77) by suggesting that the precondition for conducting a factor analysis is fulfilled and so does the LR test of independence ($Chi^2(15)$ = 519 (p-value: 0.000)). The scree plot, as well as the difference between the two largest eigenvalues (first eigenvalue: 2.6; second eigenvalue: 0.33), support the existence of one relevant factor. Re-running the factor analysis under the restriction of one factor, we obtain the factor loadings given in the last column of Table 10. Factor loadings are high; even the lowest ('How much you save') is larger than 0.5. The signs of the loadings are all positive, except for 'The rate of inflation does not influence how much I save or my spending'. We interpret this factor as measuring New Zealanders' economic adjustment to expected inflation, with higher values indicating a stronger reaction. We call this factor 'Reaction to expected inflation'.

Starting with a correlation between the factor and many respondent characteristics, we find some notable correlation coefficients. Particularly, respondents who are financially satisfied show a negative correlation with 'Reaction to expected inflation' (–0.34). The second and third largest correlation coefficients refer to time preferences. Those who are more patient (–0.22) and those not subject to hyperbolic discounting (–0.22) show a lower probability of adjusting their economic behaviour in light of expected inflation.

To study conditional correlations, we estimate a general regression model involving 59 variables and impose a valid testing-down restriction, which yields the reduced model in Table 11.

The testing-down restriction refers to the 225 observations employed when estimating the general model. At 0.21, the coefficient of determination is quite high for a cross-section regression, but even in the reduced model we still include 18 variables, one-third of which are not significant. However, eliminating these variables from the general model would violate the testing-down restriction.[12] Table 11 sets out the results of re-estimating the reduced model with more than 20 additional observations, available due to including fewer variables. This increases estimation efficiency and allows parameter stability testing. Our estimates are qualitatively stable, but there appear to be significant quantitative differences in 13 out of 18 variables and thus these results should be treated with some caution.[13]

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and other consumables': p-value: 0.38, 'How much you spend on white goods, televisions, cars, and other "big ticket" items': p-value: 0.10, 'How much you spend on eating out, holidays, and other discretionary expenditure': p-value: 0.001***, 'How much you save': p-value: 0.31, and 'The rate of inflation does not influence how much I save or my spending': p-value: 0.000***.

[12] The significance of the testing-down restriction including these variables indicates collinearity. However, removing some of them would increase standard errors of other variables, which suggests that standard-error reducing complementarity (Hayo 2017) plays a role, too.

[13] The equality test is not significant at a 5 per cent level in the case of 'Retired', 'Self-employed part time', 'Employed part time', 'Beneficiary', or 'Student'.

Table 11: Explaining factor 'Reaction to expected inflation' (reduced model)

	Coefficient	SE	Coeff./stand. dev. of dependent variable
Auckland	0.305**	0.150	0.34
North Island	0.290**	0.142	0.32
Patient time preference	- 0.573***	0.217	- 0.17#
Satisfaction with financial situation	- 0.224***	0.054	- 0.28#
Politicians act in public's best interest	- 0.069	0.053	n.a.
Information through radio	- 0.334*	0.195	- 0.37
Information through TV	- 0.186	0.160	n.a.
Information through Internet	- 0.109	0.139	n.a.
Information through financial sector	- 0.233	0.149	n.a.
Unemployed	0.096	0.374	n.a.
Retired	0.505**	0.252	0.55
Self-employed full time	0.557**	0.283	0.61
Self-employed part time	0.536	0.228	n.a.
Employed full time	0.359**	0.365	0.59
Employed part time	0.518**	0.257	0.57
Beneficiary	0.726**	0.290	0.80
Student	0.570**	0.282	0.63
Time spent on survey	- 0.007***	0.002	- 0.10#
Constant	0.825	0.352	n.a.
R^2 = 0.21; F(18, 228) = 6.2***; testing-down restriction: F(41, 163) = 1.24; number of observations: 247			

Notes: Estimated using an OLS model. White (1980) robust SEs are used. # indicates a standardised regression coefficient. For dummy variable reference values, see list of variables in the Appendix. *, **, and *** indicate significance at a 10%, 5%, and 1% level, respectively.

Concentrating on the 11 variables significant at a 5 per cent level, the following conclusions can be drawn. People living on the North Island react more strongly than those living on the South Island. The magnitude of this association is notable: for inhabitants of the North Island we find an effect on the factor 'Reaction to expected inflation' of more than 30 per cent of a standard deviation of the dependent variable compared to South Islanders.

An even stronger association can be observed for labour market indicators. Those respondents who are active on the labour market tend to have a higher likelihood of reacting to the expected inflation rate. In the cases of 'Self-employed full time', 'Employed full time' and 'Employed part time', the influence equals 56, 36, and 52 per cent of one standard deviation of the factor 'Reaction to expected inflation', respectively. Even higher are the estimated values for those who are economically vulnerable, that is, 'Beneficiary' (73 per cent) and 'Student' (57 per cent).

Three of the remaining variables are continuous variables. Respondents who reported higher values of 'Patient time preference', 'Satisfaction with financial situation', and 'Time spent on survey' are less likely to react to expected inflation. The corresponding standardised

coefficients are –0.17, –0.28, and –0.10, respectively. Thus, subjective financial situation has the relatively greatest association with 'Reaction to expected inflation', whereas the impact of the survey time indicator is three times smaller. The time preference variable lies in between. Does the size of the expected inflation rate make a difference? The correlation coefficient with the factor 'Reaction to expected inflation' is 0.002 and including the expected inflation rate in the reduced model given in Table 11 shows no significant relationship.

It is interesting to compare these findings with those from Table 7 on the previous inflation rate. Since the number of variables differs substantially, it may be more instructive to look at adjusted R^2s, where we find a value of 0.04 for the regression explaining the reaction to inflation and 0.14 for the one explaining the reaction to expected inflation. Therefore, we seem to have a relatively better understanding about who claims to react to the expected inflation rate. In terms of variables, we find little overlap. The only variable common to both models is 'Satisfaction with financial situation', which implies that those who feel better-off economically are less likely to react to the inflation rate, either current or future. However, both models agree that the objective economic variables do not seem to play a role and neither does the individual's perception of past inflation nor his or her expectation as to the future rate. This finding throws further doubt on the advisability of modelling layperson's reactions to the inflation rate under the assumption of rationality, but the caveat about a low inflation environment is relevant here, too.

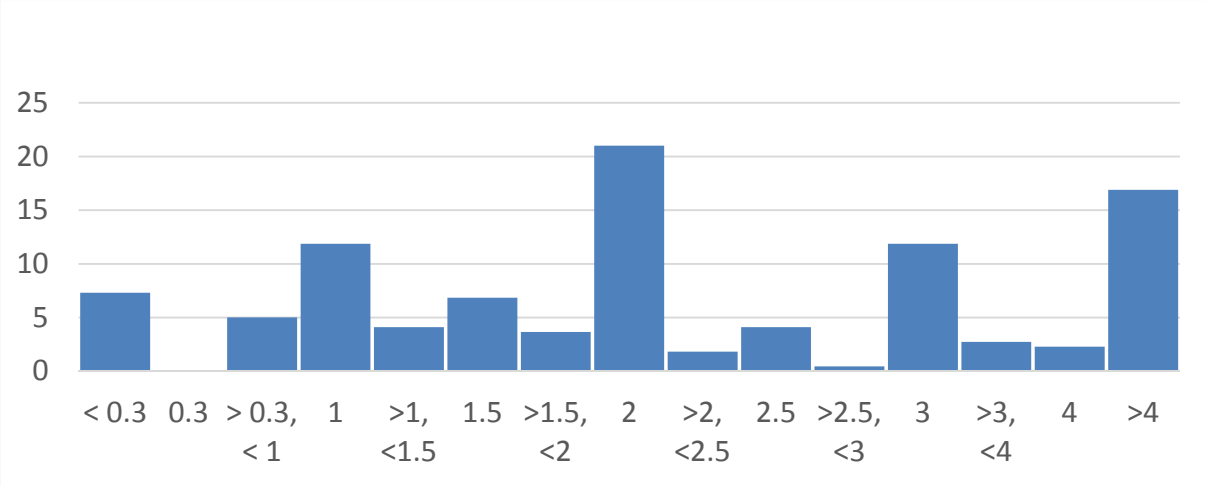
We find that the arithmetic mean for the expected inflation rate in 2017 is roughly 4 per cent and the median is 2 per cent. The actual inflation rate in 2017 was about 2 per cent meaning that, once again, a familiar pattern is revealed: the arithmetic mean overpredicts and the median is much closer to the actual values.[14] There are no directly comparable data on inflation expectations from a source other than the ones employed here. However, on behalf of the RBNZ, UMR Research quarterly collects a sample of 750 New Zealanders who are asked about their inflation expectations.[15] The arithmetic mean based on the answers given in June 2016 for the period until the end of the first quarter in 2017 is 2.2 per cent and the median 2 per cent and the answers for 2017 given in December 2016 are 3 per cent for both mean and median. So while the arithmetic mean in our dataset is larger than in any of these other surveys, our median is very similar to the one based on answers given in June 2016. When comparing this with the Business Survey of Expectations, a New Zealand-wide quarterly survey of business managers and professionals conducted by Nielsen on behalf of the RBNZ, we find a lower average of 1.2 and 1.9 per cent for the June and December 2016 survey, respectively.[16] Thus, as do others, we find that the population tends to overestimate the inflation rate compared to professional forecasters (see, e.g., Carroll 2003). More generally, there is a longstanding debate in economics about the predictive accuracy of survey-based expectation forecasts. The latest comparison we are aware of is by Berge (2017) over the period 1990–2015 for the United States. He comes to a sobering conclusion:

[14] See https://www.rbnz.govt.nz/statistics/key-graphs/key-graph-inflation
[15] See https://www.rbnz.govt.nz/statistics/m13 for more details.
[16] See https://www.rbnz.govt.nz/statistics/m14 for more details.

‘the surveys, whether used literally or bias-adjusted, do not outperform simple univariate time-series models’ (p. 3).

The shape of the expected inflation distribution looks similar to one describing the perception of past inflation. Hence, the points made in the discussion of Figure 3 referring to past inflation pertain to expected inflation, too. Figure 5 summarises the distribution.

Figure 5: Summarised distribution of ‘Inflation rate last year’ (answers in per cent)



Two per cent is the mode of this distribution and almost 70 per cent of the probability mass falls within the PTA range of 1 to 3 per cent. This suggests that the RBNZ has either been successful in communicating its main monetary policy objective or people converge to this range because of other reasons. However, there is still notable variation around the PTA range.

Finally, we want to estimate a model that helps us understand which variables are associated with the magnitude of the expected inflation rate. The approach is similar to the one taken when we investigated people’s perception of the past inflation rate. The only difference with regard to the explanatory variables is that we now additionally include people’s perception of last year’s inflation rate, increasing the number of correlates to 60. Starting with a correlation analysis, we find that the three variables yielding the largest correlation coefficients in absolute terms with ‘Expected inflation rate’ are ‘Inflation rate last year’ (0.85), ‘Macroeconomic knowledge’(–0.35), and ‘Feels informed about inflation’ (–0.31). Thus, there appears to be a strong link between past inflation and expected inflation. Moreover, the latter two explanatory variables are highly correlated with the past inflation rate (see Section3).

Next, we study whether these relationships hold in a multivariate context. Note that we now use 60 variables in the general model, as we additionally include ‘Inflation rate last year’. Table 12 contains the reduced model after a consistent testing-down process.

Table 12: Explaining 'Expected inflation rate'

	Coefficient	SE	Coefficient by standard deviation
Labour Party	- 1.25**	0.60	n.a.
Beneficiary	1.18***	0.31	n.a.
Inflation rate last year	1.06***	0.05	8
Constant	0.94**	0.48	n.a.
R^2 = 0.72; F(3, 165) = 141***; Regression SE = 5.1; White (1980) heteroscedasticity test: $Chi^2(5)$ = 3.3; testing-down restriction: F(57, 106) = 0.62; number of observations: 169.			

Notes: Estimated using OLS. SE = standard error. White (1980) robust SEs are used. For dummy variable reference values, see list of variables in the Appendix. *, **, and *** indicate significance at a 10%, 5%, and 1% level, respectively.

Before proceeding with the interpretation, we engage in two robustness tests. First, we check the significance of our estimation results using normal standard errors. The White (1980) test indicates no evidence of heteroscedasticity, but the Breusch-Pagan test does ($Chi^2(1)$ = 6.9***). Applying normal standard errors, we find that 'Labour Party' and 'Beneficiary' are no longer statistically significant, but 'Inflation rate last year' is still significant at a 1 per cent level.

Second, we re-estimate the model using additional observations that have become available after reducing the model size. Some changes occur: (i) 'Labour Party' is no longer significant; and (ii) although the signs and rough magnitude of the coefficients are the same, the coefficients are statistically significantly different from those in Table 12.[17]

Testing the size of the coefficients for the three variables reported in Table 12 against unity, we cannot reject that restriction in any of the model variations discussed above. Thus, voters for the Labour Party (Beneficiaries) tend to have a roughly one percentage point lower (higher) inflation expectation than other respondents. However, the only really robust influence appears to be 'Inflation rate last year'. Put differently, respondents' inflation expectations are not statistically significantly different from their perceived inflation rates in the preceding year. These findings are in line with attempts at modelling expectations at a macroeconomic level in New Zealand. McDonald (2017) provides empirical evidence that non-tradable inflation is better forecast by adaptive expectation formation than it is by forward-looking expectation formation. Thus, at least in this respect, micro-level and macro-level results are consistent.

Comparing our findings with Malmendier and Nagel's (2016) study using time-series based data, we discover only little evidence to support their suggestion that age plays an important role. We do find a relatively notable negative correlation coefficient between the stated expected inflation value and age (–0.28), suggesting that older respondents have more realistic expectations, but this does not survive in a multivariate context, even when excluding last year's inflation rate. Moreover, we do not find any influence of other

[17] Coefficients estimated using 185 observations: 'Labour Party' (–0.90), 'Beneficiary' (0.99***), and 'Inflation rate last year' (0.97***).

consumption-relevant variables, such as debtor/saver, income, or wealth, as might be expected when extending the findings by Ehrmann et al. (2015).

5. Conclusion

In this paper, we study how inflation is viewed by the general population of New Zealand. Based on unique representative survey data and using descriptive statistics and multivariate regressions, we explore various aspects of how laypersons perceive inflation and form inflation expectations Conceptually, our analysis takes place within an extension of a framework put forward by Ranyard et al. (2008). We focus on how an individual's economic situation, information search and interest in inflation, economic knowledge, and attitudes and values are related to inflation perception and expectation. In addition, we control for the possible influence of a large number of socio-demographic and psychological indicators. A major caveat of our analysis is that at the time of our survey, the inflation rate in New Zealand was quite low and many of our conclusions may be conditional on this type of economic environment.

Our main findings can be summarised as follows. First, people seem to feel that they are reasonably well-informed about inflation, as only about 25 per cent say that their knowledge is poor, very poor, or they don't know. However, when we ask our respondents to state what the inflation rate is, less than 45 per cent are able to do so. This suggests that laypersons' knowledge about inflation is imprecise and intuitive.

Second, people do not accurately remember previous inflation rates. In 2015, the official inflation rate in New Zealand was 0.3 per cent, whereas the arithmetic mean in our sample is about 4 per cent. Overestimation of the inflation rate by laypersons is a rather generally valid finding that is confirmed under extraordinary shocks, for instance, introduction of the euro (e.g., Greitemeyer et al. 2005) as well as normal economic conditions, for instance, as documented for almost any period in the United States by the Michigan Surveys of Consumers. Using direct or indirect filtering methods, such as winsorising or taking the median, averages can be brought closer to the actual value. We believe, however, that such practices are not appropriate when the aim is to understand people's knowledge about inflation. We find that when stating inflation rates, people are attracted to natural numbers. In contrast, the official rate of inflation does not work as an attractor. We interpret this set of findings as evidence that people use mental shortcuts when thinking about the inflation rate. More than two-thirds of the respondents remember a number between 1 and 3 per cent, which reflects the range for the inflation rate as agreed to in the Policy Targets Agreement, a unique part of the monetary regime in New Zealand. While we can rule out the possibility that New Zealanders explicitly remember the PTA values, we cannot say whether the oft-chosen range for the inflation rate is due to (i) an unconscious reflection of the PTA range, (ii) a diffuse memory of inflation rates experienced in the past, or (iii) coincidence.

Third, we study correlates of remembering high inflation rates and discover that respondents who are married, reside in towns (rather than cities or villages), and have a

desire to be informed about inflation rates significantly overpredict the inflation rate. Quite the reverse is found for those having a high level of subjective and objective macroeconomic knowledge. We also find that only 35 per cent of the population explicitly follows the inflation rate. Those who do possess a high level of subjective and objective macroeconomic knowledge as well as an interest in the RBNZ. Thus, the results are consistent with the notion that actively monitoring inflation is a precondition for having a relatively precise idea of the inflation rate and stand in contrast to the notion that people unconsciously acquire this information.

Fourth, creating an indicator of economic reaction to the perceived inflation rate using factor analysis, we find it difficult to explain who reacts to the inflation rate. Our interpretation is that the economic reaction to inflation is strongly determined by unobservable factors and/or mainly subject to idiosyncratic influences. At this point, we would like to emphasise that core economic variables, such as income, wealth, or saver/debtor position, do not appear to play any role here or elsewhere in the analyses.

Fifth, we discover that only 25 per cent of New Zealanders form expectations about the future inflation rate. There is a strong association between respondents who feel well informed about inflation and the central bank and those forming expectations. We also find that those who obtain their information about the RBNZ from either their bank advisor or another financial sector are more likely to form expectations. This is interesting in that professional observers tend to emphasise understanding the forward guidance provided by central banks and it appears that they are able to convey the importance of this to those laypersons who rely on them for information. Finally, we find evidence that respondents who are not earning their main income on the labour market are even less interested in forming inflation expectations than other groups in society. A similar finding emerges when studying stated economic reactions: respondents involved in labour market activity have a relatively greater likelihood of reacting to the expected inflation rate.

Sixth, the magnitude of the stated expected inflation rate is robustly and significantly related to the perceived inflation rate last period. The magnitude between the two inflation rates is not significantly different from unity, suggesting that perceived and expected inflation rates move in a one-to-one fashion. This micro-level finding is in line with McDonald's (2017) macroeconomic evidence, suggesting that adaptive inflation formation is superior to forward-looking expectation formation when forecasting inflation.

Thus, with respect to the population at large, we interpret our results as an indication that laypersons' knowledge about inflation is more in line with the imperfect information view prevailing in social psychology (see, e.g., Williamson and Wearing 1996) than with the rational actor view often assumed in economics. For instance, in light of the conclusion by Carvalho and Nechio (2014) that a household's understanding of interest rate decisions can be understood in terms of a Taylor rule, our findings suggest that these conclusions could be spurious and may be the result of putting too much theoretical structure on potentially uninformative empirical data.

As policy conclusions, we would like to stress that creating more interest in monetary policy, as well as increasing the level of subjective and objective information, will make it more

likely that laypersons will behave in ways expected by mainstream economic theory. This implies spending more effort on educating the general population on such matters, which raises issues similar to those discussed in the literature on 'financial literacy' (see, e.g., Lusardi and Mitchell 2014).

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Appendix

Variable Descriptions. See Hayo and Neumeier (2016) for more information about the survey and the questionnaire.

Explained Variables

Variable	Coding and Comments	Mean	Standard Deviation	Min	Max
Inflation rate last year	Remembered inflation rate for 2015 in per cent.	0.15	0.36	0	1
Monitoring the inflation rate	Dummy. Coded 1 if respondents monitor the inflation rate.	0.35	0.48	0	1
Reaction to inflation	Factor based on various answers to question: 'Which of the following does the current rate of inflation influence, if any? Please select as many options as apply' (see Table 6).	0	0.91	-1.3	1.2
Reaction to expected inflation	Factor based on various answers to question: 'Which of the following does the expected rate of inflation influence, if any? Please select as many options as apply' (see Table 10).	0	0.91	-1.3	1.3
Inflation expectation formation	Dummy. Coded 1 if respondents form an opinion about inflation in the future.	0.25	0.43	0	1
Expected inflation rate	Expected inflation rate for 2017 in per cent.	4.32	9.75	-1	80

Note: 'Inflation rate last year' is also used as an explanatory variable in general model of 'Expected inflation rate'.

Explanatory Variables

Variable	Coding and Comments	Mean	Standard Deviation	Min	Max
(i) 'Economic Situation'					
Income	Per capita household income in NZD1,000. We added 184 observations through 10 rounds of imputations using: Age, Age squared, education dummies, Saver, Future-oriented time preference, Self-employed full time, Employed full time, Employed part time, Retired, Student, Unemployed, Beneficiary. Descriptive statistics for imputation 10.	34.0	27.1	2.7	240

Net personal wealth	In NZD1,000. We added 224 observations through 10 rounds of imputations using: Age, Age squared, education dummies, Saver, Future-oriented time preference, Self-employed full time, Employed full time, Employed part time, Retired, Student, Unemployed, Beneficiary. Descriptive statistics for imputation 10.	35.2	88.0	-375	500
Saver	Dummy	0.63	0.48	0	1
Debtor	Dummy	0.30	0.46	0	1
Satisfaction with financial situation	Very dissatisfied (coded 1) Dissatisfied (coded 2) Neither satisfied nor dissatisfied (coded 3) Satisfied (coded 4) Very satisfied (coded 5) Don't know (coded 3)	3.31	1.12	1	5
Employed full time	Dummy	0.38	0.49	0	1
Employed part time	Dummy	0.11	0.32	0	1
Homemaker	Dummy	0.06	0.24	0	1
Student	Dummy	0.08	0.27	0	1
Retired	Dummy	0.12	0.33	0	1
Unemployed	Dummy	0.05	0.21	0	1
Beneficiary	Dummy	0.04	0.20	0	1
(ii) 'Economic Knowledge'					
Macroeconomic knowledge	The sum of correct answers to questions on the bond rate, the goal set in the Fiscal Strategy Report, debt-to-GDP ratio, Official Cash Rate, main objective of RBNZ, independence of RBNZ with regard to interest rate setting, interest rate reaction to an expected increase in the inflation rate, inflation target as agreed in PTA.	2	1.75	0	8
Feels informed about RBNZ	Very poor (coded 1), Poor (coded 2), Neither poor nor good (coded 3), Good (coded 4), Very good (coded 5)	2.72	0.96	1	5

Feels informed about inflation	Very poor (coded 1), Poor (coded 2), Neither poor nor good (coded 3), Good (coded 4), Very good (coded 5)	3.42	1.17	1	5
Feels informed about OCR	Very poor (coded 1), Poor (coded 2), Neither poor nor good (coded 3), Good (coded 4), Very good (coded 5)	3.10	1.34	1	5
Heard of PTA	Dummy. Coded 1 if respondent has heard of the Policy Targets Agreement.	0.15	0.36	0	1
(iii) 'Information Search'					
Desire to be informed about RBNZ	Not at all important (coded 1), Unimportant (coded 2), Neither important nor unimportant (coded 3), Important (coded 4), Very important (coded 5), Don't know (coded 3)	3.18	1.06	1	5
Information through newspaper	Dummy	0.11	0.31	0	1
Information through radio	Dummy	0.08	0.27	0	1
Information through TV	Dummy	0.18	0.39	0	1
Information through Internet	Dummy	0.22	0.42	0	1
Information through friends	Dummy	0.12	0.32	0	1
Information through colleagues	Dummy	0.07	0.26	0	1
Information through own bank	Dummy	0.06	0.24	0	1
Information through financial sector	Dummy	0.06	0.24	0	1
Does not keep up with RBNZ	Dummy	0.12	0.32	0	1
(iv) 'Attitudes and Values'					
Trust in RBNZ	5-point Likert scale ranging from (1) 'No trust and confidence at all' to (5) 'Complete trust and confidence'; Don't know (coded 3).	3.30	0.96	1	5
Institutional trust	Principal component based on trust in government, trust in parliament, trust in United Nations, and trust in International Monetary Fund.	-3e-09	1.55	-3.50	4.38
General trust	Dummy	0.34	0.47	0	1

Politicians act in public's best interest	5-point Likert scale ranging from (1) 'Most politicians in New Zealand serve the interests of particular groups' to (5) 'Most politicians in New Zealand act with the general public's best interests in mind'.	3.02	0.93	1	5
Politicians long-term oriented	5-point Likert scale ranging from (1) 'Most politicians are only concerned about the next election' to (5) 'Most politicians are concerned about New Zealand's long-term well-being'.	2.38	1.15	1	5
Politicians fiscally competent	5-point Likert scale ranging from (1) 'The Government wastes the revenue it collects in taxes' to (5) 'The Government conscientiously manages the revenue it collects in taxes'.	2.73	1.11	1	5
Confidence in politicians	5-point Likert scale ranging from (1) 'I do not have confidence in New Zealand politicians' to (5) 'Overall, I have confidence in New Zealand politicians'.	2.59	1.12	1	5
Egalitarian attitude	5-point Likert scale ranging from (1) 'To encourage individual effort, the difference between people's incomes should be greater' to (5) 'People's incomes should be more equal'.	3.32	1.20	1	5
National Party	Dummy	0.29	0.45	0	1
Labour Party	Dummy	0.23	0.42	0	1
Green Party	Dummy	0.14	0.34	0	1
New Zealand First	Dummy	0.08	0.28	0	1
(v) 'Socio-Demographic and Psychologicallindicators'					
Female	Dummy	0.52	0.50	0	1
Age	5-year intervals starting from 18 years	6.58	3.33	1	13
Children	Dummy	0.31	0.46	0	1
Married	Dummy	0.62	0.48	0	1
Secondary school qualification	Dummy	0.26	0.44	0	1
Polytechnic qualification or trade certificate	Dummy	0.20	0.40	0	1

Bachelor's degree or higher	Dummy	0.41	0.49	0	1
Self-employed full time	Dummy	0.06	0.24	0	1
Self-employed part time	Dummy	0.05	0.22	0	1
Town	Dummy	0.28	0.45	0	1
Rural	Dummy	0.20	0.40	0	1
North Island	Dummy	0.43	0.50	0	1
Auckland	Dummy	0.32	0.47	0	1
NZ European	Dummy	0.68	0.47	0	1
Maori	Dummy	0.04	0.19	0	1
Asian	Dummy	0.10	0.30	0	1
Risk propensity	Continuous variable that varies between −1 (maximum risk aversion) and +1 (maximum risk propensity). We assessed the interviewees' risk preferences by confronting the interviewees with the choice of either receiving a safe payoff or taking part in a lottery.	0.03	0.65	-1	1
Future-oriented time preference	Continuous variable running from 0 (completely impatient) to 1 (completely patient). Two experiments are conducted to assess the respondents' time preferences in order to account for the fact that many people are more patient in the long run than in the short run.	0.61	0.28	0.29	1
Short-run impatience	Continuous variable running from 0 (completely impatient) to 1 (completely patient). Two experiments are conducted to assess the respondents' time preferences in order to account for the fact that many people are more patient in the long run than in the short run.	0.56	0.27	0.29	1
Time spent on survey	Time respondent needed to fill out the questionnaire (in hours)	1.62	11.3	0.06	194

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