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ABSTRACT

We implement a new survey of firms' macroeconomic beliefs in New Zealand and document a number of novel stylized facts from this survey. Despite nearly twenty-five years under an inflation targeting regime, there is widespread dispersion in firms' beliefs about both past and future macroeconomic conditions, especially inflation, with average beliefs about recent and past inflation being much higher than those of professional forecasters. Much of the dispersion in beliefs can be explained by firms' incentives to collect and process information, i.e. rational inattention motives. Using experimental methods, we find that firms update their beliefs in a Bayesian manner when presented with new information about the economy. But few firms seem to think that inflation is important to their business decisions and therefore they tend to devote few resources to collecting and processing information about inflation.

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1 Introduction

Central banks like the U.S. Federal Reserve or the European Central Bank target inflation and employment rates, both of which depend on firm-level decisions. Because of their dynamic nature, the employment and pricing choices made by firms depend directly upon their expectations of future economic conditions. Measuring and understanding these expectations is therefore fundamental to the effective use of monetary policy. And yet, information on firms' beliefs is scant.[1] Economists have access to detailed surveys of consumers' expectations, along with those of professional forecasters, financial market participants, and even those of FOMC members. But comparable quantitative surveys of firms' beliefs are inexplicably lacking.

In this paper, we take a first step toward filling this gap by reporting results from a new large quantitative survey of firms in New Zealand. This survey, which includes over three thousand firms, provides detailed information about general managers' economic beliefs, including their expectations of recent and future macroeconomic conditions. This allows us to characterize firms' attentiveness to recent macroeconomic developments as well as their expectations about the future. We also study the determinants of each, using a rich set of quantitative firm-level controls from the survey.

This survey of firms is unique in several ways. First, the survey is quantitative in nature. While some surveys of firms' expectations exist (e.g. Conference Board, Ifo), they tend to be primarily qualitative (e.g. "do you expect prices to rise, fall or stay the same in the next twelve months?"), thus making it difficult to extract quantitative measures of expectations (Bachmann and Elstner 2013). In contrast, we extract quantitative answers from firms about their beliefs in the same manner as existing surveys of households' or professional forecasters' expectations. In addition, we ask firms to provide probability distributions for their forecasts so that we can examine not only distributions of point forecasts across respondents but also construct measures of firm-specific uncertainty about the future path of macroeconomic and microeconomic variables.

Second, the survey covers a wide range of firms. The few quantitative surveys which include some firms (e.g. Livingston survey) consider only very large firms. Because these firms typically employ macroeconomists on staff who are likely to be the respondents of any such survey, the reported forecasts mimic those of professional forecasters. But it is unclear whether these reported forecasts are in any way characteristic of other agents in the firm or are utilized in actual economic decisions made by the firm. In contrast, our survey includes both small and medium-sized firms, with respondents being the general managers of each firm.

Third, we ask firms not only about their expectations of future economic outcomes but also their beliefs about recent economic conditions. Given that macroeconomic data is readily available to firms,

[1] We refer to the beliefs of decision-makers within firms as "firms' beliefs" as short-hand, with obvious abuse of terminology.

this allows us to study how attentive firms are to macroeconomic developments as well as what factors determine how much attention firms devote to tracking macroeconomic conditions. Such potential factors include differences by industry, age, size, number of competitors, access to international markets, or expected duration until subsequent pricing decisions, among many others that we collect in the survey.

Fourth, in addition to the main survey, we conducted three follow-up surveys. This panel dimension of the survey contrasts with repeated cross-sections in typical surveys of economic agents and allows us to study the evolution of firms' beliefs about past, current and future economic conditions. We also use follow-up surveys to verify the accuracy of firms' responses.

The quality of the survey responses appears to be quite high. We verified that reported answers about the age of the firm and current prices conform to those available in administrative and online records as well as independent inquiries. We also show that firms which report higher frequencies of price reviews report more frequent price changes over the preceding twelve months on average. The panel dimension to the survey allows us to verify that firms report consistent answers across surveys. For example, we ask firms to report prices over each of the preceding four quarters, with the follow-up survey being approximately five months after the first survey. There is widespread consistency in price reports over the overlapping periods. We can also verify the quality of some of firms' expectational answers. For example, we ask firms in the main survey when they next expect to change their prices and by how much. Given that firms provide us with their prices in a follow-up survey, we can check whether firms did indeed change their prices when they expected to and by how. We document remarkable agreement between firms' expectations of their future price changes and their subsequent price decisions. In short, each test confirms that the quality of the reported data is high.

Using this novel data, we document a number of new stylized facts about the macroeconomic beliefs held by those agents in charge of running firms. First, we document significant heterogeneity in attentiveness across firms to recent macroeconomic conditions. For example, while 49% of firms report beliefs of inflation over the previous twelve months between one and three percent—we call these firms "informed" since actual inflation averaged slightly under 2%—almost 20% of firms report beliefs that inflation was 10% or more during this time period. This is despite the fact that New Zealand was the first country to implement formal inflation targeting in 1990 and has experienced relatively low and stable inflation since then. In contrast, no firms reported believing that prices had fallen during this time period, so errors about recent inflation were highly asymmetric. This asymmetry is absent in firm beliefs about GDP growth, unemployment rates, exchange rates, interest rates and industry-specific inflation rates. However, for each macroeconomic variable, there is a wide dispersion in beliefs about recent economic conditions that is strongly at odds with the assumption of common beliefs but is a priori consistent with models of inattention such as sticky information models (e.g. Mankiw and Reis 2002) or noisy

information models (Woodford 2001, Sims 2003). Also consistent with these models, there is high persistence in firms' forecast errors, a feature we can assess due to the panel nature of this survey data.

Second, given the richness of firm, industry and manager-specific information in the survey, we can study the sources of variation in inattention across firms. Focusing on inflation backcasts, we find that the characteristics of the manager account for very little of the variation in beliefs about recent inflation, nor do recent price changes made by the firm or in the firm's industry. Instead, we find robust evidence that firms' inattentiveness to recent macroeconomic information is systematically related to their incentives to process or track such information: firms which face more competitors and firms which expect to change their prices sooner are more likely to be better informed than firms with fewer competitors or those which do not expect to change their prices in the near future. In the same spirit, firms with steeper average profit functions (for whom information is more valuable) also tend to have better information. These patterns are consistent with rational inattention explanations of agents' expectations formation process, as in Sims (2003), Reis (2006), or Mackowiak and Wiederholt (2009).

Third, firms' forecasts resemble those of households much more than those of professional forecasters. In the fourth quarter of 2013, the mean forecast of inflation across firms, for example, was about 5% while that of households was over 3% whereas professional forecasters in Consensus Economics were forecasting an annual inflation rate of only 2.0%. Second moments reveal even larger disparities. Professional forecasters disagreed very little about inflation forecasts, whereas both households and firms display significant heterogeneity in inflation forecasts. This heterogeneity is again highly asymmetric: while 56% of firms expect inflation to be between 0 and 5%, all other firms expect inflation to be higher than this range. The diversity of views among firms is also not limited to inflation: we document similar heterogeneity in beliefs about future output growth, the interest rate and the unemployment rate.

Fourth, we focus on macroeconomic forecasts and their relationship to firms' beliefs about recent macroeconomic conditions. Across macroeconomic variables, there is a very strong correlation between firms' backcasts and forecasts, which suggests that inattention to recent conditions is a primary source of differences in beliefs about the future. For example, firms which are "informed" about recent inflation rates tend to report inflation forecasts much closer to ex-post true values than do "uninformed" firms and tend to do so with more confidence. Questions that extract the uncertainty around firms' inflation forecasts reveal much higher levels of uncertainty for firms which report higher forecasts of inflation. But how "informed" a firm is not time-invariant: firms classified as "informed" in the first wave of the survey display a similar distribution of inflation forecasts by the time of the fourth wave as do firms originally classified as "uninformed." This feature reflects the fact firms often make large revisions in their forecasts across survey waves.

Our fifth set of facts therefore focuses on how firms revise their forecasts in light of new information. Specifically, we implemented an experimental design in the fourth wave of the survey in which we provided random subsets of firms with additional information about recent macroeconomic variables, forecasts of professional forecasters, the value of the central bank's inflation target, or the average forecast of other firms in the survey. Firms were asked to quantify their forecasts and the uncertainty around their forecasts prior to this information being revealed to them, then were asked for new forecasts after the additional information was provided to them. Consistent with models of Bayesian learning, firms systematically adjusted their forecasts in response to this new information and did so in the expected direction. The responses to information about inflation were generally stronger than those for information about GDP growth or unemployment and were particularly large in response to information about the central bank's inflation target. Also consistent with Bayesian learning is the fact that those firms with higher levels of a priori uncertainty revised their forecasts by more than did firms who were more confident in their original forecasts. This novel experimental evidence supports the notion that firms update their beliefs as in noisy information models and suggests that firms' inflation forecasts are particularly sensitive to new information.

Finally, we explore how firms seek out and process macroeconomic information. For example, firms report a striking asymmetry in how they would respond to positive versus negative news about the economy on TV: over 70% of firms would seek out more information if the economic news were negative, while less than 30% would do so if the economic news were positive. This cyclicality is consistent with empirical evidence in Coibion and Gorodnichenko (2011) and points toward important state-dependence in the acquisition and processing of information by firms, as in Gorodnichenko (2008) or Alvarez et al. (2011).

Rational inattention models suggest that agents should devote more resources to tracking variables which affect their profits or utility more. The survey asked firms to rank macroeconomic variables in terms of their importance for their business decisions. Consistent with rational inattention models, firms make systematically smaller errors about recent values of the variables that are important to their business decisions and report less uncertainty about them. There is also a strong correlation between the variables that firms identify as being important to business decisions and those which they track. Strikingly, well under half of firms report that they track inflation (whereas 80% report tracking GDP) and the average inflation backcast errors of these firms are five times larger on average than those made by firms which track inflation. One reason why some firms' inflation forecast errors are so large may therefore be that these firms do not view aggregate inflation as important to their business and do not devote resources to tracking its evolution.

Another prediction of models with endogenous acquisition of information is that strategic complementarities should induce firms to focus relatively more on public signals. We find a strong

positive correlation between the degree of strategic complementarity in price setting of firms and their preference for receiving public over private signals, which is in agreement with predictions of Hellwig and Veldkamp (2009). Higher strategic complementarity is also positively associated with firms preferring to wait for other firms to change their prices first when facing uncertainty—a finding consistent with Gorodnichenko (2008). Hence, these predictions of models with endogenous acquisition of information also receive support in the survey data.

Our results build on a growing literature studying the properties of agents' expectations. Theoretical work has long found that departures from full-information rational expectations can have profound consequences for economic dynamics and optimal policy (e.g. Lucas 1972). More recent work has studied the empirical properties of agents' expectations and how these relate to different models of the expectations formation process. Mankiw, Reis and Wolfers (2003), for example, document that the dispersion in U.S. households' inflation forecasts is much larger than that of professional forecasters. Carroll (2003) studies the transmission of macroeconomic information from professional forecasters to households. Coibion and Gorodnichenko (2012) estimate the rates at which different agents' forecast errors respond to structural shocks while Coibion and Gorodnichenko (2011) test for predictability of forecast errors from past forecast revisions as implied by models of imperfect information. Andrade and LeBihan (2013) assess the ability of imperfect information models to match key facts of the expectations of professional forecasters. Carvalho and Nechio (2014) find that many households report expectations that are inconsistent with monetary policy actions. This line of research has documented pervasive and systematic deviations from full-information rational expectations, with much of the empirical evidence being consistent with models of inattentiveness.

We differ from this previous work primarily in that we implement and study the results of a new survey of firms' macroeconomic expectations, whereas previous research has relied primarily on forecasts of households (such as from the Michigan Survey of Consumers), professional forecasters (Survey of Professional Forecasters, Consensus Economics surveys), financial market participants (expectations extracted from asset prices) or policymakers (Greenbooks, FOMC member forecasts). Like this prior work, we find pervasive departures from full-information rational expectations but now for the case of firms. In addition, we document not only the heterogeneity in firms' beliefs about future macroeconomic outcomes but also dramatic differences in their perceptions of recent economic developments, a key feature of imperfect information models. Furthermore, and again consistent with predictions of rational inattention models, we find systematic evidence that the quality of firms' information about macroeconomic conditions in part reflects their incentives to track and process such information, as in e.g. Gorodnichenko (2008) or Alvarez et al. (2011). We therefore interpret our results as not only filling an important gap in the literature by studying quantitative measures of firms' expectations but also as

providing some of the most direct evidence for rational inattention motives in the determination of agents' macroeconomic expectations.

The paper is organized as follows. Section 2 describes how the survey was implemented as well as evidence on the quality of firms' responses to survey questions. Section 3 focuses on firms' attentiveness to recent macroeconomic developments. Section 4 examines the forecasts of firms and how these forecasts relate to their beliefs about recent conditions. Section 5 provides additional results on how firms seek out and process information about macroeconomic conditions. Finally, section 6 concludes by discussing some implications of these results.

2 Implementation of the Survey and Quality Control

In this section, we first describe the way in which the survey was implemented (sampling frame, response rates, etc.). We also assess the quality of the responses provided by firms. Specifically, we cross-check firms' response against publicly available information, we make independent inquiries to verify the accuracy of survey responses, and check consistency of responses over time. We find that the quality of the survey is quite high: failure rates hover between 1 and 5 percent.

2.1 Implementation of the Survey

The survey of firms in New Zealand was done in four waves. The primary survey was implemented between September 2013 and January 2014 and included 3,153 firms. We selected firms using two directories: Kompass New Zealand (KNZ) and Knowledge Management Services (KMS). Around 10,000 firms were selected from the former and an additional 5,000 new firms from the latter. Both directories were purchased and they contain a comprehensive profile on New Zealand businesses including details on their activities, brands, management, products and services. Firms were randomly selected from both directories.

Firms were selected according to the Australia and New Zealand Standard Industrial Classification 2006 (ANZSIC06). To this end, we chose firms from four broad industrial groups: manufacturing; retail and wholesale trade; construction and transportation; professional and financial services. We selected firms that had an annual GST turnover greater than NZ$30,000 and at least 6 workers. Firm size within each industry could be classified as small (= 6-19 workers), medium (= 20-49 workers) and large (= beyond 50 workers).[2]

Since manufacturing and professional and financial services account for relatively large shares of GDP (Statistics NZ, 2012), we aimed to have two third of our sample from these two industries. The remaining one third is a combination of firms from other industries. We excluded industries related to the government, community service, agriculture, fishing and mining, and energy, gas and water from the

[2] Consistent with Statistics New Zealand surveys, see http://www.stats.govt.nz/browse_for_stats/businesses/business_growth_and_innovation/business-op-survey-2011-tables.aspx.

sample. These sectors are often dominated by a handful of extensively regulated firms or by very small firms.

Using the KNZ directory, we chose around 10,000 firms from a total of 15,000, thus rejecting 5,000 because they were very small in size. Smaller firms can be very unpredictable in their continuity; we therefore exclude all firms with less than 6 workers. The KMS directory contains around 30,000 firms and we randomly selected around 5,000 new firms not included in the KNZ directory. This yielded a population of around 15,000 firms. The general managers of these firms were surveyed by phone and the response rate was around 20 percent, yielding slightly over 3000 responses.

Firms received the information sheet and questionnaire through email about ten days before the phone call. This gave participants some time to consider their participation.[3] The phone survey occurred as follows: a research assistant (RA) called the general manager and asked questions. The RA recorded the answers in the questionnaire by hand and also recorded the responses in the phone. Then, an independent RA confirmed that the answers written in the questionnaire corresponded to the recorded responses in the phone. To maintain confidentiality of the participants and information, the phone records were then deleted at the end of the survey. The collected data was verified by two independent RAs. Specifically, they checked whether the spreadsheet responses matched the answers in the hardcopy questionnaire. Responses that were observable outliers were deleted from the sample, for instance, a firm that claims to have employed around 300 workers and sells about $10,000 worth of goods in three months. At the onset, we ran a pilot survey of 60 firms (which are not included in the main survey) to verify if the questions made sense to firms or if there were some questions which they systematically refused to answer.

The survey included a number of detailed questions about the firm, including its age, the size and composition of employment in the firm, questions about the composition of costs (share of labor, share of materials), exposure to foreign trade, as well as questions about the competitiveness of the firm's industry. Table 1 presents summary statistics from some of these questions, across all firms as well as across subsets of firms. We group firms into four main industries: a) Manufacturing, b) Trade, c) Professional and Financial Services, and d) Construction and Transportation. This is a slightly more aggregated grouping than SIC1. We then also consider more disaggegrated classifications, which we will refer to as "sub-industries," and which are more aggregated than SIC2 (Appendix 2 describes ANZSIC codes associated with each sub-industry). We implement this more aggregated classification to ensure that each sub-industry has more than 100 firms in the survey, as illustrated in Table 1. Note that the Construction and Transportation industry is not further decomposed as this sector contains significantly

[3] The most frequently mentioned reason for not participating was a concern for confidentiality, and especially an unwillingness to answer questions regarding total production value and capacity, as well as questions about profit margins.

fewer firms in the survey than other industries. In Appendix 3, we describe the construction of sampling weights to correct for possible imbalances in the sample relative to the population of firms. Using weights makes little difference for most of our estimates.

The average age of firms in our sample is 14.5 years and the average number of employees is just under 30. Both mask substantial underlying heterogeneity. For example, the largest firm in our sample has just under 700 employees. The combined employment of firms in our sample represents about 5% of total employment in New Zealand. The share of total revenues going to labor costs varies significantly across sectors but averages nearly 50% across all firms in the survey, with significantly lower shares in manufacturing firms and significantly higher shares in professional services. The share of revenues from foreign sales also varies widely: manufacturing firms have much higher shares of revenues coming from abroad than do other firms. We also asked about firms' current profit margins as well as their historical or average profit margins. Firms in professional and business services reported significantly higher margins both at the time of the survey as well as on average than did firms in other industries, with finance having the largest average margin while construction and transportation firms report the lowest average margins. Firms in all industries report, on average, that current margins are below historical margins.

A significant portion of the first wave was devoted to price setting and information collection decisions by firms. For example, we asked firms how frequently they formally review their prices (e.g. weekly, monthly, quarterly, etc.). The average duration between price reviews for all firms is 7.4 months, with much higher durations in construction and transportation (almost 11 months) and non-food retailing (over 11 months). We also asked firms when they expected to change the price of their main product and by how much. The average firm reported an expectation of nearly six months before their next price change, which would be a 5.6% increase in price on average. Within industries, sectors in which firms report longer durations until their next price change also report, on average, larger expected price changes. In the trade sector for example, food retailers state that they expect to change their price in under three months by less than 5% on average while non-food retailers expect to keep their prices unchanged for over seven months but then raise them by over 7% on average.

We also executed three follow-up surveys. The first follow-up (wave #2) was between February and April 2014. We contacted all firms from the main survey and achieved around 23 percent response rate from our initial set of firms, or slightly more than 700 responses. The second follow-up (wave #3) was between August and September 2014 and received 1,607 responses. The third follow-up (wave #4) was between December 2014 and January 2015 and received 1,257 responses. Follow-up surveys repeated some of the questions from the main survey but also included new questions not in the original survey. For example, the first follow-up expanded the set of macroeconomic variables which firms were asked about, the second follow-up primarily focused on collecting individual characteristics of the

respondent (e.g. age, income, education), and the third follow-up explored how firms acquire and process new information. We provide questionnaires for each wave in the Appendix.

2.2 Assessing the quality of the survey data

Because firms have no direct incentive to participate in the survey or to provide thoughtful or truthful answers, one may be concerned about the quality of the responses to the questions. To ascertain the quality of the survey responses, we considered a number of checks.

The first is to directly verify the quality of those responses which can be checked against other sources. For example, respondents were asked about the age of their firm. Since firms must be registered with the government, we can check administrative records to verify whether the reported age of the firm and administrative records conform. We performed this check for all firms in the survey and found that, for 87% of the firms in the sample, the reported age of the firm conformed to administrative records. When the two did not match, we inquired with the general managers as to the source of the mismatch. In almost all cases, the source of the difference was either that the firm had been registered before it started operating or that there had been a change in ownership. There were only three cases in which general managers had simply made a mistake as to the age of the firm, a failure rate of less than one-tenth of one percent.

A second response provided by firms which we could independently verify was the stated price of their main product. Because some firms maintain an online presence that includes prices of their goods, we verified two forms of firms' responses. First, does the firm actually sell the good which they claimed constitutes their primary revenue-generating product? For the 300 (randomly selected) firms for which we performed this check, only forty-seven did not explicitly list their main product on their website. We then called each of these firms to verify that they indeed sell the product. There were six firms for which we found that the product was not sold by the firm, a failure rate of 2%. Second, we verified the listed price of the good online against the price reported in the survey. Out of the 300 firms we checked, many did not have prices listed online. In these cases, we verified via online enquiries what price was available for the "main product" in the survey. There were 55 firms for which we were not able to verify prices. For the remaining 245 firms for whom we could either identify prices on their websites or via direct online enquiry, only nine reported prices different from those in the follow-up survey, a failure rate of 3.7%.

A third response which we could asses was whether the firm exports products or services abroad. To verify this, we again checked 300 firms. Of these 300 firms, 87 claimed in the survey to receive a positive share of revenues from foreign sales. We visited the websites of the 300 firms to determine whether they appeared to export products or services. For the 213 firms who claimed no foreign sales, only four reported clear export availability on their websites. Of the 87 firms who claimed foreign sales, we checked their websites to determine whether they appeared to export. If this could not be verified from

the website, we then called the firms to enquire about their ability to sell products and services abroad. Only seven of the 87 firms reported that they do not export despite having claimed positive shares of foreign sales in the survey. Jointly, this again yields a failure rate of 3.7%.

Another dimension of the survey that we could independently verify is the quality of answers to questions about individual characteristics of the survey respondent, primarily from the third wave of the survey. Many firms maintain an online profile of their staff, especially directors and managers. We randomly selected 10 percent of respondents from the third wave of the survey to assess whether the responses given by them about their position, qualifications and experiences were consistent with the publicly available data. We were unable to find names (position details) of only around 5% (8%) of the survey respondents. This is because some firms do not have an online profile of their staff. For those that had online details about qualification and experiences of their staff, we found a very strong match with the survey responses (≈99%).

In addition to verifying firms' survey responses against outside sources, we can also assess the internal consistency of their responses. For example, the survey includes a question about the *average* frequency at which firms review their prices, which we convert to an average number of months between price reviews, and also includes questions about their actual prices over the previous twelve months. Specifically, we asked firms to report their current price as well as their price three months, 6 months, 9 months and 12 months prior. From this last set of questions, we can measure the number of times prices were changed at this quarterly frequency. One would expect that firms who report higher frequencies of price reviews should, on average, report more frequent price changes as well. We test this in our data by regressing the number of price changes over the previous twelve months on the average number of months between price reviews from the main survey. The results are reported in Panel A of Table 2. Longer durations between price reviews are negatively related to the number of price changes reported by firms for the previous twelve months, regardless of the inclusion of different industry fixed effects or the use of sampling weights.

Second, we can verify whether firms report the same answers in response to the same question across the two surveys. We do this in two ways. The first is that, in both surveys, we asked firms to report the average frequency of price reviews. We can then compare whether firms report the same answer across surveys. As documented in Panel B of Table 2, the coefficient on the time between price reviews in the main survey is approximately one, and the R^2 is extremely high. A second way comes from the fact that we ask firms to report their prices at 3-month intervals going back one year in each survey. Because the surveys are separated in time by less than a year, there are overlapping periods for which firms reported prices in the first two waves of the survey. We can then assess whether these prices are consistent across the two surveys. As documented in Panel C of Table 2, when we regress the prices in

the follow-up survey on those in the main survey for these common periods, we find coefficients not statistically different from one and very high R^2.[4]

Ultimately, because we will focus on firms' beliefs about macroeconomic conditions, we would like to verify the quality of reported expectations of firms. We can do so using two survey questions. First, we asked firms in the main survey in how many months they expected to next change their price. Given that the follow-up survey includes reported price changes since the main survey, we can therefore verify whether firms who expected to change their prices soon did so at a higher frequency than firms who expected not to change their prices for an extended period. For each firm, we determine whether the firm has changed its price between the follow-up survey and the time of the first survey, by comparing the "current" price in the follow-up survey with either the "current price" from the first survey or the 3- or 6-month prior price in the follow-up survey. We then construct the fraction of firms who changed their price within each bin of possible durations until next price change reported in the main survey. As illustrated in Panel A of Figure 1, for firms who expected to change their price within the next four months at the time of the first survey, approximately 90% did indeed change their price by the time of the follow-up survey. For firms who originally expected not to change their price for at least seven months, almost none of the firms changed their price (exactly none when price changes are measured relative to the price from the main survey). In between four and seven months of expected price duration, there is a sharply falling share of firms which changed their prices, consistent with the time difference between the surveys. Hence, firms' original answers about when they next expected to change their prices have very strong predictive power for their ex-post decisions about whether to change prices.

One possible limitation of this test is that if firms change their prices at very fixed frequencies (as in Taylor 1980), then their ability to predict the date of the next price change may not be very informative about the quality of their expectations. An alternative test is to examine their expectation of the *size* of their next price change. We do so in Panel B of Figure 1, which plots the expected percentage price change reported in the main survey against actual price changes (percentage difference between "current" prices in the follow-up survey and "current" prices in the main survey). Note that these can differ because firms changed prices by a different amount than expected or changed them more than once. Nonetheless, there is a strikingly strong correlation between the ex-ante expectation of firms about the amount by which they will change their prices and their ex-post price changes from the follow-up survey, with most of the observations laying very close to the 45 degree line. Panel D of Table 1 confirms the fact that the estimated slope of the relationship is not statistically different from ones. These results are therefore consistent with firms reporting their true expectations in the survey.

[4] One should not expect perfect correlation between the two because the time periods for which firms are reporting prices may not perfectly overlap.

While one should always bear in mind the limitations of survey data, these results suggest that the quality of this survey data is quite high. For questions which can be independently verified against external sources, we find a lot of consistency between responses and outside sources, including for the reported age of the firm, prices of main products, and participating in foreign trade. There is also a lot of consistency across different questions within the survey. Firms which report reviewing their prices frequently also reported more frequent price changes on average. Similarly, reported prices across the main and the follow-up survey match up very closely, despite the time lags involved. And importantly, firms' responses about their expectations line up very closely with their subsequent actions, suggesting that we can be confident about the quality of respondents' answers about their beliefs and that firms' actions are based on these beliefs.

3 (In)Attentiveness to current and recent economic conditions

A unique dimension of the survey is that we ask firms about their beliefs regarding *recent* macroeconomic conditions. Whereas full-information rational expectations models assume that agents can immediately observe economic developments, models of inattention imply that agents find it optimal to limit the resources they devote to tracking information about the economy, leading to imperfect information about current and past economic conditions. The questions in the survey about perceptions of recent and current economic conditions can therefore provide a metric to evaluate the amount of inattention to aggregate economic conditions on the part of firms. In this section, we first describe the degree of inattention using different macroeconomic variables then discuss possible sources of inattention.

3.1 Degree of Inattention

To measure inattention to aggregate conditions, we rely primarily on questions in which respondents were asked about recent macroeconomic outcomes. For example, in the case of inflation, we asked respondents how much they believed overall prices in the economy had changed *over the last twelve months.* At the time of the first survey, annual CPI inflation in New Zealand was 1.5%, as illustrated in Figure 2. Inflation has been relatively stable in New Zealand since it became the first country to put in a place a formal inflation target in 1990, with only a few brief episodes in which inflation peaked around 4%. We then construct the "errors" made by firms with respect to inflation over the preceding 12 months by subtracting their reported belief about recent inflation from the actual inflation rate over this time period. Panel A of Figure 3 plots the distribution of these errors vis-a-vis recent inflation. First, approximately half of firms (49%) made relatively small errors, within 2 percentage points of the actual inflation rate, and we refer to these as "informed" firms. Approximately one in three firms made errors of more than 5 percentage points, and one in ten firms in the survey made errors of more than 10 percentage points. This points to very large heterogeneity in firms' attentiveness to recent inflation dynamics, with a wide range

of beliefs about recent price changes in the New Zealand economy despite the fact that actual inflation has consistently been low and fairly stable for 25 years.

A second point to note from Panel A of Figure 3 is that the distribution of inflation errors is highly asymmetric. Large errors are systematically negative, with these firms believing that price changes have been much larger than what actually happened. Only 5% of firms report a perception of recent inflation that is lower than actual inflation. Thus, the distribution of firm beliefs about recent inflation is very unevenly distributed around the actual value, despite the fact that inflation at the time of the survey was not exceptionally low. Armantier et al. (2012) document a similar distribution of perception errors on the part of U.S. households in a 2011 survey.

The dramatic heterogeneity in beliefs about recent inflation is not unique to inflation. In the fourth wave of the survey, we also asked firms about their perceptions of the growth rate of GDP over the last twelve months and the current unemployment rate, from which we can construct analogous backcast errors made by firms. The distributions of these errors are also plotted in Panel A of Figure 3. As with inflation, there is significant heterogeneity in beliefs across firms about the recent GDP growth rate and unemployment rate, although the dispersion of beliefs for these variables is significantly lower than for inflation and is largely symmetric around true values. In the fourth wave of the survey, we also asked firms to report their beliefs about price changes in their industry over the last 12 months. Using PPI inflation rates at the two-digit industry (SIC2) level, we also display the distribution of errors made by firms about industry-specific inflation rates in Panel A of Figure 3. Unlike errors about aggregate inflation, the distribution of errors about industry-specific inflation rates is symmetric and centered around zero, with the same order of dispersion as errors about GDP growth and unemployment. Hence, these results suggest that aggregate inflation generates unique patterns of errors on the part of firms that differ both qualitatively and quantitatively from those that arise for other macroeconomic variables or industry-specific price changes.

One can assess the extent to which inattention to economic conditions varies across macroeconomic variables. To do so, we regress the absolute value of a firm *i*'s "error" with respect to a macroeconomic variable *z* on the absolute value of the inflation error, i.e.

$$\left|z_t - B_t^i z_t\right| = \alpha + \beta\left|\pi_{t,t-12} - B_t^i \pi_{t,t-12}\right| + \delta_j + error \qquad (3.1)$$

where B^i denotes the belief (backcast or nowcast) of firm *i*, $\pi_{t,t-12}$ is the inflation rate over the last twelve months, and δ_j is a sub-industry fixed effect. We implement this test for each macroeconomic variable about which firms were asked in different waves and report all results in Table 3. The evidence is mixed: while inflation errors are positively correlated with errors in other macroeconomic variables in waves 1 and 2 of the survey, there is no such correlation in the final wave of the survey. These results suggest that while there is some sense in which inattention by firms extends across macroeconomic variables, the correlation is generally weak, especially when looking at inflation errors. This is consistent with the

evidence in Panel A of Figure 3 that firms make qualitatively different errors about inflation than other macroeconomic variables.

There is also significant heterogeneity in the dispersion within industries of firm-level errors about inflation. Panel B of Figure 3 plots these inflation errors for the four broad industry groupings: manufacturing; trade; professional and financial services; construction and transportation. In both manufacturing and trade, the majority of firms are well-informed. For example, two-thirds of firms in the manufacturing sector and eighty percent of firms in the trade sector have inflation errors of less than two percentage points. In contrast, the equivalent shares for the professional and financial services sector and the construction and transportation sector are only thirteen percent and twenty percent respectively. Furthermore, these last two sectors also have much larger fractions of firms making large errors than do firms in manufacturing or trade. These features systematically occur within each sub-industry as well, suggesting that inattention to inflation reflects deeper structural characteristics of firms or respondents.

3.2 Sources of Inattention

What accounts for the degree of inattention paid by firms to recent inflation dynamics? Panel B of Figure 3 highlights pronounced industry characteristics as one potential source. But as documented in Table 1, there are many economic differences between these sectors. For example, manufacturing and trade firms have, on average, a smaller share of costs coming from labor, lower profit margins, more exposure to foreign trade, and more frequent price reviews than do firms in construction, transportation, and professional financial services. There could also be differences in the recent pricing decisions of firms in these industries which affect their perceptions of overall price changes. Alternatively, differences in inattention could be driven by the personal characteristics of respondents, such as their age, income or education.

To assess the relative importance of these potential determinants of firm-level inattention, we regress firms' inattention to inflation, as measured by their absolute errors about recent inflation rates, on four groups of variables. The first group includes firm-level characteristics, such as the (log) age of the firm, its (log) total employment, labor costs as a share of revenues, and the share of foreign sales in total revenues.

The second group of explanatory variables focuses on the amount of competition faced by firms. Specifically, we include the number of direct competitors faced by the firm in its primary product, the average profit margin of the firm (similar results obtain using contemporaneous margins), as well as the firm's perception of how its price compares to those of its main competitors (as a percentage differential). Rational inattention arguments would imply that more competition should induce firms to devote more resources to collecting and processing information about their economic environment. The last variable in this block is the absolute value of the slope of the profit function. We calculate the slope as the ratio of by how much a firm could increase its profit (as a percent of revenue) if it could reset its price freely at the time of the survey relative to the percent price change the firm would implement if it could reset its price

freely at the time of the survey. Economic theory (e.g., Gorodnichenko 2008, Alvarez et al. 2011) suggests that if the slope of the profit function around the current price is close to zero, then a firms' incentive to change its price or to acquire information is low since the incremental gain is profits is approximately second-order while the costs could be first order. One should therefore expect that a greater slope in the profit function should be associated with better information and hence smaller forecast errors.

The third block of variables that we include focuses on price changes, both at the level of the firm and the industry. These include the percentage change in the firm's price over the previous twelve months. One might expect that firms which have raised their prices more could be extrapolating from their own behavior to that of others in forming beliefs about recent inflation, leading to larger errors about recent inflation. Similarly, we include the PPI inflation rate over the preceding twelve months for the firm's industry.[5] Again, one might expect that firms in industries where prices have gone up more rapidly would extrapolate these patterns to the broader economy leading to larger errors over recent inflation dynamics. Rational inattention motives suggest an opposite effect: firms who have raised their prices by more (or who are in industries where prices have gone up by more) face higher incentives to track economic conditions because of this greater volatility, potentially leading to smaller errors about recent inflation. We also include firms' reports about the expected size of their next price change as well as the number of months until they expect to change their price next. There is a clear rational inattention interpretation for the latter: firms have an incentive to collect information prior to changing prices (e.g. Gorodnichenko 2008, Alvarez et al. 2011) so one would expect firms which report short durations until the next price change to have more precise information about economic conditions. An alternative source of correlation with these variables could be going in the opposite direction: if firms think inflation has been high, then they should be more likely to change their prices sooner and by more. This channel would induce a positive correlation between inflation errors (since these are almost exclusively driven by beliefs of high inflation) and the expected size of price changes and negative correlation between inflation errors and expected durations until the next price change.

The fourth and final group of variables focuses on the characteristics of the individual respondent rather than the firm. These include the age of the respondent, income, education, and tenure at the firm.[6] Unlike all other variables, which were collected in the first wave of the survey, personal characteristics of respondents were collected in the third wave are therefore available only for a subset of firms. We therefore present results excluding individual characteristics but using all firms in the first wave in Table 4 (columns 1-2), results using only individual characteristics of respondents (columns 3-4) for firms participating in the

[5] PPI inflation rates are not made available at a consistent aggregation level. We use the most detailed level of industry inflation rates available for each firm. For some firms, these inflation rates are available at a more disaggregated level than the sub-industry sector while for others, inflation rates are available only at more aggregated levels than our sub-industry classification.

[6] Respondents are asked to report their income by choosing one of six income bins. We construct a continuous variable by assigning the mid-point of each income bin.

third wave, and results using all variables (columns 5-6). In each case, we use the absolute value of inflation errors made by firms in the first wave as the dependent variable since some control variables (such as expected duration until next price change) are not time-invariant and were only measured in the first wave of the survey.

As documented in Table 4, the correlations in the data are broadly supportive of rational inattention motives. We find negative correlations between firms' and industry inflation rates and the size of firms' inflation errors, consistent with firms devoting more attention to collecting and processing macroeconomic information in the face of more volatile price changes. The correlation between inflation errors and the expected duration until the next price change is negative, again as suggested by rational inattention motives. The coefficient on the slope of the profit function is negative, such that firms with steeper slopes in their profit functions have better information on average. Firms facing more competitors also make smaller errors on average. These results are robust to including sub-industry fixed effects and controlling for individual characteristics of respondents and therefore point squarely toward rational inattention motives in firms' decision about tracking inflation dynamics.

Two other results stand out from Table 4. First, larger firms make systematically larger errors about inflation, even after controlling for other firm or industry characteristics. However, firms in New Zealand are much smaller on average than firms in larger economies like the U.S. (for example, the largest firm in our sample has 698 employees), so it is unclear to what extent this result would apply in other countries. Second, the personal characteristics of respondents play little role in determining inflation errors once firm-level characteristics are included. This may reflect selection issues, since all respondents are general managers of firms and thus are not representative of the broader population, in which household surveys typically reveal systematic differences in beliefs about inflation according to individual characteristics.

3.3 Persistence of Inattention

Because our data has a panel component, we can assess the average persistence of inattention among firms, i.e. do firms with bigger errors in one period also tend to make bigger errors in the following period? To assess the persistence of inattention, we regress firms' absolute errors in later survey waves on the absolute errors they made in the previous waves:

$$\left|x_t - B_t^i x_t\right| = \alpha + \beta\left|x_{t-1} - B_{t-1}^i x_{t-1}\right| + \delta_j + error \qquad (3.2)$$

where x is the variable being predicted by firms, B_t^i denotes firm i's belief (nowcast or backcast) about variable x, and δ_j is a fixed effect for the industry or sub-industry.

Panels A and B of Table 5 presents results using beliefs about inflation over the last twelve months across the first two waves of the survey as well as between the first and fourth waves (no question about inflation backcasts was asked in the third wave). Without fixed effects, we find a persistence level

of 0.60, with over 30% of the variation in inattention in the first follow-up survey being predictable given inattention in the initial survey. With the average time between waves 1 and 2 of the survey being 5 months, an estimate of 0.60 in the persistence of inflation errors at this frequency is equivalent to a quarterly rate of 0.74, almost identical to the convergence rate of 12-month ahead inflation forecast errors made by consumers in the Michigan Survey of Consumers (Coibion and Gorodnichenko 2012). The persistence parameter declines to 0.39 with industry or sub-industry fixed effects, but is even higher when we use sampling weights (0.72). The estimates are systematically lower in Panel B when we compare errors in the fourth wave to those in the first wave, which reflects the longer time span between these waves.

In Panel C, we reproduce these results using beliefs about the contemporaneous output gap from the first two waves of the survey. The estimated persistence of inattention is now between 0.5 and 0.6 depending on the specification, and past errors account for over forty percent of the cross-sectional variation in errors during the follow-up survey. Panel D presents equivalent results for errors about unemployment between the second and fourth waves, again yielding even higher estimates of the persistence in inattention. In all cases, the persistence of inattention is statistically significantly different from zero at the 1% level.

While previous work has studied the persistence of forecast errors by different agents (e.g. Coibion and Gorodnichenko 2012, 2014), this survey is unique in that it allows us to characterize the persistence in firms' inattention to past and current macroeconomic conditions, yielding the result that there seems to be only slow convergence in beliefs about past and current macroeconomic variables. This gradual convergence in beliefs even about past or current macroeconomic conditions is consistent with models in which agents are subject to information frictions limiting agents' ability or willingness to track recent economic developments, as in sticky information models (Mankiw and Reis 2002) or noisy information models (Woodford 2001, Sims 2003).

4 Beliefs about future macroeconomic conditions

The previous section characterizes the dispersion in beliefs among firms about recent macroeconomic conditions. In this section, we turn to firms' forecasts of future macroeconomic outcomes. We first describe how the macroeconomic forecasts of firms compare to those of other agents in New Zealand. Second, we discuss how differences in beliefs about recent economic conditions relate to differences in forecasts about future economic outcomes. Third, we describe a unique experiment that illustrates how firms adjust their forecasts when presented with new information.

4.1 The Macroeconomic Forecasts and Firms and Other Economic Agents

In Table 6, we report means and standard deviations of macroeconomic forecasts, both from firms in our survey as well as other agents' forecasts for New Zealand over the same periods. In December 2013, the

Reserve Bank of New Zealand was predicting that annual CPI inflation for September 2014 would be 1.3%, just slightly below the 1.5% annual CPI inflation rate experienced over the preceding twelve months. Professional forecasters included in the December 2013 Consensus Economic survey for New Zealand were forecasting annual CPI inflation of 2.0% over the next twelve months. The cross-sectional standard deviation of these forecasts was very low, at 0.2%, indicating widespread agreement among professional forecasters about the likely future dynamics of inflation. Household forecasts of 1-year ahead annual inflation are available from a quarterly survey of 1,000 households run by the Reserve Bank of New Zealand. Reported values from this survey are trimmed, dropping all inflation forecasts above 15% and below -2%. In the December 2013 survey, households in New Zealand were on average forecasting an inflation rate of 3.4%, with a much higher level of disagreement indicated by a cross-sectional standard deviation of 2.0%. The much wider disagreement in inflation forecasts among households than for professional forecasters has been widely documented in the literature, especially for the U.S. (e.g. Mankiw, Reis and Wolfers, 2003). The higher mean of household inflation forecasts, which is also observed in the U.S. over the same time period, is another unique characteristic of household forecasts, although this difference is not always historically present and appears to be driven largely by gasoline price movements (Coibion and Gorodnichenko 2015).

We find that the mean forecast of inflation among firms, after applying the same trimming procedure as that used for households, was 5.3%, with a cross-sectional standard deviation of 3.1%. Thus, firms in New Zealand, at least during this time period, exhibited the same upward bias in inflation forecasts as households relative to professional forecasters and the same characteristic of widespread disagreement. This is despite nearly twenty-five years of official inflation targeting on the part of the Reserve Bank of New Zealand. These large disparities in means and dispersion also suggest that professional forecasts are unlikely to be representative of firms' macroeconomic beliefs. The same qualitative results obtain using the follow-up surveys: the mean forecast and the standard deviation of firm inflation beliefs are both significantly higher than what is observed for professional forecasters.

Table 6 also reports means and standard deviations of forecasts from the second wave for other macroeconomic variables, including interest rates, the unemployment rate and the growth rate of real GDP. Unfortunately, no household forecasts of these variables are available for households in New Zealand, so we can only compare forecasts of firms to those of professional forecasters and the Reserve Bank of New Zealand. For unemployment rates, the Reserve Bank of New Zealand projected in its March 2014 Monetary Policy Report that the unemployment rate in March 2015 would decline to 4.9%, from its value of 6.0% in December 2013. Professional forecasters in March 2014 were predicting an unemployment rate of 5.3%, again with very little disagreement as displayed by a standard deviation of only 0.3%. In contrast, while firms in the follow-up survey were predicting a mean unemployment rate twelve months later of 5.2%, there was again much more disagreement among firms than professionals, with a standard deviation of firm

forecasts of 1.2%. Very similar results obtain for the expected change in interest rates over the next twelve months or the expected annual growth in real GDP over the next twelve months: in both cases, mean forecasts of firms and professionals are broadly similar, but the disagreement among firms is much larger.[7] Nonetheless, it is clear that inflation forecasts present the largest disparities between firms and professionals.

These properties of firms' inflation forecasts are insensitive to the wording of the question. The specific phrasing that we use is: "*During the next twelve months, by how much do you think prices will change overall in the economy? Please provide an answer in percentage terms*" whereas surveys of professional forecasters typically ask for predicted *inflation* rates rather than "changes in prices". Bruine de Bruin et al. (2012) and Drager and Fritsche (2013) find that inflation expectations of households are higher and more dispersed when they are asked about "overall price changes" rather than "inflation rates", so one reason for the extra heterogeneity in firm forecasts could be if this wording choice is important. To investigate this possibility, we presented a different language for the inflation question to 100 firms in the first follow-up survey, specifically asking firms: *"During the next twelve months, what will be the overall inflation rate in the economy? Please provide an answer in percentage terms."* As documented in more detail in Appendix 4, we find no evidence that firms who were presented this alternative language in the follow-up survey either had different inflation expectations at that period or changed their expectations between the two surveys by an unusual amount. This result obtains both for forecasts and backcasts of inflation.

Another possible source of variation is the use of point forecasts. Engelberg, Manski and Williams (2009) find that there can sometime be significant differences between the point estimates and the means from forecasters' probability distributions, and that it is better to construct point forecasts from agents' responses to questions about possible distributions of outcomes. In the first follow-up survey, we asked all firms to assign probabilities to different bins of inflation outcomes as well as to provide point forecasts of inflation. After constructing the implied point forecasts from the probability distributions and comparing them to the explicit point forecasts, we find a strong positive correlation between firms' point forecasts and those extracted from the distribution, with a slope coefficient of close to 1, as documented in Appendix 5. In short, we find little evidence that the properties of firms' inflation forecasts are sensitive to the language of the survey or the use of point vs distributional forecasts.

However, there is a pronounced difference in terms of firms' expectations of overall inflation versus their expectations of their own future price changes or changes in their unit costs. In the second follow-up survey (wave #3), firms were asked about their expectations of aggregate price changes in the

[7] We focus on forecasts of the change in interest rates because interest rate forecasts by the Reserve Bank of New Zealand and Consensus Economics are for a 90-day interest rate, while the survey question posed to firms inquired about a 1-year interest rate. For firms' forecasts of real GDP, the survey did not ask for a point forecast but rather for firms to assign probabilities to different outcomes (see Appendix 1). We use midpoints of each bin, a maximum real GDP growth of 6% (for the top bin), and a minimum growth of GDP of -1% (for the bottom bin) to construct point forecasts of real GDP growth for each firm.

economy as well as about their expectations of changes in their own unit costs over the same time horizon. As documented in Appendix 6, the correlation between their answers to these two questions is essentially zero. This means that correctly measuring firms' expectations of aggregate inflation requires the survey to explicitly ask firms about their expectations about aggregate inflation, and that one cannot draw any immediate inference about their aggregate expectations from their expectations over their own price changes or unit costs. Some surveys of firms, such as the Business Inflation Expectations survey of the Atlanta Federal Reserve, unfortunately ask firms only about expectations over their own unit costs and not about their expectations of aggregate inflation. The absence of any correlation between the two suggests that these surveys are largely uninformative about firms' beliefs about aggregate inflation.

The cross-sectional differences in beliefs about future inflation that we document are important, in the sense that firms appear to incorporate their beliefs about future inflation into their economic decisions. Specifically, we asked firms in the third wave the following four hypotheticals, one for each of prices, employment, investment and wage decisions: "If you thought overall prices in the economy over the next 12 months were going to rise by more than what you are currently forecasting, would you: a) be more likely to increase your (prices/employment/investment/wages), b) no change, c) more likely to decrease your (prices/employment/investment/wages)." Approximately 75 percent of firms reported that higher inflation expectations would affect at least one of their economic decisions. Appendix Table 1 documents the breakdown of individual answers. Higher inflation expectations induce 25-35% of firms to report that they are more likely to increase prices, employment, investment, and/or wages. The correlation amongst the answers to these questions is typically low, however, so most firms would not adjust their decisions along more than one or two of these margins. But firms' responses to these questions suggest that their inflation expectations do have a direct impact on their economic decisions.

4.2 Beliefs about the Past and Beliefs about the Future

What accounts for the pronounced heterogeneity in firm forecasts relative to those of professional forecasters? Jonung (1981) documents that in a survey of Swedish households from 1978, those households who believed recent inflation to have been higher than other households also tended to have higher forecasts of future inflation. Armantier et al. (2012) find similar patterns in a 2011 survey of U.S. households. One natural hypothesis in light of this prior work is that firms' different beliefs about future economic conditions reflect in part their different beliefs about recent economic activity. To assess this possibility, we estimate the following regressions:

$$F_t^i x_{t+12} = \alpha + \beta B_t^i x_t + \delta_j + error \qquad (4.1)$$

where $F_t^i x_{t+12}$ denotes the 12-month ahead forecast of firm i for variable x, which we regress on the firm's belief (nowcast or backcast) about recent values of that variable ($B_t^i x_t$) allowing for sub-industry fixed effects (δ_j). We implement these regressions using each macroeconomic variable and survey wave

for which we have both backcasts and forecasts and present results in Table 7. For inflation and unemployment, two or more survey waves are available, so we also estimate a version of this specification augmented with firm-level fixed effects using each of the waves available. In all cases but one (inflation in wave #2), we find statistically significant positive correlations between beliefs about recent values and firms' forecasts of future economic outcomes, including in specifications with firm-level fixed effects. These results corroborate the findings of Jonung (1981) that differences in beliefs about past economic conditions play an important role in accounting for differences in beliefs about the future, but in this case for firms.

Another way to assess the role played by different information sets is to compare the distribution of inflation forecasts for "informed" firms, i.e. those with absolute errors about recent inflation of less than 2 percentage points, with that for "uninformed" firms. This is illustrated in Panel A of Figure 4, using data from the first wave of the survey. The distribution of forecasts for informed firms is much more concentrated than that for uninformed firms, with the latter having a much more pronounced tail of very high inflation forecasts, a pattern which is repeated in each wave of the survey. Few firms that are aware of recent inflation levels predict inflation rates above 10%, in contrast to uninformed firms. But as noted in Table 5, inattention to recent inflation by firms varies over time. If we classify firms as informed and uninformed using their errors in the first wave of the survey and compare the distributions of inflation forecasts of these two groups in the fourth wave, as illustrated in Panel B of Figure 4, we find that the two distributions are much closer to each other than in the first wave. This suggests that as firms' information about recent inflation dynamics evolves over time, their forecasts change as well. In the next section, we test this notion using an experimental design.

This strong correlation between beliefs about the past and forecasts of the future implies that the same forces which account for the heterogeneity in beliefs about recent inflation also account for much of the variation in beliefs about future inflation. We illustrate this in Figure 5 for the three rational inattention variables which had significant effects on the size of inflation backcast errors in Table 4. In the figure, we show both average backcasts and forecasts of inflation for firms grouped by each of these characteristics: number of competitors, duration until the next price change, and slope of the profit function. Firms which face more competitors, firms which expect to change their prices sooner, and firms with steeper profit functions have not only lower backcasts of inflation on average but also lower forecasts.

4.3 How Firms Revise their Forecasts with New Information

The robust link between firms' beliefs about the past and their forecasts of the future suggests that different information sets play a leading role in accounting for the heterogeneity in macroeconomic forecasts of firms. A key question is therefore how firms adjust their forecasts when they receive new

information. We investigate this question using an experimental approach. Specifically, firms in the fourth wave of the survey were asked to assign probabilities to different outcomes for future inflation, output growth and unemployment rates, from which we can compute their mean forecasts and the uncertainty surrounding these forecasts. 700 firms were then randomly allocated to one of 7 groups of 100 firms each which were treated with additional information about the economy. After receiving this information, firms were asked for a point forecast for the variable about which they received the information, allowing us to measure the extent to which they revised their forecasts in response to new information. The remainder of the firms did not receive additional information.

There were two groups of firms which received information about unemployment rates or GDP growth. For each of these groups, firms were told the most recent outcomes for one of these two variables (the most recent unemployment rate was 5.4% or the most recent annual real GDP growth rate was 3.9%). The remaining five groups were provided with information about inflation: 1) the most recent professional forecast of inflation over the next twelve months (2.0%), 2) the central bank's inflation target (2%), 3) both the professional forecast and the central bank's inflation target, 4) the most recent value of inflation (1.0%), and 5) the average inflation forecast of other firms in the survey (4.9%). Firms in each treatment group received only one piece of additional information.

Figure 6 plots, for each macroeconomic variable, the priors of each firm against their posteriors after receiving the information. Firms whose beliefs were above average tended to revise their forecasts down while those whose beliefs were below average tended to revise their forecasts up, as indicated by the regression lines having slopes of less than one. This pattern is what one would expect if firms engage in Bayesian learning.

To see the workings of Bayesian learning more formally, suppose firm i has prior with mean μ_i and precision τ_i (one can relate precision to the standard deviation of the "forecast/nowcast error" $\tau_i = 1/\sigma_i^2$). We assume that the prior is normally distributed. Each firm receives a common signal s (this is equivalent to the information treatment in each group) with precision ψ_s. The precision can vary with the type of signal depending on, for example, the credibility that firms attribute to the source. We assume that the signal is also normally distributed. Firms use Bayesian updating to obtain posterior p_i:

$$p_i = \mu_i + \frac{\psi_s}{\psi_s+\tau_i}(s-\mu_i) \Longrightarrow (p_i-\mu_i) = \frac{\psi_s}{\psi_s+\tau_i}(s-\mu_i). \quad (4.2)$$

Firms should revise their forecasts in the direction of the signal and should do so by more when the signal they receive is further from their prior. This revision should also be larger when the source of the signal is more credible, i.e. interpreted as having a greater precision ψ_s.

We can evaluate this insight more formally using the following regression:

$$p_i = c + \beta\mu_i + error \quad (4.3)$$

where we present estimates pooled across the different inflation treatment groups (with fixed effects for each treatment group), as well as for each group separately. In this specification, $\beta = 1 - \frac{\psi_s}{\psi_s+\tau_i}$ and the constant term absorbs the common signal. Panel A of Table 8 and Figure 6 show that the pooled estimate of β for inflation is 0.31, much lower than the estimates of 0.76 and 0.69 for unemployment and GDP growth respectively. Thus, the sensitivity of firms' inflation beliefs to new information is much higher than it is for real macroeconomic variables. This does not appear to reflect the source of the information: when we estimate the sensitivity of inflation revisions to information about the most recent values (equivalent to the information provided about unemployment and GDP growth), the coefficient is similar.

There is considerable variation in the sensitivity of inflation forecast revisions depending on the source of the information. Firms revised their forecasts by the most when presented with information about the central bank's inflation target or recent inflation values, and responded by less when presented with professional forecasts and even less so with the forecasts of other firms in the survey. This suggests that firms assign the highest precision to the signal about the central bank's inflation target and recent inflation dynamics, more so than to predictions of professional forecasters or those of other firms.

A related prediction of Bayesian updating is that the precision of the firm's prior also matters in determining by how much it revises its forecast in light of new information. To demonstrate this intuition formally, we can approximate the revision in firm forecasts as

$$\log\left(\frac{p_i-\mu_i}{s-\mu_i}\right) = -\frac{1}{\psi_s} \times \left(\frac{1}{\sigma_i^2}\right) + h.o.t. \quad (4.4)$$

Firms with more uncertainty about their priors (high σ_i^2) should revise their forecasts by more for a given difference between the signal and their prior. This effect should be weaker when the precision of the signal is high. In the limit, if the signal is perfectly informative, the prior uncertainty does not matter as $p_i = s$ and hence $\log\left(\frac{p_i-\mu_i}{s-\mu_i}\right) = 0$. We examine this prediction using the following regression:

$$\frac{p_i-\mu_i}{s-\mu_i} = c + \beta\sigma_i + error \quad (4.5)$$

where we expect $\beta > 0$ and to be lower for signals that are associated with higher levels of credibility. With the exception of GDP growth, we indeed find that firms with more uncertainty about their priors tend to revise their forecasts by more, as illustrated in Panel B of Table 8. In addition, the magnitudes of the coefficients conform to those found in the previous set of regressions: the implied precision of the signal is highest when firms are told about the central bank's inflation target and lowest when they are told of other firms' forecasts.

In short, when presented with new macroeconomic information, firms update their beliefs in a Bayesian manner, both in that they revise their forecasts toward the signal they receive and do so more when they are more uncertain. This updating is particularly strong for inflation forecasts, which likely

reflects the lack of information firms seem to have about recent inflation dynamics and the high levels of uncertainty that they report around their forecasts.

5 How Do Firms Seek Out New Information?

We now turn to why firms have more precise information about some variables than others. We first focus on which variables firms report as being important to their business decisions and how this correlates with the errors firms make about these variables. We then investigate which macroeconomic variables firms actually track and the ways in which they acquire information about economic conditions. Finally, we consider the degree of strategic complementarity in firm decisions and how this relates to their information acquisition decisions.

5.1 Which Variables Do Firms Care About?

In rational inattention models (e.g. Mackowiack and Wiederholt 2009), agents face limited information processing capacity and endogenously choose how to allocate these limited resources to tracking information which most matters for their objective function. In such a setting, one would expect firms to be therefore have better information about recent values of the variables that affect their profits more. In the fourth wave of the survey, firms were asked to rank inflation, GDP and unemployment in terms of their importance for firms' business decisions. Approximately half of firms ranked inflation as the least important variable among the three while just over a third ranked it as most important. GDP was the most commonly top-ranked macroeconomic variable.

We can utilize these firm rankings of the relative importance of different macroeconomic variables to determine whether a variable's relative importance to a firm's business decisions is reflected in the quality of the firm's information about that variable. For each possible pair of macroeconomic variables (among inflation, unemployment and GDP), we create two metrics to capture their relative importance to firm *i*. The first is a dummy variable equal to one if firm *i* identifies variable *X* as more important than variable *Y* and zero otherwise. The second is the difference between the rank of variable *X* and the rank of variable *Y*. We use each of these metrics as an explanatory variable in regressions where the dependent variable is either the relative uncertainty in forecasts about the two variables reported by firms, $\log\left(\frac{\sigma_i^X}{\sigma_i^Y}\right)$, or the relative size of backcast errors made by firms about the two variables, $\log\left(\frac{|B_t X_{t-h} - X_{t-h}|}{|B_t Y_{t-h} - Y_{t-h}|}\right)$. Note that given the structure of the survey, we compare uncertainty and inattention across variables within a firm and thus one can interpret these regressions as controlling for firm fixed effects.

Using either the relative uncertainty in forecasts (Panel A, Table 9) or the relative size of backcast errors (Panel B, Table 9) as well as either metric for the relative rank of two macroeconomic variables, we

find robust evidence that when firms rank one variable as more important than another for their business decisions, then they tend to have better knowledge of recent dynamics of that variable and have less uncertain forecasts of that variable. The only exception is when comparing the effect of UE and GDP relative ranks on the relative uncertainty surrounding firms' forecasts of these variables, in which case the estimates are not significantly different from zero (they are statistically significant in the case of relative backcast errors). Jointly, these results are supportive of rational inattention channels through which firms have better knowledge of those variables which matter for their objective functions.

5.2 Which Variables Do Firms Track and How?

Better knowledge of those variables which matter more for firms' business decisions could reflect an endogenous information acquisition decision or it could reflect stronger procyclicality in a firm's production. To assess whether the previous results reflect firms choosing to collect more information about specific macroeconomic variables, we asked them to identify which macroeconomic variables (out of inflation, unemployment and GDP) they keep track of. The responses are summarized in Table 10. Approximately 60 percent of firms report that they do not track inflation, compared to only 21 percent of firms who report not tracking GDP. Hence, consistent with what firms reported about the relative importance of macroeconomic variables to their business decisions, inflation is tracked by a much smaller fraction of firms than real variables like GDP. In fact, the modal answer (32% of firms) is that they track both unemployment and GDP but not inflation. Conditional on tracking multiple variables, the vast majority of firms (over 90%; column 2, Table 10) try to synchronize their acquisition of information across the variables they track. This feature of the data is strongly predicted by the canonical sticky information model where updates of information are perfectly synchronized across variables. It is consistent with noisy information models in which firms track variables continuously and thus obtain new information about macroeconomic aggregates at the same time.

The mapping between firms' answers as to which variables they track and the relative importance of different macroeconomic variables is summarized in Table 11 and illustrates the consistency of answers across these questions. For example, of the firms who reported that inflation was the most important out of the three macroeconomic variables for their business decisions, 99% of them reported that they track inflation. Similarly, 98% of the firms who ranked inflation as the least important of the three macroeconomic variables choose not to track inflation dynamics. Interestingly, of the firms who rank inflation as second most important to their business decisions, only one in five actually report tracking inflation. This is significantly at odds with what we observe for unemployment and GDP, where even among firms who rank these variables as least important, around 50% of them still track that variable.

These answers do not appear to be cheap talk on the part of firms, as the answers that they provide are very strongly associated with the forecasts and backcasts that they report. Table 12 presents the mean size of backcast errors for each variable depending on whether firms reported tracking that variable or not, as well as corresponding mean forecasts and mean uncertainty around the forecasts. There are pronounced differences between firms that report tracking a variable and those that do not, especially for inflation. Firms that track inflation have average absolute backcast errors of approximately one percentage point compared to an average error of five percentage points for those which do not track inflation. Differences in average forecasts of inflation are also very pronounced: firms that track inflation have an average year-ahead forecast of 3.5% while those that do not track inflation forecast inflation of 5.9% on average with higher levels of uncertainty around their forecasts. Thus, the endogenous decisions of firms as to whether or not to track a macroeconomic variable have profound consequences on their knowledge about this variable's recent dynamics and future values.

One reason why only those firms which rank inflation highest in importance for their business decisions may choose to track inflation is that firms seem to value synchronized information updates. As documented in Table 10, firms which track more than one macroeconomic variable systematically prefer to update their information about each variable simultaneously (over 90%). Because information about inflation often comes in news articles that are distinct from those about GDP and unemployment, some firms may not find the additional effort to collect information about inflation in addition to one or both of these real variables worthwhile unless they view inflation as the most important macroeconomic variable for their business decisions.

One can also relate a firm's decision about whether or not to track inflation or the relative rank of inflation in terms of their business decisions to observable and time-invariant characteristics of firms and managers, as done in section 3.2 to explain the size of errors about recent inflation made by firms. Because inflation backcast errors and a firm's decision about whether or not to track inflation are so highly correlated, as documented in Table 12, the results are qualitatively similar (see Appendix Table 5.2) in that rational inattention forces go a long way in accounting for how important firms view inflation or whether they track inflation. Firms facing more competitors and firms with lower average profit margins are more likely to track inflation and to view inflation as important to their business decisions. We also find that firms for which foreign sales account for a larger share of revenues are less likely to track inflation in New Zealand, as are firms which receive larger shares of their revenues from long-term contracts. The personal characteristics remain statistically insignificant predictors of firms' decision to track inflation, and industry-fixed effects add little once these other explanatory variables have been accounted for. In short, much of the cross-sectional variation in firms' knowledge of recent inflation dynamics can be reconciled with rational inattention motives.

In addition to choosing which macroeconomic variables to track and whether to synchronize their updating about different variables, firms must decide when to collect new information. To better try and understand the circumstances that induce firms to seek out information, we presented them with two hypothetical questions. One was if they heard *bad* news about the economy on TV, would they be more or less likely to look for more information? This question targets whether there is state-dependence in the acquisition of information (if they say it is more likely), or whether information updating is time-dependent (if they say it makes no difference). The results, presented in Table 13, strongly support state-dependence in the information updating process: over 75% of firms report that they are much more likely or somewhat more likely to seek our new information when they receive bad news about the economy. This evidence is in line with the lower levels of information rigidity identified during recessions in Coibion and Gorodnichenko (2011).

The second question firms were asked was if they heard *good* news about the economy on TV, would they be more or less likely to look for more information? This question targets not just state-dependence of information acquisition but also its symmetry. The results, presented in Table 13, are the opposite of those found in response to bad economic news: over 60% of firms report that they are much less or somewhat less likely to seek out more information in response to good economic news. This evidence points toward strong asymmetry in firms' information acquisition over the course of the business cycle, with firms actively looking for more information during downturns when news are bad but relying on their more outdated information during booms when news are good.

5.3 Strategic Complementarity

Another important channel emphasized in the literature on firms' information acquisition is strategic complementarity in price setting. When firms place more weight on the decisions of others, this should affect their information acquisition decisions as well. For example, firms with higher levels of strategic complementarity should prefer to receive signals which are received by others ("common signal") over signals that are available only to themselves ("private signal"), since the common signal also provides information about the likely actions of other firms.

Our survey data allows us to measure one important component of the strategic complementarity faced by firms, namely how sensitive their revenues are to competitors' price changes, by asking them the following hypothetical question: "Suppose a typical firm in your industry cuts its price by 10%, by how much would your sales be affected?" The average response to this question is a decline in sales of 7%. We can also determine firms' preferences for signals which only they observe versus signals received by other firms by asking firms which signal they would prefer.[8] 75 percent of firms reported that they would

[8] The survey question is, "Suppose that there are two sources of information about the state of the economy. These sources are equally informative/useful, but they can give different signals about the state of the economy (that is,

prefer to receive the common signal. To assess whether higher levels of strategic interaction lead firms to prefer public signals, we regress one on the other and present results in Panel A of Table 14. Regardless of whether we control for industry fixed effects or include firm-specific and manager-specific controls, we find a robust positive correlation between the degree of strategic complementarity faced by firms and their preference for a common signal. This provides unique and direct evidence for the effects of strategic interaction on firms' choice of signals, as emphasized in Hellwig and Veldkamp (2009).

A related prediction from Gorodnichenko (2008) is that firms facing uncertainty about the state will tend to wait for other firms to act instead of immediately changing their prices when there is strategic complementarity in price setting, since they can extract information about the state from the actions of others. Firms in the survey were asked "Suppose you want to adjust your prices but are uncertain about the state of the economy, what would you do?" Firms selecting the answer "wait until other firms make a price adjustment" would then be acting in the way predicted by the model. Using a dummy variable equal to one when firms select this answer and zero otherwise, we find (Panel B of Table 14) that firms with higher levels of strategic complementarity are more likely to report that they would prefer to wait for other firms to adjust their prices, as predicted by the theory. This supports theories of inertia in prices that rely on the notion that information from other firms' prices does not rapidly diffuse through the economy because each firm is waiting for others to adjust their prices first.

A third implication of this class of models is that, when strategic complementarity is high, another firm's price change is more informative about aggregate conditions than when strategic complementarity is low. This is because other firms also have an incentive to wait to change their prices and therefore tend to do so only when they have strong information about the economy. As a result, firms should draw stronger inferences from the price changes of others when everyone has an incentive to delay their own actions. We can assess this prediction using another question from the survey: "Suppose your main competitor raises its price by 10%, by how much would you revise your expectation of inflation over the next twelve months?" We regress answers to this question on the dummy variable for whether firms prefer to wait until other firms change their prices. The results, presented in Panel C of Table 14, point toward a significantly positive correlation between firms' desire to wait for other firms to change prices first and the inference they draw from their competitors' price changes, as suggested by the theory.

These results therefore provide novel and direct evidence for models in which the gradual diffusion of information and price stickiness interact to delay the response of the economy to shocks when strategic complementarity is high. The latter induces firms to focus on public signals and rely on other firms' price changes as a source of information. As firms become more reticent to change prices, any firm

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they can disagree). In addition, the first source can be seen by other firms in your industry while the second source is available only to you. You can see only one source. Which source would you pick?" The possible answers are "The source that can be seen by other firms" and "The source that can be seen only by you."

that does change its price is therefore providing a stronger signal to other firms about fundamentals. Each of these channels is supported by the survey data in a direct and transparent manner that illustrates the usefulness of surveys of firms.

6 Conclusion

Using a novel survey of firms' macroeconomic expectations, we document a number of new stylized facts about firms' beliefs. One such fact is that disagreement among firms is pervasive and much larger than that among professional forecasters, both about past and future macroeconomic conditions. This disagreement about macroeconomic conditions resembles that among households along a number of dimensions, such as its size, its persistence, and its asymmetry. Nearly twenty five years after the Reserve Bank of New Zealand became the first country to officially adopt an inflation target, we find little evidence that firms fully grasp the stability that has characterized inflation dynamics in New Zealand.

Inattention among firms varies along some dimensions predicted by the theory. Specifically, much of this inattention to macroeconomic conditions appears related to firms' incentives to collect and process macroeconomic information, as predicted by models of rational inattention in which firms face costs or frictions in collecting and processing information. For example, firms facing more competition or important pricing decisions in the near future having better information overall. And firms facing steeper profit functions, for whom information should thus be more valuable, also have better information on average.

While we document pervasive inattention by firms to different macroeconomic variables, aggregate inflation stands out as the variable about which firms seem least well-informed on average. Many firms view inflation as unimportant to their business decisions and choose not to track its recent values, leading to large misperceptions about recent inflation dynamics and forecasts that are far out of line with historical values, even though they display significant knowledge about industry-specific price changes. While firms respond in a Bayesian manner to new information about inflation, they seem to find little incentive to seek out this information themselves, except when news reports are negative. Since negative news reports about inflation tend to occur when inflation is unusually high, this may account for why firms' average beliefs about inflation, like those of households, are so much higher than those of professional forecasters.

One potential implication of these results is that firms' expectations, especially about inflation, may not be nearly as well "anchored" as has been recently emphasized (e.g. Bernanke 2010). This could be problematic for policymakers for a number of reasons. First, there is little data currently available on firms' expectations for policymakers to track. Second, the wide dispersion in firms' and households' beliefs suggests that the average degree of inattention to economic conditions, and especially inflation trends, is high among these agents. To the extent that monetary policymakers have recently been relying upon policies whose key transmission mechanism is supposed to be inflation expectations, the outlook for

such policies working effectively is likely limited. A third implication is that the willingness of monetary policymakers to engage in non-traditional actions at the zero-bound is in part based on their view that agents' expectations are well-anchored, so that there is little concern about expectations becoming unmoored in the long-run by these actions. But if expectations are not nearly as anchored as posited by policymakers, then the potential risks of these policies may well have been underestimated.

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Table 1: Summary Statistics from Firm Survey

	Number of firms	Firm Characteristics							Next Price Change	
		Age	Employment	Labor's Share	Trade Share	Current Margin	Average Margin	Duration between Price Reviews	Months until next change	Expected Size
All firms	3,150	14.5	28.6	48.0	4.4	26.6	32.3	7.4	5.9	5.6
Manufacturing	997	16.8	32.7	39.3	10.7	21.3	28.1	6.4	5.7	5.9
Chemicals and metals	213	16.0	32.1	38.4	13.2	22.6	29.0	6.6	5.9	6.3
Equipment and machinery	164	15.9	28.3	38.3	11.3	23.3	28.8	5.7	5.0	5.9
Food and beverage	261	18.3	35.5	40.2	9.0	20.4	27.2	6.0	5.3	5.6
Paper/wood, printing and furniture	139	15.3	31.4	39.6	8.0	20.3	28.2	6.6	6.1	5.5
Textile and clothing	220	17.5	34.3	39.6	11.7	20.3	27.6	6.9	6.1	6.3
Trade	837	8.5	23.9	44.5	2.8	20.5	26.8	7.6	4.5	6.1
Car, supermarket and food retailing	116	9.5	27.8	40.8	2.4	18.5	26.5	6.3	2.9	4.8
Hotel and food services	305	8.2	25.6	41.3	4.2	16.3	26.8	5.5	2.8	5.2
Other store retailing	181	8.3	22.5	49.5	0.0	25.2	27.9	11.2	7.2	7.2
Wholesale trade	235	8.4	22.3	42.4	5.7	18.5	25.5	5.3	3.2	6.2
Professional and financial services	1,146	17.0	28.9	57.7	0.6	37.0	41.1	7.6	6.9	5.0
Accounting services	186	18.9	34.6	58.6	0.5	36.3	41.0	7.3	8.0	4.7
Finance	151	12.8	21.1	56.4	0.0	40.0	44.0	6.7	6.2	4.1
Insurance	156	16.7	28.8	57.0	0.9	39.4	42.5	7.7	6.7	5.0
Aux. finance and insurance	125	11.5	20.9	56.9	0.2	40.3	43.5	6.6	5.0	4.2
Legal services	139	21.3	36.5	58.5	1.4	37.5	41.3	8.0	7.5	4.8
Rental, hiring and real estate	163	18.4	26.6	59.1	0.3	33.5	37.7	7.9	6.3	6.0
All other professional services	226	18.0	30.9	57.5	0.9	34.1	39.1	8.4	7.5	5.4
Construction and transportation	170	12.6	25.5	50.0	0.0	18.4	24.7	10.8	8.4	6.2

Notes: The first column of the table presents the number of firms in each industry and sub-industry category in the main survey (wave #1). Other columns are mean values across all firms in each industry or sub-industry of specific variables listed. Sectors in italics are defined as "industries" while sectors not in italics are defined as "sub-industries", with the exception of "Construction and Transportation" which is counted as both. See section 2 for details.

Table 2: Verification of Quality and Consistency of Survey Responses

Industry FE	N	Y	N	N
Sub-Industry FE	N	N	Y	N
Weights	N	N	N	Y
	(1)	(2)	(3)	(4)
Panel A: Number of price changes over the previous year				
Time between price reviews	-0.203***	-0.200***	-0.204***	-0.185***
	(0.002)	(0.002)	(0.003)	(0.005)
Observations	3,150	3,150	3,150	3,137
R^2	0.670	0.689	0.695	0.639
Panel B: Average freq. of price reviews in the follow-up survey				
Average frequency of price reviews	0.996***	0.995***	0.993***	0.997***
	(0.004)	(0.004)	(0.005)	(0.005)
Observations	716	716	716	712
R^2	0.976	0.976	0.976	0.984
Panel C: Recall price (log) in the follow-up survey				
Log price	1.002***	1.001***	1.001***	0.998***
	(0.002)	(0.001)	(0.002)	(0.004)
Observations	716	716	716	712
R^2	0.997	0.997	0.997	0.998
Panel D: Actual price change between the main and follow-up surveys				
Expected price change	0.952***	0.938***	0.931***	1.056***
	(0.056)	(0.056)	(0.059)	(0.058)
Observations	375	375	375	374
R^2	0.677	0.685	0.690	0.759

Notes: Panel A: the dependent variable is the number of quarterly price changes over the previous year. The maximum number of price changes is four. The time between price reviews takes values 0.25 (weekly), 1 (monthly), 3 (quarterly), 6 (every size month), 12 (annually), 18 (less frequently than annually). Panel B: the dependent variables is the average frequency of price reviews reported in the follow-up survey. Panel C: the dependent variable is the price 3 month ago (for firms surveyed in December 2013 or January 2014) or 6 month ago (for firms surveyed in September 2013, October 2013, or November 2013) reported in the first follow-up survey. The regressor is the actual price reported in the main survey. Panel D: the dependent variable is the percent change of current prices reported in waves 1 and 2. The regressor is the expected percent change in the next price review reported in wave 1. The sample is constrained to firms that had an actual price change and that expected to have a price review in the next five months. Constant is included but not reported. Industry and sub-industry fixed effects are as defined in Table 1. Column (4) applies sampling weights. Robust standard errors are reported in parentheses. ***,**, * denotes statistical significance at 1%, 5%, and 10% levels respectively. See section 2 for details.

Table 3: Correlation of Inattention across Macroeconomic Variables

Survey:	Wave 1	Wave 2			Wave 4		
Inattention to:	Output gap	Output gap	Unempl. rate	Interest rate	GDP growth rate	Unempl. rate	Exchange rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Abs. Value of Inflation Backcast Errors	0.97***	0.59***	0.02**	0.02*	0.02	-0.01	-0.00
	(0.06)	(0.11)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
N	3,153	716	716	716	1,257	1,257	1,257
R^2	0.18	0.09	0.07	0.03	0.01	0.02	0.01

Notes: The table reports regressions of firms' absolute errors for variables indicated in the second row on firms' absolute errors for inflation over preceding twelve months. The top row indicates which survey wave was used in the analysis. Sub-industry fixed effects (as defined in Table 1) are included but not reported. Robust standard errors are reported in parentheses. ***,**, * denotes statistical significance at 1%, 5%, and 10% levels respectively. See section 3.1 for details.

Table 4. Determinants of Firm Inattention

	(1)	(2)	(3)	(4)	(5)	(6)
Firm characteristics						
Log(Age)	0.03	-0.15*			0.06	-0.13
	(0.09)	(0.09)			(0.15)	(0.14)
Log(Employment)	0.46***	0.83***			0.38**	0.71***
	(0.12)	(0.11)			(0.17)	(0.15)
Labor's share of costs	0.11***	-0.00			0.11***	-0.00
	(0.01)	(0.01)			(0.01)	(0.01)
Foreign trade share	-0.00	0.01***			0.00	0.01**
	(0.00)	(0.00)			(0.01)	(0.01)
Number of Competitors	-0.02***	-0.02***			-0.03***	-0.03***
	(0.01)	(0.01)			(0.01)	(0.01)
Avg. margin	0.07***	-0.01			0.09***	0.00
	(0.01)	(0.01)			(0.01)	(0.01)
Price rel. to competitors	0.03***	0.01			0.02**	-0.00
	(0.01)	(0.01)			(0.01)	(0.01)
Firm's past price changes	-1.60**	-1.60**			-0.62	-0.66
	(0.72)	(0.63)			(0.94)	(0.87)
Industry PPI inflation	-0.03***	-0.03***			-0.04**	-0.04***
	(0.01)	(0.01)			(0.02)	(0.01)
Expected size of price change	-0.03**	-0.01			-0.01	-0.00
	(0.01)	(0.01)			(0.02)	(0.02)
Duration until price change	0.15***	0.10***			0.16***	0.12***
	(0.02)	(0.01)			(0.02)	(0.02)
Abs. slope of profit function	-0.44***	-0.46***			-0.53***	-0.60***
	(0.10)	(0.09)			(0.14)	(0.13)
Manager characteristics						
Age			0.02*	0.00	0.00	0.00
			(0.01)	(0.01)	(0.01)	(0.01)
Education:						
Some college			0.65**	0.01	0.29	0.09
			(0.26)	(0.21)	(0.21)	(0.19)
College			0.55*	0.14	0.31	0.27
			(0.32)	(0.25)	(0.27)	(0.24)
Graduate (MA+)			0.14	-0.26	0.20	-0.02
			(0.32)	(0.24)	(0.25)	(0.22)
Tenure			0.11***	0.07***	0.00	-0.01
			(0.02)	(0.01)	(0.02)	(0.02)
Income			0.00	0.00	0.00	0.00
			(0.00)	(0.00)	(0.00)	(0.00)
Industry FE	N	Y	N	Y	N	Y
N	3,149	3,149	1,454	1,454	1,453	1,453
R^2	0.29	0.44	0.05	0.39	0.37	0.49

Notes: Dependent variable is the absolute value of firm errors about past 12-month inflation from Wave #1 survey. Industry fixed effects are defined as in Table 1. Omitted category for manager's education is" high school diploma or less." Robust standard errors are reported in parentheses. ***,**, * denotes statistical significance at 1%, 5%, and 10% levels respectively. See section 3.2 for details.

Table 5: Persistence of Inattention.

Industry FE	N	Y	N	N
Sub-Industry FE	N	N	Y	N
Weights	N	N	N	Y
Dependent variable: abs. error in the follow-up surveys	(1)	(2)	(3)	(4)
Panel A: Inflation over the previous 12 months, Wave #2				
Abs. error for inflation in Wave #1	0.596***	0.392***	0.387***	0.715***
	(0.038)	(0.050)	(0.051)	(0.065)
Observations	716	716	716	712
R^2	0.328	0.467	0.484	0.364
Panel B: Inflation over the previous 12 months, Wave #4				
Abs. error for inflation in Wave #1	0.345***	0.303***	0.297***	0.275***
	(0.021)	(0.024)	(0.025)	(0.034)
Observations	1,257	1,257	1,257	1,251
R^2	0.303	0.322	0.346	0.235
Panel C: Output Gap, Wave #2				
Abs. error for output gap in Wave #1	0.510***	0.520***	0.513***	0.582***
	(0.042)	(0.043)	(0.043)	(0.057)
Observations	716	716	716	712
R^2	0.413	0.418	0.428	0.402
Panel D: Unemployment rate, Wave #4				
Abs. error for unemployment rate in Wave #2	0.668***	0.678***	0.688***	0.713***
	(0.054)	(0.053)	(0.051)	(0.070)
Observations	464	464	464	461
R^2	0.463	0.473	0.501	0.535

Notes: The table reports regressions of firms' absolute errors for inflation over the last twelve months (Panels A and B), the contemporaneous output gap (Panel C), and contemporaneous unemployment rate (Panel D) in waves #1, #2, and #4 on firms' errors over the same variables in waves #1 and #2. Constant is included but not reported. Column (2) includes industry fixed effects while column (3) includes sub-industry fixed effects, as defined in Table 1. Column (4) applies sampling weights. Robust standard errors are reported in parentheses. ***,**, * denotes statistical significance at 1%, 5%, and 10% levels respectively. See section 3.3 for details.

Table 6: Macroeconomic Forecasts of Firms and Other Economic Agents

	Recent data	Central Bank	Professional Forecasters	Households	Firms
Forecasts from 2013Q4					
12-Month Ahead Annual Inflation Rate					
Mean Forecast (or actual value)	1.5%	1.3%	2.0%	3.4%	5.3%
Std. Dev. of Forecasts			0.2%	2.0%	3.1%
Forecasts from 2014Q1					
12-Month Ahead Annual Inflation Rate					
Mean Forecast (or actual value)	1.5%	1.9%	2.0%	3.6%	5.9%
Std. Dev. of Forecasts			0.3%	1.8%	2.8%
12-Month Ahead Unemployment Rate					
Mean Forecast (or actual value)	6.0%	4.9%	5.3%	n.a.	5.2%
Std. Dev. of Forecasts			0.3%	n.a.	1.2%
12-Month Ahead Annual GDP Growth Rate					
Mean Forecast (or actual value)	2.3%	3.5%	3.4%	n.a.	3.1%
Std. Dev. of Forecasts			0.5%	n.a.	0.8%
12-Month Change in Interest Rates					
Mean Forecast (or actual value)	0.6%	1.9%	1.2%	n.a.	1.1%
Std. Dev. of Forecasts			0.3%	n.a.	1.2%

Notes: The table reports recent values, forecasts and dispersion in forecasts of different macroeconomic variables and for different agents. Actual inflation rates are for the CPI and the 12-month change in interest rates is for the 1-year bill. Actual values are from Sept. or Dec. 2013 for main survey and follow-up survey periods respectively, except for interest rates which are the average value from Oct.-Dec. 2013 minus the average value from Oct.-Dec. 2012. Forecasts from the Reserve Bank of New Zealand are from the Dec. 2013 and March 2014 Monetary Policy reports. Professional forecasts are from Consensus Economics. Household inflation forecasts are from the Reserve Bank of New Zealand's Survey of Households. The inflation forecasts of households are trimmed by the Reserve Bank of New Zealand and exclude all forecasts of inflation above 15% and below -2%, so same trimming is applied to firms' inflation forecasts for comparison. Other firm forecasts are unadjusted. See section 4.1 for details.

Table 7: Beliefs about Future and Past Values of Macroeconomic variables.

Variables	Wave #1	Wave #2	Wave #4	Firm FE
	(1)	(2)	(3)	(4)
Inflation rate, aggregate	0.248***	0.065	0.345***	0.322***
	(0.033)	(0.061)	(0.043)	(0.042)
N	3,149	716	1,255	5,126
R^2	0.419	0.396	0.211	0.206
Inflation rate, industry			0.616***	
			(0.122)	
N			1,255	
R^2			0.644	
Unemployment rate		0.337***	0.865***	0.651***
		(0.039)	(0.028)	(0.066)
N		716	1,255	1,973
R^2		0.244	0.821	0.392
GDP growth rate			0.654***	
			(0.047)	
N			1,255	
R^2			0.690	
Exchange rate			0.991***	
			(0.012)	
N			1,255	
R^2			0.898	

Notes: The table reports estimates of firms' 12-month-ahead forecasts of a given variable—indicated in the left column—on the backcast (over previous 12 months) or nowcast of the variable. Nowcasts are used for the unemployment rate and the exchange rate. Sub-industry fixed effects (defined as in Table 1) are included but not reported. Each column shows which wave is used in estimation. Column (4) reports results for the specification when data are pooled across waves and firm fixed effects are included. Robust standard errors are reported in parentheses.***,**, * denotes statistical significance at 1%, 5%, and 10% levels respectively. See section 4.2 for details.

Table 8. Information updates.

Information source:	Inflation						UE	GDP
	pool	SPF	CB target	CB target + SPF	π_{t-1}	$\overline{E_{-\iota}\pi_{t+12}}$	$\overline{E_{-\iota}UE_{t+12}}$	$\overline{E_{-\iota}GDP_{t+12}}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Dependent variable: posterior p_i								
Prior, μ_i	0.307***	0.352***	0.221***	0.221***	0.275***	0.515***	0.762***	0.688***
	(0.031)	(0.075)	(0.062)	(0.064)	(0.051)	(0.047)	(0.076)	(0.123)
Observations	500	100	100	100	100	100	100	99
R-squared	0.375	0.319	0.195	0.273	0.347	0.676	0.717	0.498
Panel B. Dependent variable: scaled revision of posterior: $\frac{p_i-\mu_i}{s-\mu_i}$								
Uncertainty, σ_i	0.074***	0.088**	0.016	0.049**	0.083***	0.133***	0.298*	-0.488
	(0.014)	(0.040)	(0.036)	(0.024)	(0.026)	(0.028)	(0.165)	(0.338)
Observations	448	86	80	91	93	98	81	80
R-squared	0.035	0.024	0.002	0.035	0.051	0.083	0.021	0.028

Notes: Panel A reports results for specification (4.3) where the dependent variable is the posterior point prediction of the variable indicated in the first row of the table and the regressor is the prior, i.e. the point prediction implied by the reported probability distribution for the corresponding variable. The prior is the belief of a firm *before* the firm is presented with additional information. The posterior is the belief of a firm *after* the firm is presented with additional information. Fixed effects for source of information are included in column (1) but not reported. Panel B reports result for specification (4.4) where the dependent variable is the revision in beliefs (posterior minus prior) scaled by the difference between the signal s and the prior for the variable indicated in the first row of the table. The posterior and prior are defined as in Panel A. The regressor is the standard deviation implied by the probability distribution for the corresponding variable. Fixed effects for source of information are included in column (1) but not reported. To minimize the effects of extreme observations, the sample in each column is constrained to include only observations with $\left|\frac{p_i-\mu_i}{s-\mu_i}\right| \leq 2$. Robust standard errors are reported in parentheses. ***,**, * denotes statistical significance at 1%, 5%, and 10% levels respectively. See section 4.3 for more details.

Table 9. Ranking of attention and associated backcast errors and forecast uncertainty.

	Regressor: $\mathbf{1}(Rank_i^X > Rank_i^Y)$			Regressor: $Rank_i^X - Rank_i^Y$		
X	Inflation	Inflation	UE	Inflation	Inflation	UE
Y	UE	GDP	GDP	UE	GDP	GDP
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: dependent variable is the relative uncertainty in forecasts $\log\left(\frac{\sigma_i^X}{\sigma_i^Y}\right)$						
Rank regressor	-0.161***	-0.155***	-0.019	-0.060***	-0.046***	-0.005
	(0.034)	(0.035)	(0.032)	(0.012)	(0.011)	(0.014)
Observations	1,100	1,136	1,069	1,100	1,136	1,069
R-squared	0.019	0.016	0.000	0.023	0.015	0.000
Panel B: dependent variable is the relative size of backcast errors $\log\left(\frac{\lvert B_t X_{t-h} - X_{t-h}\rvert}{\lvert B_t Y_{t-h} - Y_{t-h}\rvert}\right)$						
Rank regressor	-2.067***	-1.890***	-1.020***	-0.733***	-0.606***	-0.493***
	(0.063)	(0.059)	(0.062)	(0.022)	(0.018)	(0.025)
Observations	1,249	1,231	1,225	1,249	1,231	1,225
R-squared	0.475	0.498	0.175	0.507	0.504	0.228

Notes: Panel A: dependent variable is relative uncertainty in forecasts $\log(\sigma_i^X/\sigma_i^Y)$ where σ_i^X measures uncertainty in forecasts from the probability distribution for variable X. Panel B: relative size of backcast errors $\log\left(\frac{\lvert B_t X_{t-h} - X_{t-h}\rvert}{\lvert B_t Y_{t-h} - Y_{t-h}\rvert}\right)$ where $B_t X_{t-h}$ is the backcast made at time t for variable X at time $t-h$. The horizon h is 12 month for inflation and GDP growth rate and 0 for the unemployment rate. We use this question to rank variables in terms of relative attention

> **Which macroeconomic variables are most important to you in making your business decisions?** Please rank the variables below from 1 (most important) to 3 (least important)
>
> *a.* *Unemployment rate* …
> *b.* *GDP* …
> *c.* *Inflation* …
> *d.* *None of these is important to my decisions*

$Rank_i^X - Rank_i^Y$ is the difference in ranks of variables X and Y as perceived by firm i. Ranks can take values 1, 2, 3. Thus the maximum difference is 2 and the minimum is -2. A higher value of the difference indicates that variable X is more important than variable Y. $\mathbf{1}(Rank_i^X > Rank_i^Y)$ is the dummy variable equal to one if firm i thinks that variable X is more for firms business decisions than variable Y. Robust standard errors are reported in parentheses. ***,**, * denotes statistical significance at 1%, 5%, and 10% levels respectively.

Table 10. Which Macroeconomic Variables Do Firms Track?

Variables followed	Fraction of firms	Fraction of firms that try to look at all the indicators simultaneously that they follow
	(1)	(2)
Inflation, Unemployment, GDP	0.216	0.919
Inflation, Unemployment	0.066	0.916
Inflation, GDP	0.101	0.937
Unemployment, GDP	0.329	0.976
Inflation	0.027	-
Unemployment	0.108	-
GDP	0.151	-

Notes: Column (1) reports the share of firms that track a combination of variables shown in the left column. Column (2) reports the share of firms tracking variables simultaneously conditional on firms tracking multiple variables.

Table 11. Macroeconomic variables: importance for business decisions and tracking.

Importance for business decisions (1=high, 3=low)	Inflation		Unemployment		GDP	
	Follow	Do not Follow	Follow	Do not Follow	Follow	Do not Follow
	(1)	(2)	(3)	(4)	(5)	(6)
1	0.371	0.003	0.205	0.009	0.395	0.017
2	0.028	0.104	0.394	0.101	0.290	0.082
3	0.011	0.482	0.120	0.171	0.112	0.104
Total	0.410	0.590	0.720	0.280	0.798	0.202

Notes: The table shows shares of firms reporting importance of a given macroeconomic variable for their business decisions and whether they track the variable.

Table 12. Differences between firms that follow a given variable and firms that do not follow.

Variables followed	Backcast error		Forecast		Forecast uncertainty (st. dev.)	
	Follow	Do not Follow	Follow	Do not Follow	Follow	Do not Follow
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation	1.151	5.131	3.453	5.916	1.797	2.131
Unemployment	0.459	1.987	5.614	6.675	0.770	0.685
GDP	1.014	2.393	3.478	4.054	0.731	0.735

Notes: The difference between "follow" and "do not follow" means is statistically different from zero at 1 percent for all cases but one: forecast uncertainty for GDP.

Table 13. State-Dependence in Acquisition of Information

		Suppose you hear on TV that the economy is doing poorly. Would it make you more likely to look for more information?					
		Much more likely	Somewhat more likely	No change	Somewhat less likely	Much less likely	Total
Suppose you hear on TV that the economy is doing well. Would it make you more likely to look for more information?	Much more likely	0.036	0.032	0.005	0.004	0.004	0.080
	Somewhat more likely	0.096	0.069	0.018	0.014	0.017	0.214
	No change	0.037	0.025	0.010	0.010	0.005	0.086
	Somewhat less likely	0.240	0.149	0.060	0.035	0.022	0.507
	Much less likely	0.044	0.039	0.013	0.011	0.006	0.113
	Total	0.453	0.313	0.106	0.073	0.054	1.000

Notes: The table reports shares of firms by their desire to seek for more/less information in response to good/bad news about the economy.

Table 14. Complementarity in acquisition of information

	No controls	Sub-industry FE	Sub-industry FE Firm controls Manager controls
	(1)	(2)	(3)
Panel A: Information complementarity			
Price complementarity	0.287***	0.287***	0.290***
	(0.022)	(0.022)	(0.023)
Observations	1,257	1,257	1,140
R-squared	0.146	0.158	0.177
Panel B: Importance of waiting for other firms			
Price complementarity	0.436*	0.410*	0.415*
	(0.231)	(0.226)	(0.240)
Observations	1,257	1,257	1,140
R-squared	0.003	0.019	0.033
Panel C: Revision of inflation expectations when the main competitor raises its price			
Importance of waiting for other firms	0.134***	0.132***	0.139***
	(0.023)	(0.024)	(0.026)
Observations	1,257	1,257	1,140
R-squared	0.026	0.037	0.055

Notes: **Panel A**: The dependent variable is information complementarity which is a dummy variable equal to one if a firm picks "The source that can be seen by other firms" and zero otherwise. The regressor is price complementary which measures (in percent, absolute value) by how much sales of a given firm fall when a typical firm in your industry cuts its price by 10%. The response is divided by 10.

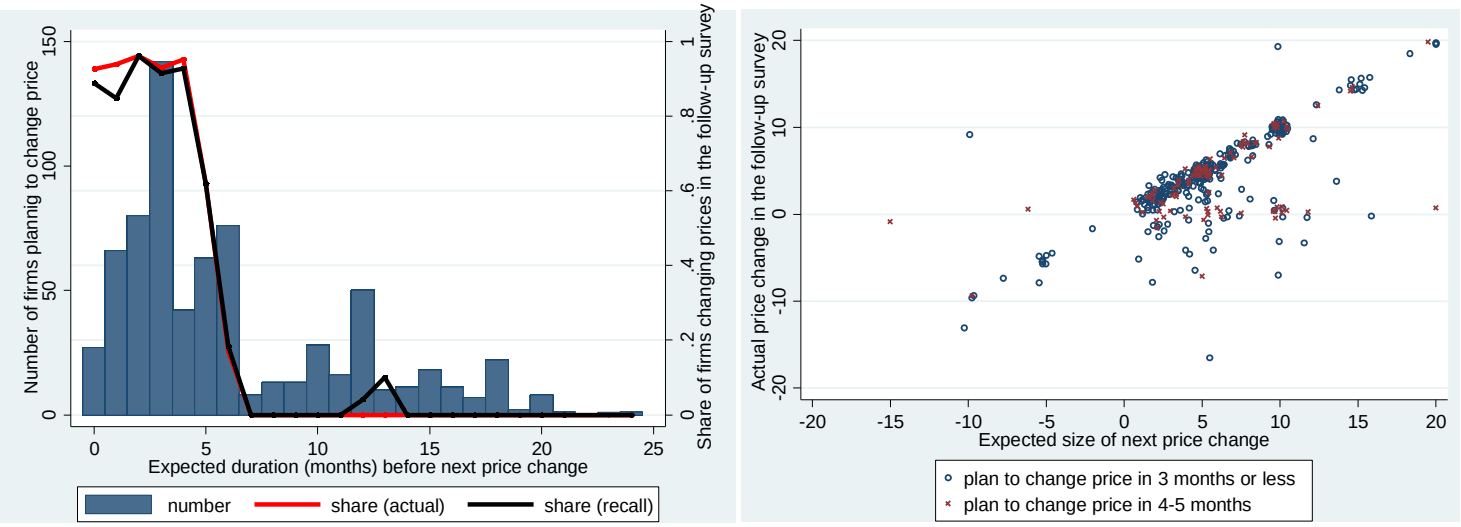
Panel B: The dependent variable is the dummy variable equal to one when a firm chooses "*Wait until other firms make a price adjustment"* in response to "*Suppose you want to adjust your prices but you are uncertain about the state of the economy. What would you do?*" and zero otherwise. The response is divided by 10. Price complementarity is defined as in Panel A.

Panel C: The dependent variable is the response to the following question: "Suppose your main competitor raises the price of its product by 10 percent. By how much would you revise your expectation of inflation over the next 12 months". The response is divided by 10. The regressor is the dummy variable equal to one when a firm chooses "*Wait until other firms make a price adjustment"* in response to "*Suppose you want to adjust your prices but you are uncertain about the state of the economy. What would you do?*" and zero otherwise.

Robust standard errors are reported in parentheses. ***,**, * denotes statistical significance at 1%, 5%, and 10% levels respectively.

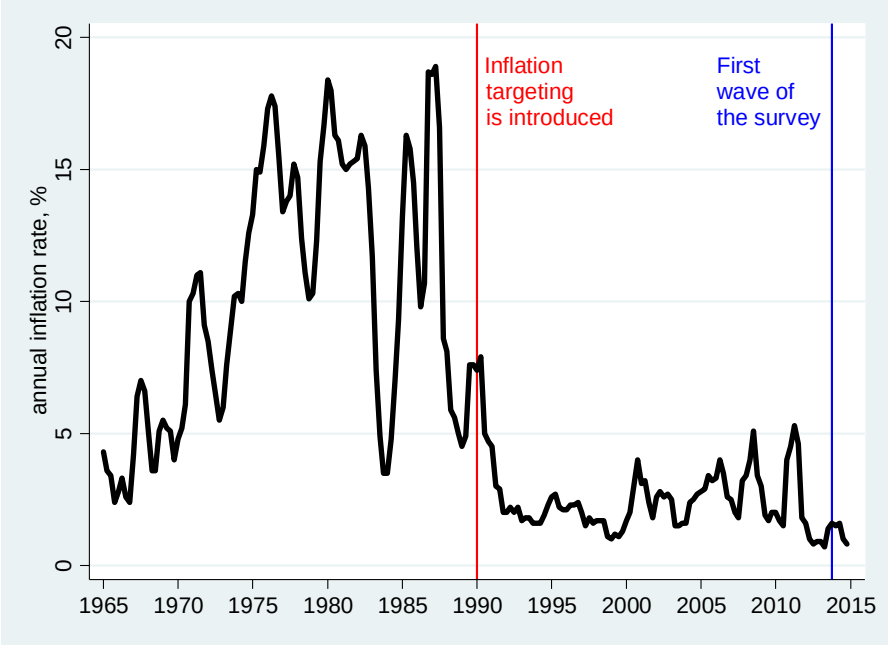
Figure 1: Firms' Expected and Actual Price Changes

Panel A: Expected Durations until Price Change *Panel B: Expected Size of Price Changes*



Notes: In Panel A, the bars (left axis) show the number of firms reporting a given expected duration before next price change in the main survey. The lines show the fraction of firms who actually adjusted their prices between the follow-up survey and the main survey, grouped by each duration. The red line measures changes in prices as the difference in current prices reported in the main and follow-up survey. The black line measures changes in prices as the change between the current price reported in the follow-up survey and the previous price reported in the follow-up survey. The previous price is the price 3 months ago for firms surveyed in December 2013 or January 2014 and 6 months ago for firms surveyed in September 2013, October 2013, or November 2013. See section 3 for details. Panel B plots firms' expectation of the size of their next price change (in %) as reported in the main survey (*x*-axis) versus firms' actual percentage change in price between the follow-up survey and the main survey (*y*-axis) for firms who reported that they expected to change prices within the next five months. Circles and crosses indicate the expected duration (reported in the main survey) before the next price change. See section 2 for details.

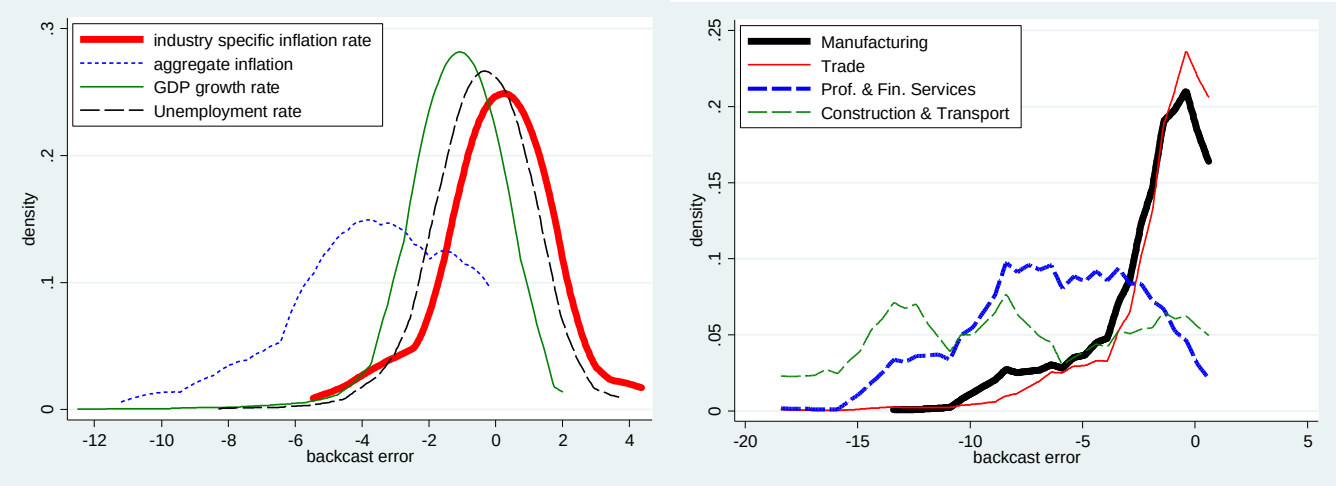
Figure 2: Inflation in New Zealand



Notes: The figure plots annual CPI inflation in New Zealand.

Figure 3: Distributions of Errors about Recent Macroeconomic Conditions

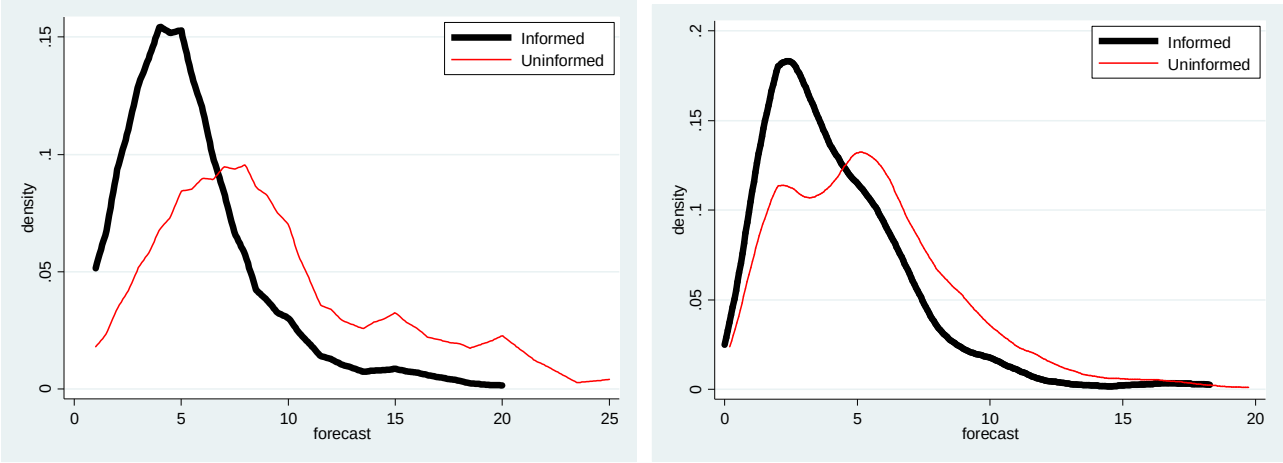
Panel A: Errors about Different Macroeconomic Variables *Panel B: Inflation Errors by Industry*



Notes: Panel A plots kernel density estimates of distributions of errors about recent values of different macroeconomic variables made by firms. Panel B plots kernel density estimates of the distribution of errors about recent inflation made across different industries. See section 3.1 for details.

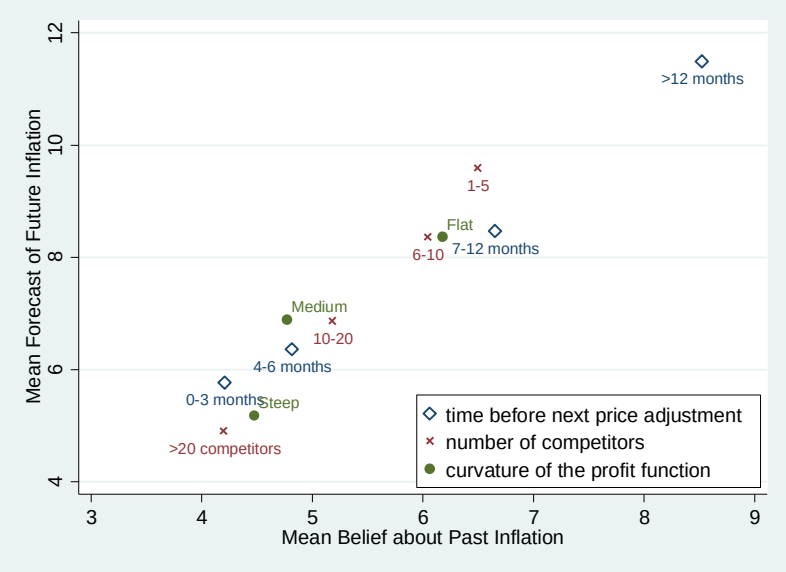
Figure 4: Distribution of Inflation Expectations across Firms

Panel A: Wave #1 => Wave #1 Panel B: Wave #1 => Wave #4



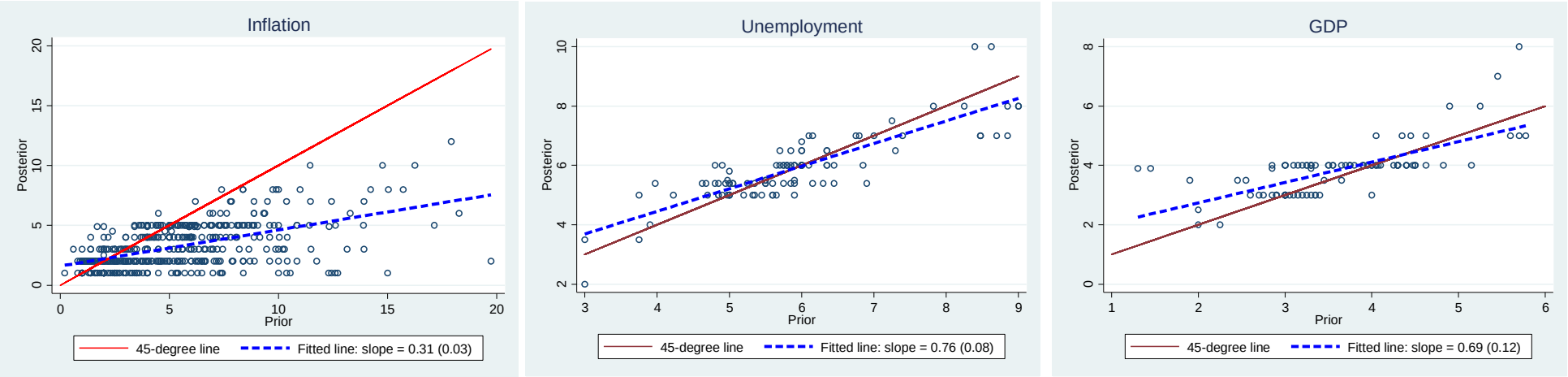
Notes: The two panels plot distributions of firms' inflation forecasts over the next twelve months. Panel A plots the distribution for "informed" firms (those whose errors about recent inflation were less than 2% points) versus "uninformed" firms in the first survey. Panel B plots equivalent distributions in the fourth wave of the survey, but continuing to identify "informed" and "uninformed" firms based on the size of their backcast errors in the first survey. See section 4.2 for details.

Figure 5: Inflation Backcasts and Forecasts by Firm Characteristic



Notes: The figure plots mean backcasts and forecasts of inflation for firms grouped by firm characteristics in the main survey. One grouping is by number of months until next expected price change, a second grouping is by the number of competitors, and the third grouping is by the tercile of the distribution of the steepness of the profit function. See section 4.2 for details.

Figure 6. Forecast Updating by Firms upon Receiving New Information



Notes: Each panel plots initial forecasts of firms in wave 4 ("prior") against their revised forecasts ("posterior") after being provided with new information. Panels include the 45 degree line and regression lines. Each panel is for forecasts of individual macroeconomic variable. See section 4.3 for details.

APPENDIX

APPENDIX 1
Selected Survey Questions

Wave #1

What is the main product of this firm?
"Main product": The product (good or service) or product group from which this firm gets its largest share of revenue.

How many workers are employed in this firm? How many are used for the main product or product line?

	Employment for firm:	Employment for main product:
Full-time:	.....	.....
Contracted:	.....	.....
Part-time:	.....	.....
Casual:	.....	.....

How many years old is the firm?

Answer:	**……**	**year(s) old**

Report the dollar value of the total amount produced by this firm over the last 3 months and that for the main product or product line. Please also report the dollar value of the amount the firm *could* have produced over the last 3 months if it had been operating at full capacity (i.e. given the equipment and machinery already in place and ready to operate; with normal downtime; with the number of shifts, hours of operation and overtime pay that can be sustained under normal conditions and a realistic work schedule in the long run; labor, materials, utilities, etc. are fully available; the same product mix as the actual production).

	Total Production Value	**Production Value for Main Product**
Actual Production:	**…… $**	**…… $**
Potential Production:	**…… $**	**…… $**

What percentage of the firm's revenues in the last 12 months came from sales in New Zealand (vs. other countries)**?**

Answer:	**……**	**% of sales originating in New Zealand**

How many direct competitors does this firm face in its main product line?

Answer:	**……**	**firms.**

Out of the total revenues of the firm, what fraction is used for compensation of all employees and what fraction is used for the costs of materials and intermediate inputs (raw materials, energy inputs, etc…)?

	Labor Costs	**Costs of Materials and other Inputs**
Share of total revenues:	**……. %**	**……. %**

What is the average selling price of this firm's main product (or product group)?

Domestic market current price =	(NZ$)	.....
Overseas market current price (if applicable) =	(currency.....).	.....
N/A (please tick)	☐	

How would you compare the price of this firm's main product relative to the prices of competing products (of similar quality, characteristics, warranty)? Please provide an answer in percentage terms (e.g. "-10%" if your product is 10% cheaper than that of most comparable competitors).

Answer:	**……**	**%**

What was the average selling price (in domestic market) of this firm's main product (or product group) in previous periods?

3 months ago = (NZ$) .....
6 months ago = (NZ$) .....
9 months ago = (NZ$) .....
12 months ago = (NZ$) .....
N/A (please tick) ☐

Considering your main product line or main line of services in the domestic market, by what margin does your sales price exceed your operating costs (i.e., the cost material inputs plus wage costs but not overheads and depreciation)? Please report your current margin as well as historical or average margin for the firm.

	Current Margin	**Average Margin**
Answer:	**…… %**	**…… %**

Approximately how often does this firm regularly review (formally) the price of its product?

Please circle the appropriate number:
1 = daily
2 = weekly
3 = monthly
4 = quarterly
5 = half-annually
6 = annually
7 = less frequently than annually
8 = N/A

When do you expect this firm to next change its price of the main product and by how much? Please provide a numerical answer in months for the former (e.g. "0" for within the next month, 1 for one month from now, …) and a percentage answer for the latter (e.g. "+10%" for a 10% increase in price or "-10%" for a 10% decrease)

Answer: I expect my firm to change the price of our main product by …… % in …….. months

If this firm was free to change its price (i.e. suppose there was no cost to renegotiating contracts with clients, no costs of reprinting catalogues, etc…) **right now or in three months, by how much would it change its price in either case?** Please provide a percentage answer (e.g. "+10%" for a 10% increase in price). **By how much do you think profits would change as a share of revenues in either case?** Please provide a numerical answer in percent (e.g. "+10%" if profits are expected to rise by 10% of revenues).

	If price could change this month:	**If price could change in three months:**
Expected change in price:	**…… %**	**…… %**
Expected change in profits:	**…… % of revenues**	**…… % of revenues**

During the *last twelve* months, by how much do you think prices changed overall in the economy? Please provide an answer in percentage terms.

Answer: …… %

During the *next twelve* months, by how much do you think prices will change overall in the economy? Please provide an answer in percentage terms.

Answer: …… %

By how much higher or lower than normal do you think the *current* level of overall economic activity is? Please provide an answer in percentage terms (e.g. "-5%" for five percent lower than normal, "+10%" for ten percent higher than normal, etc…).

Answer: …… %

Wave #2

SECTION A. QUESTIONS ABOUT THE FIRM

What is the selling price of this firm's main product (or product group)?

Domestic market current price =	(NZ$) .....
Overseas market current price (if applicable) =	(currency.....). .....
N/A (please tick) ☐	

What was the average selling price (in domestic market) of this firm's main product (or product group) in previous periods?

3 months ago =	(NZ$) .....
6 months ago =	(NZ$) .....
9 months ago =	(NZ$) .....
12 months ago =	(NZ$) .....
N/A (please tick) ☐	

SECTION B. MACROECONOMIC EXPECTATIONS

During the *last twelve* months, by how much do you think prices changed overall in the economy? Please provide an answer in percentage terms.

Answer:	**……**	**%**

During the *next twelve* months, by how much do you think prices will change overall in the economy? Please provide an answer in percentage terms.

Answer:	**……**	**%**

By how much higher or lower than normal do you think the *current* level of overall economic activity is? Please provide an answer in percentage terms (e.g. "-5%" for five percent lower than normal, "+10%" for ten percent higher than normal, etc…).

Answer:	**……**	**%**

What do you think the unemployment rate currently is in New Zealand and what do you think it will be in twelve months? Please provide a quantitative answer in percentage terms (e.g. "5.2%" for an unemployment rate of 5.2%) over each period.

Current unemployment rate		**Unemployment rate in 12 months**	
……	**%**	**……**	**%**

What do you think is the interest rate on a 1-year government bond currently and what do you think it will be in twelve months? Please provide a quantitative answer in percentage terms (e.g. "5.2%" for an unemployment rate of 5.2%) over each period.

Current interest rate		**Interest rate in 12 months**	
……	**%**	**……**	**%**

Please assign probabilities (from 0-100) **to the following ranges of growth rates of the overall economy (real GDP) over the next 12 months:** (Note that the probabilities in the column should sum to 100)

Possible growth rates for real GDP	**Probabilities**	
More than 5% per year:	**……**	**%**
From 4 to 5% per year:	**……**	**%**
From 3 to 4% per year:	**……**	**%**
From 2 to 3% per year:	**……**	**%**
From 1 to 2% per year:	**……**	**%**
From 0 to 1% per year:	**……**	**%**
The economy will contract (<0% per year):	**……**	**%**

Total (each column should sum to 100%):	**100**	**%**

Please assign probabilities (from 0-100) **to the following ranges of overall percentage price changes in the economy over the next 12 months:** (Note that the probabilities in the column should sum to 100)

Possible percentage changes in prices	**Probabilities**	
More than 5% per year:	**……**	**%**
From 4 to 5% per year:	**……**	**%**
From 3 to 4% per year:	**……**	**%**
From 2 to 3% per year:	**……**	**%**
From 1 to 2% per year:	**……**	**%**
From 0 to 1% per year:	**……**	**%**
Prices will fall (<0% per year):	**……**	**%**
Total (each column should sum to 100%):	**100**	**%**

Wave #3

What is your age? …….years

What is your gender? Please tick a box: ☐ male ☐ female

What is your highest educational qualification?

1. Less than high school 2. High school diploma 3. Some college or Associate's degree

4. College diploma 5. Graduate studies (Masters or PhD)

How many years of work experience do you have in this firm? …….years

How many years of work experience do you have in this industry? …….years

How many years have you worked outside of NZ? …….years

How much is your gross income per annum?

1. Less than $30,000 2. 30,000-49,999 3. 50,000-74,999 4. 75,000-99,999

5. 100,000-149,999 6. 150,000 or more

During the next twelve months, by how much do you think your firm's unit costs will change? Please provide an answer in percentage terms.

During the *next twelve* months, by how much do you think overall prices in the economy will change? Please provide an answer in percentage terms.

If you thought overall prices in the economy over the next 12 months were going to rise by more than what you are currently forecasting, would you:

a) Be more likely to increase your prices
b) No change
c) Be more likely to decrease your prices

Please explain your answer briefly: ……..

If you thought overall prices in the economy over the next 12 months were going to rise by more than what you are currently forecasting, would you:

a) Be more likely to increase the wages that you pay
b) No change
c) Be more likely to decrease the wages that pay

Please explain your answer briefly: ……..

If you thought overall prices in the economy over the next 12 months were going to rise by more than what you are currently forecasting, would you:

a) Be more likely to increase your employment
b) No change
c) Be more likely to decrease your employment

Please explain your answer briefly: ……..

If you thought overall prices in the economy over the next 12 months were going to rise by more than what you are currently forecasting, would you:

a) Be more likely to increase your investments (capital expenditures)
b) No change
c) Be more likely to decrease your investments (capital expenditures)

Please explain your answer briefly: ……..

Wave #4

During the *last twelve* months, by how much do you think prices have changed in your industry? Please provide a precise and quantitative answer in percentage terms.

ANSWER: …….. %

During the *next twelve* months, by how much do you think prices will change in your industry? Please provide a precise and quantitative answer in percentage terms.

ANSWER: …….. %

During the *last twelve* months, by how much do you think prices have changed overall in the economy? Please provide a precise and quantitative answer in percentage terms.

ANSWER: …….. %

What do you think the real GDP growth rate has been in New Zealand during the last 12 months? Please provide a precise quantitative answer in percentage terms.

ANSWER: …….. %

What do you think the unemployment rate currently is in New Zealand? Please provide a precise quantitative answer in percentage terms.

ANSWER: …….. %

Please assign probabilities (from 0-100) **to the following ranges of overall price changes in the economy over the next 12 months for New Zealand:** (Note that the probabilities in the column should sum to 100)

Percentage Price Changes in 12 Months	**Probabilities**	
More than 25%:	**……**	**%**
From 15 to 25%:	**……**	**%**
From 10 to 15%:	**……**	**%**
From 8 to 10%:	**……**	**%**
From 6 to 8%:	**……**	**%**
From 4 to 6%:	**……**	**%**
From 2 to 4%:	**……**	**%**
From 0 to 2%:	**……**	**%**
Less than 0%:	**……**	**%**
Total (the column should sum to 100%):	**100**	**%**

Please assign probabilities (from 0-100) **to the following ranges of growth rates of the overall economy (real GDP) over the next 12 months:** (Note that the probabilities in the column should sum to 100)

Possible growth rates for real GDP	**Probabilities**	
More than 5% per year:	**……**	**%**
From 4 to 5% per year:	**……**	**%**
From 3 to 4% per year:	**……**	**%**

From 2 to 3% per year:	**……**	**%**
From 1 to 2% per year:	**……**	**%**
From 0 to 1% per year:	**……**	**%**
The economy will contract (<0% per year):	**……**	**%**
Total (the column should sum to 100%):	**100**	**%**

Please assign probabilities (from 0-100) **to the following ranges of unemployment rates in 12 months for New Zealand:** (Note that the probabilities in the column should sum to 100)

Possible Unemployment Rates in 12 Months	**Probabilities**	
More than 8%:	**……**	**%**
From 7 to 8%:	**……**	**%**
From 6 to 7%:	**……**	**%**
From 5 to 6%:	**……**	**%**
From 4 to 5%:	**……**	**%**
Less than 4%:	**……**	**%**
Total (the column should sum to 100%):	**100**	**%**

Randomly select firms into five sets [do not select firms based on their previous answers about inflation, price/information stickiness, etc.]

Subset 1 of firms: [no additional information]. **Go to question 13.**

Subset 2 of firms: Professional forecasters are currently predicting that the overall prices in New Zealand will rise by 2.0% over the next twelve months. By how much do you think overall prices in the economy will change during the next twelve months? Please provide a precise quantitative answer in percentage terms.

ANSWER: …….. %

Go to question 15.

Subset 3 of firms: Professional forecasters are currently predicting that the overall prices in New Zealand will rise by 2.0% over the next twelve months. The Reserve Bank of New Zealand targets an overall rise in prices of approximately 2% each year. By how much do you think overall prices in the economy will change during the next twelve months? Please provide a precise quantitative answer in percentage terms.

ANSWER: …….. %

Go to question 15.

Subset 4 of firms: The Reserve Bank of New Zealand targets an overall rise in prices of approximately 2% each year. By how much do you think overall prices in the economy will change during the next twelve months? Please provide a precise quantitative answer in percentage terms.

ANSWER: …….. %

Go to question 15.

Subset 5 of firms: Overall prices in New Zealand have gone up by 1.0% over the last twelve months. By how much do you think overall prices in the economy will change during the next twelve months? Please provide a precise quantitative answer in percentage terms.

ANSWER: …….. %

Go to question 15.

Subset 6 of firms: Firms in the economy expect overall prices to increase by X.X% over the next twelve months. By how much do you think overall prices in the economy will change during the next twelve months? Please provide a precise quantitative answer in percentage terms.

ANSWER: …….. %

Go to question 15.

For firms in subsets 2-5, add no information. For firms in subset 1, randomly select firms into

a. **subset and provide additional information (subset 1.a). Ask the question below.**
b. **others no information (subset 1.b). If selected in this subset, go to question 14.**

The most recent data for real GDP in New Zealand indicate that the economy grew 3.9% over twelve months. By how much do you think real GDP will grow overall in the economy over the next twelve months? Please provide a precise quantitative answer in percentage terms.

ANSWER: …….. %

Go to question 15.

For firms in subsets 2-5 and subset 1a, provide no additional information. For other firms, randomly select firms into

c. **subset and provide additional information (subset 1.a.i). Ask the question below.**
d. **others no information (subset 1.b.ii). If selected in this subset, go to question 15.**

The most recent unemployment rate in New Zealand is 5.4%. What do you think the unemployment rate will be in New Zealand in twelve months? Please provide a precise quantitative answer in percentage terms.

ANSWER: …….. %

15. **Which macroeconomic variables are most important to you in making your business decisions?** Please rank the variables below from 1 (most important) to 3 (least important)

e. *Unemployment rate* …
f. *GDP* …
g. *Inflation* …
h. *None of these is important to my decisions*

16. **Which macroeconomic variables do you keep track of?** Check each variable that you keep track of**.**

a. *Unemployment rate* …
b. *GDP* …
c. *Inflation* …
d. *None of these is important to my decisions* …

If they check three variables go to 14a.
If they check two variables go to 14b.

If they check one variable, go straight to question 15.

16a. How do you acquire information about macroeconomic variables (inflation, unemployment or GDP)?

a. I try to look at all these indictors at the same time
b. I try to look at unemployment and GDP together
c. I try to look at unemployment and inflation together
d. I try to look at inflation and GDP together
e. I look at each of these variables separately

16b. How do you acquire information about macroeconomic variables (inflation, unemployment or GDP)?

a. I try to look at both indictors at the same time
b. I look at them separately.

17. Suppose you hear on TV that the economy is doing well. Would it make you more likely to look for more information?

a. Much more likely
b. Somewhat more likely
c. No change
d. Somewhat less likely
e. Much less likely

18. Suppose you hear on TV that the economy is doing poorly. Would it make you more likely to look for more information?

a. Much more likely
b. Somewhat more likely
c. No change
d. Somewhat less likely
e. Much less likely

19. Suppose a typical firm in your industry cuts its price by 10%. By how much would YOUR sales be affected?

a. Increase by … percent
b. No change
c. Decrease by … percent

20. Suppose that there are two sources of information about the state of the economy. These sources are equally informative/useful, but they can give different signals about the state of the economy (that is, they can disagree). In addition, the first source can be seen by other firms in your industry while the second sources is available only to you. You can see only one source. Which source would you pick?

a. The source that can be seen by other firms
b. The source that can be seen only by you

21. Suppose your main competitor raises the price of its product by 10 percent. By how much would you revise your expectation of inflation over the next 12 months?

a. Increase by … percent
b. No change
c. Decrease by … percent

22. Suppose you want to adjust your prices but you are uncertain about the state of the economy. What would you do

a. Collect more information now and then make a decision

b. Wait another quarter until more information comes in (but do not look for it actively)
c. Wait until other firms make a price adjustment
d. Change your price right away

23. What share of your turnover (total vs. for main product) comes from long-term versus short-term customers?

	Share of total turnover	**Share of turnover for main product**
Long-term customers (relationship lasting more than one year)	*….. %*	*….. %*
Short-term customers (relationship lasting 1 year or less)	*….. %*	*….. %*
	[check if sum =100]	*[check if sum =100]*

24. *What do you think is the current exchange rate of the New Zealand Dollar relative to the U.S. Dollar?*
Answer: …. (either US dollar / NZ dollar or vice-versa)

25. What do you think the exchange rate of the New Zealand Dollar will be in twelve months relative to the U.S. Dollar?
Answer: …. (either US dollar / NZ dollar or vice-versa)

APPENDIX 2
Classification of firms into industries and sub-industries

	SIC2 Codes
Manufacturing	
Chemicals and metals	1700-2299
Equipment and machinery	2300-2499
Food and beverage	1110-1219
Paper/wood, printing and furniture	1400-1699, 2500-2599
Textile and clothing	1300-1399
Trade	
Car, supermarket and food retailing	3900-4199
Hotel and food services	4400-4599
Other store retailing	4200-4399
Wholesale trade	3300-3899
Professional and financial services	
Accounting services	6932
Finance	6200-6299
Insurance	6300-6399
Aux. finance and insurance	6400-6499
Legal services	6931
Rental, hiring and real estate	6600-6799
All other professional services	5400-6099, 6900-7399 (excl. 6931, 6932)
Construction and transportation	3000-3299, 4600-5399

Notes: The table reports allocation of SIC codes to industries (in italics) and sub-industries (not in italics + Construction and transportation).

APPENDIX 3

Construction of sampling weights

The statistical office of New Zealand provides detailed information on the number of firms by industry (up to four-digit disaggregation of ANZSIC-06 industry classification) and firm size bins (1-5, 6-9, 10-19, 20-49, 50-99, 100+ employees). The data can be accesses at http://www.stats.govt.nz/, "Business demography tables", "employment size groups for geographic units (ANZSIC06) 2000-2013." The information on the number of firms is based on the Statistic New Zealand Longitudinal Business Frame. The Statistic NZ Business Frame generally includes all employing units and those enterprises with GST turnover greater than $30,000 per year.

Denote the population number of firms in industry *i* and employment size *s* with N_{is}. For each industry and bin size, we compute the number of firms in our survey. Denote the number of firms in our survey in industry *i* and in size bin *s* with $\widetilde{N}_{is}$.

We construct the weight for firms in industry *i* and firm size bin *s* as $\omega_{is} = N_{is}/\widetilde{N}_{is}$.

In our baseline results, we use weights constructed for 5 firm size bins (6-9, 10-19, 20-49, 50-99, 100+ employees) and 3-digit ANZSIC-06 industry classification. We use 3-digit industry classification to ensure that we have firms in all industries. Note that in the survey we collected information only on firms with more than 5 employees. We exclude firms with 5 or fewer employees because these firms are likely to fall below the economic significance criteria on Statistics New Zealand's Business Frame (BF).

The average value of ω_{is} is 11.7, the median is 5.5, the standard deviation is 15.5. In a small fraction of cases $\omega_{is} < 1$, which is likely to arise due to inconsistencies in industry/size classification of firms in our survey and in the official statistics. For example, the official data uses employment in February while our data are for the fourth quarter. Industrial and business classifications for smaller firms in the official statistics are primarily maintained using administrative data while we use survey responses of firms about their main product. As we increase the coarseness of firm size and/or industry classification, the fraction of cells with $\omega_{is} < 1$ shrinks to zero. In a handful of cases, $\omega_{is} > 100$. To avoid the adverse effects of assigning large weights to a small number of firms (this can have a disproportionate effect on regression estimates), we censor ω_{is} at 100.

APPENDIX 4

Sensitivity of inflation expectations to wording of questions

Consistent with the Michigan Survey of Consumers, we asked firms about the expected change in *prices*. The economists, however, often operate with inflation rates. While there is a one-to-one mapping between changes in prices and inflation rates, one may be concerned that the wording of the question may be important here since people may have cognitive biases or difficulties with respect to this mapping. In addition, when we ask firms about expected inflation over the next three months, we implicitly assume that firms report annualized inflation rates. To assess the importance of these issues, we presented alternative formulations of the expected inflation (e.g. Q16) to 100 randomly selected firms.

Baseline: **During the *next three* months, by how much do you think prices will change overall in the economy? Please provide an answer in percentage terms.**

Alternative #1**: During the *next three* months, what will be the inflation rate in the economy? Please provide an answer in percentage terms.**

Alternative #2: **During the *next three* months, what will be the annualized inflation rate in the economy? Please provide an answer in percentage terms.**

We asked similar questions about inflation over the next twelve months as well as about past inflation over the last three and twelve months. Appendix Table 4.1 shows that the differences in responses across questions are not statistically significantly different from zero. Thus, firms do not appear to systematic biases or exhibit difficulties with interpreting the questions.

Appendix Table 4.1. Mean differences in responses to baseline and alternative formulations of inflation expectation questions

	Backcast		Forecast	
	3 months	12 months	3 months	12 months
	(1)	(2)	(3)	(4)
	Panel A: Alternative #1, inflation expectations			
Difference from the baseline	-0.175	-0.735	0.280	-0.804
	(0.440)	(0.601)	(0.696)	(0.633)
	Panel B: Alternative #2, inflation expectations			
Difference from the baseline	0.161	0.824	0.469	-0.096
	(0.387)	(0.539)	(0.539)	(0.651)
	Panel C: Alternative #1, change in inflation expectations			
Difference from the baseline	-0.030	-0.070	1.353**	-0.545
	(0.370)	(0.456)	(0.607)	(0.740)
	Panel D: Alternative #1, change in inflation expectations			
Difference from the baseline	-0.452	-0.602	0.701	-0.312
	(0.468)	(0.606)	(0.538)	(0.685)

Notes: the table reports the difference between the mean response to a question in alternative formulation and the mean response in the baseline formulation of the question. The sample of firms used for the baseline formulation is constrained to cover only industries (3-digit level) that are populated by firms that answered an alternative formulation of the question. ** denotes statistical significance at 5% level.

APPENDIX 5

Point forecasts vs. means from probability distributions

In addition to asking firms about their point forecasts of inflation, we asked firms to provide probability distribution for their forecasts in wave #2. The question is formulated as follows:

Please assign probabilities (from 0-100) **to the following ranges of overall percentage price changes in the economy over the next 12 months:** (Note that the probabilities in the column should sum to 100)

Possible percentage changes in prices	**Probabilities**	
More than 5% per year:	**……**	**%**
From 4 to 5% per year:	**……**	**%**
From 3 to 4% per year:	**……**	**%**
From 2 to 3% per year:	**……**	**%**
From 1 to 2% per year:	**……**	**%**
From 0 to 1% per year:	**……**	**%**
Prices will fall (<0% per year):	**……**	**%**
Total (each column should sum to 100%):	**100**	**%**

One may be concerned that the implied mean from the probability distribution may be different from the point forecast reported by firms because firms may have cognitive biases and difficulties in connecting point forecasts and distributions for their forecasts. We calculate the mean forecast implied by the probability distribution as follows:

$$\begin{aligned}\tilde{F}_t^i \pi_{t,t+12} = &-0.5 \times \left(\textbf{Prices will fall } (< \textbf{0\% per year})\right) + 0.5 \times (\textbf{From 0 to 1\% per year}) + 1.5 \\ &\times (\textbf{From 1 to 2\% per year}) + 2.5 \times (\textbf{From 2 to 3\% per year}) + 3.5 \\ &\times (\textbf{From 3 to 4\% per year}) + 4.5 \times (\textbf{From 4 to 5\% per year}) + 10 \\ &\times (\textbf{More than 5\% per year})\end{aligned}$$

Note that the value for the (**More than 5% per year**) bracket is set at 10 to reflect that many firms report high mean inflation forecasts and that firms reporting a high weight on this bracket have inflation forecasts on average in excess of 10 percent per year. Appendix Figure 4.1 plots point forecast for inflation $F_t^i \pi_{t,t+12}$ against the mean value implied from the probability distribution $\tilde{F}_t^i \pi_{t,t+12}$. Note that many observations are above the red line, which shows results from a fitted OLS regression. To explain this pattern, one should observe that many firms predict more than 5 percent inflation (point forecasts) and thus put a very high weight on the (**More than 5% per year**) bracket. Since the bracket cannot provide details on inflation above 5%, the mean implied by the distribution is not able to capture variation on inflation expectations above 5% and hence errors are likely to be one-sided.

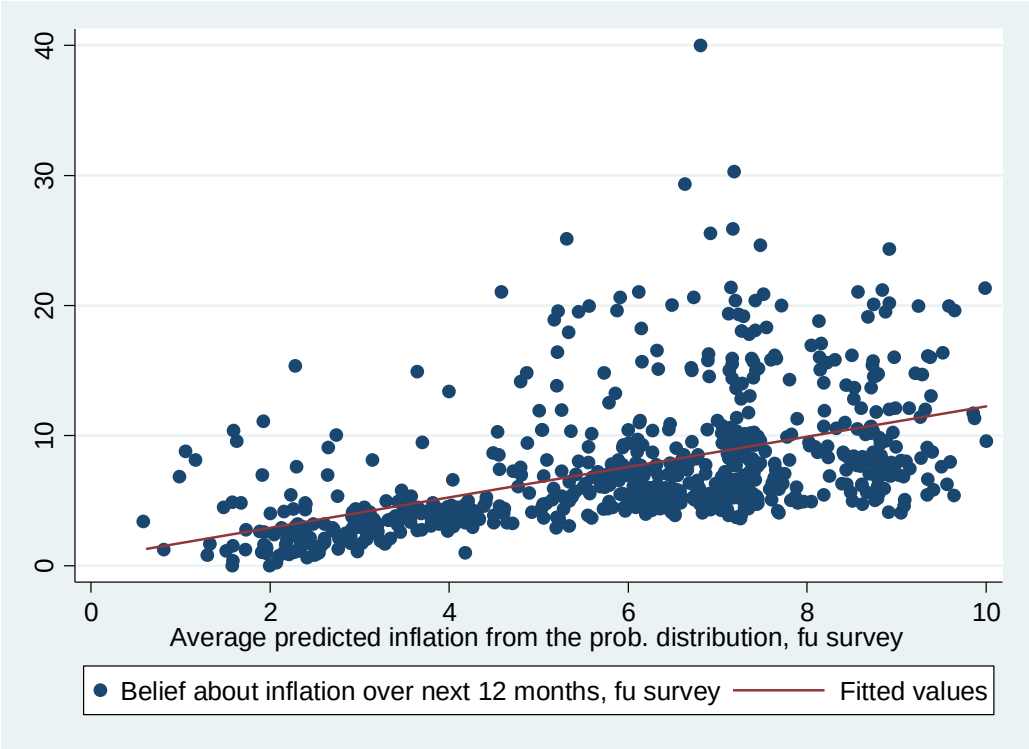
To evaluate this conjecture, we present results of regressing $F_t^i \pi_{t,t+12}$ on $\tilde{F}_t^i \pi_{t,t+12}$ using OLS and quantile (median) regressions (Appendix Table 4.2). Quantile regressions minimize the effect of influential observations and outliers. We also present results for subsamples where firms predict $\tilde{F}_t^i \pi_{t,t+12} \leq 5\%$ and $\tilde{F}_t^i \pi_{t,t+12} > 5\%$. Note that with quantile regressions, which are least sensitive to one-sided errors, the slope is close to one and the constant term is close to zero in all cases. The constant term for the OLS regressions is largest for firms with $\tilde{F}_t^i \pi_{t,t+12} > 5\%$ while the slope for these firms is smaller than for firms with $\tilde{F}_t^i \pi_{t,t+12} \leq 5\%$. Thus, we conclude that, although construction of brackets limits information for inflation rates above 5%, point forecasts for inflation are close to the mean forecasts implied by the probability distributions.

Appendix Table 4.2. Consistency of inflation forecasts: point estimate vs. mean implied by the probability distribution.

Dependent variable: Point forecast $F_t^i \pi_{t,t+12}$	Regression	
	OLS	Quantile
	(1)	(2)
Panel A: all observations		
Mean forecast implied by the distribution, $\tilde{F}_t^i \pi_{t,t+12}$	1.167***	1.111***
	(0.063)	(0.053)
Constant	0.566*	-0.333
	(0.339)	(0.333)
Observations	716	716
R-squared	0.261	
Panel B: firms with $\tilde{F}_t^i \pi_{t,t+12} \leq 5\%$		
Mean forecast implied by the distribution, $\tilde{F}_t^i \pi_{t,t+12}$	0.951***	1.026***
	(0.246)	(0.043)
Constant	0.933	-0.103
	(0.774)	(0.141)
Observations	229	229
R-squared	0.108	
Panel C: Firms with $\tilde{F}_t^i \pi_{t,t+12} > 5\%$		
Mean forecast implied by the distribution, $\tilde{F}_t^i \pi_{t,t+12}$	0.798***	0.916***
	(0.191)	(0.191)
Constant	3.375**	1.099
	(1.409)	(1.398)
Observations	487	487
R-squared	0.035	

Notes: Responses are from the follow-up survey. Robust standard errors are reported in column (1). ***, **, * shows statistical significance at 1%, 5%, and 10% levels respectively.

Appendix Figure 4.1. Point forecast for inflation vs. mean forecast implied by the probability distribution.



Notes: $\tilde{F}_t^i \pi_{t,t+12}$ is on the horizontal axis. $F_t^i \pi_{t,t+12}$ is on the vertical axis. Responses are from the first follow-up survey.

APPENDIX 6

Firms' expectations of aggregate inflation vs. expected changes in own unit costs

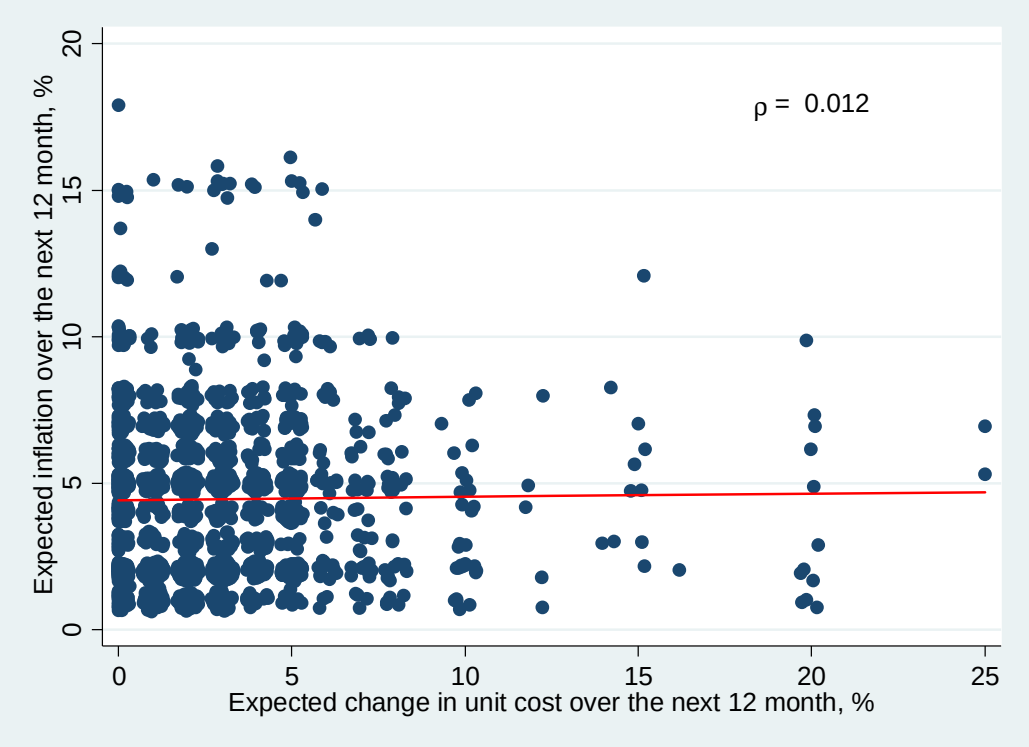
Some surveys of firms, such as the Business Inflation Expectations survey of the Atlanta Federal Reserve, ask firms about their expectations of future changes in their unit costs rather than their expectations of aggregate inflation. In the third wave of the survey, we asked firms the following two questions to assess the potential relationship between these two distinct concepts:

Expected changes in unit costs:
"During the next twelve months, by how much do you think your firm's unit costs will change? Please provide an answer in percentage terms."

Benchmark inflation question:
During the next twelve months, by how much do you think overall prices in the economy will change? Please provide an answer in percentage terms.

We then compare firms' answers to the two questions in Appendix Figure 6.1 below. The correlation between firms' expectations over future aggregate inflation and their expectations over their future changes in unit costs is essentially zero.

Appendix Figure 6.1. Expectations of future inflation vs. future changes in own unit costs



Notes: The vertical axis is firm's expectations about aggregate inflation and horizontal axis is firm's expectations about future changes in their own unit costs.

APPENDIX 7

Additional tables and figures

Appendix Table 1. How Firms Respond to Higher Inflation Expectations

Panel A.			
	Response		
Variable	increase	no change	decrease
price	0.354	0.604	0.042
wage	0.253	0.727	0.019
employment	0.274	0.715	0.011
investment	0.293	0.694	0.013
Panel B.			
	Wage response		
Price response	increase	no change	decrease
increase	0.130	0.217	0.007
no change	0.114	0.480	0.011
decrease	0.009	0.030	0.002
Panel C.			
	Employment response		
Wage response	increase	no change	decrease
increase	0.082	0.167	0.004
no change	0.184	0.536	0.007
decrease	0.007	0.012	0.000
Panel D.			
	Employment response		
Investment response	increase	no change	decrease
increase	0.089	0.200	0.004
no change	0.182	0.504	0.007
decrease	0.002	0.011	0.000

Notes: Panel A presents shares of firms responding "increase", "decrease", or "no change" to the survey question is "If you thought overall prices in the economy over the next 12 months were going to rise by more than what you are currently forecasting, would you be more likely to [increase/decrease/no change] your [prices/employment/investment/wages]?" Panels B-D show breakdowns of how firms responded to pairs of questions. See section 4.1 for details.

Appendix Table 2. Ranking of attention and associated backcast errors and forecast uncertainty.

	Regressor: $1(Rank_i^X > Rank_i^Y)$			Regressor: $Rank_i^X - Rank_i^Y$		
X	Inflation	Inflation	UE	Inflation	Inflation	UE
Y	UE	GDP	GDP	UE	GDP	GDP
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: dependent variable is the relative uncertainty in forecasts $\log\left(\frac{\sigma_i^X}{\sigma_i^Y}\right)$						
Rank regressor	-0.109***	-0.107***	-0.027	-0.042***	-0.032**	-0.008
	(0.040)	(0.041)	(0.035)	(0.014)	(0.013)	(0.015)
Observations	993	1,030	967	993	1,030	967
R-squared	0.032	0.036	0.020	0.035	0.035	0.019
Panel B: dependent variable is the relative size of backcast errors $\log\left(\frac{\lvert B_t X_{t-h} - X_{t-h}\rvert}{\lvert B_t Y_{t-h} - Y_{t-h}\rvert}\right)$						
Rank regressor	-1.917***	-1.661***	-1.009***	-0.687***	-0.538***	-0.487***
	(0.069)	(0.071)	(0.065)	(0.025)	(0.022)	(0.027)
Observations	1,133	1,117	1,112	1,133	1,117	1,112
R-squared	0.492	0.510	0.193	0.520	0.521	0.243

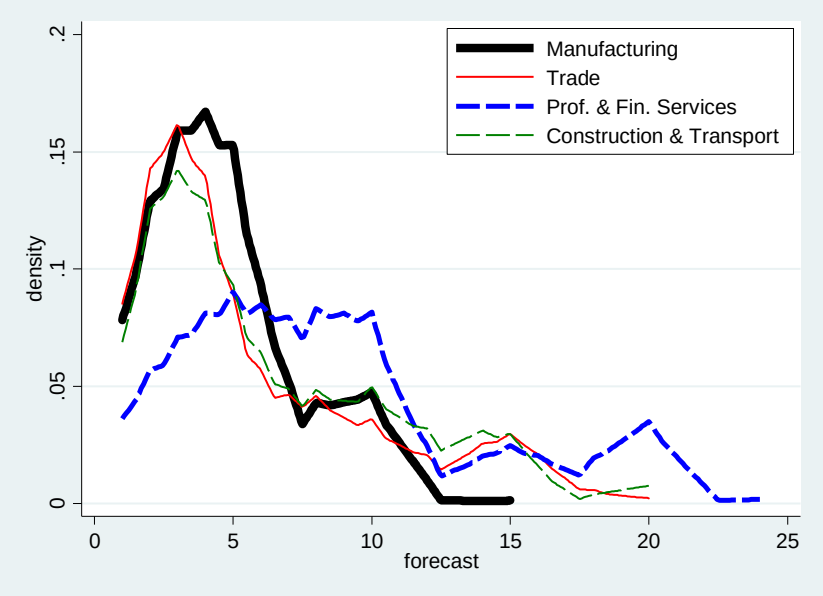
Notes: This table replicates Table 13 with firm and manager controls used in Table 4. See notes to Table 13 for more details.

Appendix Table 3. Determinants of tracking and importance of inflation for business decisions.

	Track inflation		Relative importance of inflation for business decisions	
	(1)	(2)	(3)	(4)
Firm characteristics				
Log(Age)	-0.032	-0.021	0.056	0.037
	(0.022)	(0.022)	(0.043)	(0.044)
Log(Employment)	-0.037	-0.054**	0.052	0.082*
	(0.023)	(0.022)	(0.045)	(0.044)
Labor's share of costs	-0.010***	-0.000	0.016***	-0.000
	(0.001)	(0.002)	(0.002)	(0.004)
Foreign trade share	-0.002**	-0.003***	0.002	0.004*
	(0.001)	(0.001)	(0.002)	(0.002)
Number of Competitors	0.003***	0.003**	-0.007***	-0.006**
	(0.001)	(0.001)	(0.003)	(0.003)
Avg. margin	-0.012***	-0.004**	0.021***	0.009**
	(0.001)	(0.002)	(0.002)	(0.003)
Share of revenue from LT customers	-0.005***	-0.005***	0.010***	0.009***
	(0.001)	(0.001)	(0.001)	(0.001)
Manager characteristics				
Age	0.001	0.001	-0.002	-0.001
	(0.002)	(0.002)	(0.003)	(0.003)
Education:				
Some college	-0.035	-0.020	0.033	0.006
	(0.032)	(0.031)	(0.062)	(0.060)
College	0.022	0.018	-0.059	-0.053
	(0.038)	(0.037)	(0.071)	(0.070)
Graduate (MA+)	0.039	0.055	-0.061	-0.089
	(0.040)	(0.040)	(0.078)	(0.076)
Tenure	0.001	0.002	-0.001	-0.003
	(0.002)	(0.002)	(0.005)	(0.005)
Income	-0.000	-0.000	0.001	0.001
	(0.000)	(0.000)	(0.001)	(0.001)
Industry FE	No	Yes	No	Yes
Observations	1,139	1,139	1,139	1,139
R-squared	0.277	0.313	0.242	0.276

Notes: The dependent variable in columns (1) and (2) is the dummy variable equal to one if a firm tracks inflation and zero otherwise. The dependent variable in columns (3) and (4) is the importance rank of inflation (relative to GDP and unemployment rate) for a firm's business decisions. The score runs from 1 (most importance) to 3 (least importance). Robust standard errors are reported in parentheses. ***,**, * denotes statistical significance at 1%, 5%, and 10% levels respectively.

Appendix Figure 1: Distribution of 12-Month Ahead Inflation Forecasts by Industry



Notes: Each panel plots the distribution of the firms' forecasts of inflation over the next twelve months by industry, as defined in Table 1. Data is from the main survey. See section 5.2 for details.