Preliminary Version
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HOW DO FIRMS FORM THEIR EXPECTATIONS?

NEW SURVEY EVIDENCE

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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. For example, firms which face more competitors or firms which expect to change their prices sooner have systematically better macroeconomic information.

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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 economic 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 exist (e.g. Confidence 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 tt 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 large 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, this

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

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 a follow-up survey. 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 the follow-up survey to check consistency of firm's 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 the 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 economic beliefs held by those agents in charge of running firms. Focusing first on the attention that firms pay to macroeconomic conditions, we document significant heterogeneity in attentiveness across firms. 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. In contrast, no firms reported believing that prices had fallen during this time period, so errors about recent inflation were highly asymmetric, a feature which is also present in households' inflation perceptions (Armantier et al. 2012). Similar patterns obtained with beliefs about output gaps and interest rates. The very wide dispersion in beliefs about recent economic conditions displayed in the survey responses is strongly at odds with the assumption of many macroeconomic models that firms hold common beliefs about past macroeconomic conditions 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).

We also document several striking properties of the cross-firm heterogeneity in beliefs about recent economic conditions. First, there are clear industry-level differences in these beliefs. While firms in manufacturing, retail and wholesale trade tended to be disproportionately "informed" (typically 60-80% of firms in these sectors), firms working in finance, insurance and business services were exceptionally *un*informed about recent macroeconomic conditions: less than 15% of firms in consulting, accounting, banking, and related sectors can be classified as "informed" by our baseline inflation metric. These differences cannot be accounted for by different industry inflation experiences or even by firms' recent price changes, so it does not appear that firms are directly extrapolating from their industry's experience. However, 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) or Mackowiak and Wiederholt (2009). We also find little evidence that managers of larger or older firms are any better informed than others, if anything they are less well-informed. This suggests that one should not necessarily expect to see less heterogeneity in information sets among larger firms than those in our sample.

Turning to firms' expectations about future inflation, the key finding is that, at least in terms of cross-sectional moments, firms' expectations appear much closer to those of households than to those of professional forecasters. The mean forecast of inflation across firms, for example, is about 5% while that of households is over 3% whereas professional forecasters in Consensus Economics were forecasting an annual inflation rate of only 2.0% in the fourth quarter of 2013. 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, interest rates and unemployment rates.

What drives this heterogeneity in beliefs about future macroeconomic conditions? As with heterogeneity in beliefs about past macroeconomic conditions, there are pervasive industry differences. While the majority of firms in manufacturing or retail and wholesale trade forecast inflation under 5%, only 20% of firms in professional and financial services firms do so. There is also a strong positive correlation

between firms' beliefs about recent inflation and their forecasts of future inflation, although even among "informed" firms there remains substantial heterogeneity in beliefs. We argue that much of the dispersion in beliefs about future inflation, like the dispersion in beliefs about past economic conditions, likely reflects rational inattention motives. For example, we again find that firms in more competitive sectors, firms which expect to change prices sooner, or those with steeper profit functions have systematically lower inflation expectations, even after controlling for beliefs about recent inflation. In fact, controlling for factors associated with rational inattention and the size of the firm greatly reduces the predictive power of beliefs about past inflation in explaining expectations of future inflation. We interpret this as again being indicative of rational inattention motives: the amount of competition faced by firms and their need for better information for decision-making determines the precision of their information about both recent and future economic conditions.

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, etc..). 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 is in part reflecting 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 documents properties of the firms included in the survey. Section 3 presents evidence on the quality of firms' responses to survey questions. Section 4 focuses on firms' attentiveness to recent macroeconomic developments, while section 5 targets the properties of firms' expectations about future macroeconomic conditions. Finally, section 6 concludes by discussing some implications of these results.

2 Description of the survey

The survey of firms in New Zealand was done in two periods. 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, people, products and services. Firms were randomly selected from both directories. We did not utilize the New Zealand Business Frame because it does not identify firms.

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 select 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 remaining 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 dominated 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.

Appendix 1 lists all of the survey questions which are used in this paper. 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: Manufacturing, Trade, Professional and Financial Services, and 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

[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.

illustrated in Table 1. Note that the Construction and Transportation industry is not further decomposed as this sector contains significantly 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 survey is devoted to price setting and information collection decisions by firms. For example, we ask 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 a follow-up survey 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. Table 1 reports the number of firms participating in the follow-up survey by industry and sub-industry. The questions in the follow-up survey included some of the same questions as in the initial survey (to provide a panel dimension) but also some new questions which build on the initial survey. We will explore both dimensions of the survey in the paper.

3 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 consider 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 are 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 can try to independently verify is 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%. We attribute these errors to data entry failures in which different firms were recorded as having responded to the survey than those which were actually called. 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 can verify is 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 claim no foreign sales, only four report clear export availability on their websites. Of the 87 firms who claim 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%.

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 report prices in both surveys. 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 original survey, by comparing the

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

"current" price in the follow-up survey with either the "current price" from the original 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 Figure 1, for firms who expected to change their price within the next four months at the time of the original 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 Figure 2, 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 one, including once one conditions on industry or sub-industry fixed effects. These results are therefore consistent with firms reporting their true expectations in the survey.

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 who 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.

4 (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.

4.1 Degree of Inattention

To measure inattention to aggregate conditions, we rely primarily on a question from the main survey held during 2013Q4 in which we asked respondents by how much they believed overall prices in the economy had changed *over the last twelve months*. At the time of the survey, annual CPI inflation in New Zealand was 1.5%, as illustrated in Panel A of Figure 3. 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%. New Zealand's experience of stable inflation under an inflation-targeting regime has been one of the key factors in inducing many other countries to adopt such regimes, with one of the key supposed advantages being an "anchoring" of agents' inflation expectations (Walsh 2009).

We 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 B 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 nearly thirty years.

A second point to note from Panel B of Figure 3 is that the distribution of errors is highly asymmetric. Large errors are systematically negative, with these firms believing that price changes have been much larger than what has 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 economic conditions displayed in Figure 3 is not unique to inflation. In the main survey, we also asked firms about their perceptions of the current output gap ("By how much higher or lower than normal do you think the *current* level of overall economic activity is?"). At the time of the survey, the actual output gap as estimated by the Reserve Bank of New Zealand was 0.8%. So we can construct "errors" of firms about the contemporaneous output gap as the deviation of the actual output gap from the firms' belief about the gap. As documented in Appendix Figure 1, we again find dramatic and asymmetric variation in beliefs about the output gap, with the majority of firms reporting beliefs that output was between 5% and 10% lower than normal. For both inflation and the output gap, we get the same qualitative results for the distribution of inattentiveness from identical questions in the follow-up survey (albeit for the subset of firms in the follow-up survey).

The latter also includes two additional questions to firms about their beliefs regarding the current unemployment rate and current interest rates (one-year bill rates). This allows us to construct two additional measures of inattention to current economic conditions for those firms participating in the follow-up survey. As documented in Appendix Figure 1, we also find large variation in beliefs about interest rates and unemployment that are biased toward higher unemployment and interest rates than were present in the New Zealand economy at the time. The dispersion is lower for these variables, and the skewness not as pronounced as for inflation and the output gap. But the implied degree of inattention is nonetheless still strikingly large. Only two-thirds of firms could identify the unemployment rate within one percentage point, and fifteen percent of firms were off by more than two percentage points. The precision rate for interest rates is even lower.

One can also verify that inattention to economic conditions is not overly sensitive to which macroeconomic variable is used. For example, if we regress the absolute value of a firm *i*'s "error" with respect to a macroeconomic variable *z* (output gap, unemployment rate or the interest rate) on the absolute value of the inflation error, i.e.

$$\left|z_t - F_t^i z_t\right| = \alpha + \beta\left|\pi_{t,t-12} - F_t^i \pi_{t,t-12}\right| + \delta_j + \varepsilon_i$$

where F^i denotes the belief (or forecast) of firm i and δ_j is an industry fixed effect, we systematically find positive and statistically significant values of β. Table 2 documents these results for the output gap, interest rates, and the unemployment rate as different LHS variables, both excluding and including fixed effects at the "sub-industry" level as defined in section 2. For the output gap, we report estimates both within the main survey as well as within the follow-up survey. These results indicate a common inattention to macroeconomic conditions among firms, with those firms paying less attention to recent inflation

developments also being less informed on average about recent unemployment, output and interest rate levels.

In short, these results point toward *pervasive inattention by firms to macroeconomic conditions*, with remarkable cross-sectional variation in beliefs about recent macroeconomic outcomes. While the amount of dispersion in beliefs is largest for inflation and output, there is widespread disagreement about all four macroeconomic variables.

4.2 Sources of Inattention

What explains the degree of inattention paid by firms to recent macroeconomic conditions? One important factor appears to be industry-related. In Figure 4, we plot the distribution of inattention to inflation (i.e. absolute values of errors about inflation over the preceding twelve months) by industry: manufacturing vs. trade vs. professional and financial services vs. construction and transportation. There are sharp differences in the distribution of inattention across these industries. In both manufacturing and trade, the majority of firms are relatively 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. Strikingly, there is very little variation in the distribution of inflation errors across sub-industries. As documented in Appendix Figure 2, all subsectors of manufacturing and trade have very similar distributions, with the share of informed firms always being in the neighborhood of 65-75%, whereas all subsectors of the professional and financial services industry (including financial firms) have very small shares of informed firms, typically around 10%. Hence, the clear industry differences visible in Figure 4 represent *systematic differences between the manufacturing and trade sectors versus the construction, transportation and professional services sectors that hold across all major subindustry groups*.

As documented in Table 1, there are many economic differences between these sectors. For example, manufacturing and trade firms have, on average, 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.

To assess the potential determinants of firm-level inattention, we regress firms' inattention to inflation, as measured by their absolute errors about recent inflation rates, on three groups of variables. First we consider 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. While all four variables are

statistically significant predictors of inattention to inflation when no fixed effects are included (and account for 22% of the cross-sectional variation in inflation errors), including industry fixed effects leaves only two statistically significant correlations: larger firms are associated with larger inflation errors and higher exposure to trade is associated with larger inflation errors. The former is a very robust feature of the data and indicates that, while large firms have more resources available to collect macroeconomic information, whether this information is effectively incorporated in the actual decisions of managers is very much in doubt. The role of trade share could be interpreted as reflecting the fact that firms who sell more on foreign markets have less incentive to focus resources on the New Zealand economy, although the size of the effects are relatively small compared to the total dispersion in inattention. It should also be noted that including industry fixed effects doubles the R^2 of the regression, which suggests that these variables only partially account for the cross-industry differences in inattention documented in Figure 4.

We also consider a second group of explanatory variables focusing 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 would induce firms to devote more resources to collecting and processing information about their economic environment. Consistent with this intuition, we find that firms facing more competitors, firms with lower margins on average, and firms whose prices are low relative to those of other firms made smaller errors on average vis a vis recent inflation rates. Once one includes industry fixed effects, the same results continue to hold for the number of competitors and the firm's relative price. We therefore interpret these results as being consistent with rational inattention motives for acquiring and processing information.

The third block of variables that we include focus on price changes, both at the level of the firm and the industry. First, we 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

[5] PPI inflation rates are not made available at 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.

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 who 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 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.

As documented in Table 4, the correlations in the data are 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. Finally, 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.

When we include all of these variables in a single regression, along with industry fixed effects, our qualitative findings are unchanged. First, larger firms made larger errors vis a vis recent inflation dynamics. Second, incentives to collect and process information are robust predictors of the degree of inattention on the part of firms with respect to economic conditions. Firms which depend less on sales in New Zealand made larger errors. Firms with more competitors made smaller errors. Firms who changed their prices by more or whose industries experienced larger inflation rates made smaller errors. Firms who expected to

change their prices sooner and firms with steeper slopes of the profit function made smaller errors. Each of these results is qualitatively consistent with firms responding to incentives in deciding how many resources to allocate to tracking the aggregate economy.

We assess the robustness of these results in Appendix Table 1 and find little sensitivity. Including sub-industry fixed effects has no effect on parameter estimates and does not raise the R^2 of the regression, consistent with the findings in section 4.1. of large differences in inattention across industries but not across sub-industries within industries. Second, restricting the sample to firms which made errors of less than 5 percentage points, and thereby dropping almost one-third of the sample, again leads to very similar results, although most of the estimated parameters are now smaller and the effects of firms' and industry recent price changes now have insignificant effects. Using sampling weights or restricting the set of firms to those included in the follow-up survey also does not meaningfully affect the estimates. Finally, we find the same qualitative patterns if we use errors about the output gap rather than inflation as the dependent variable. The only qualitative differences are that there is now a positive correlation between the age of firms and the size of their errors, along with positive correlations of average margins and price differentials vis a vis output errors. In short, our two key findings–namely that larger firms made, if anything larger errors and that the degree of attention paid by firms to macroeconomic conditions is highly correlated with incentives to do so–appear to be robust features of the data.

4.3 Persistence of Inattention

Our data has a panel component, with a single follow-up survey. We can exploit this panel dimension to assess the average persistence of inattention among firms, i.e. do firms with bigger errors in the first period also tend to make bigger errors in the following period?

To assess the persistence of inattention, we regress firms' absolute errors in the follow-up survey on their absolute errors in the main survey:

$$\left|x_t - F_t^i x_t\right| = \alpha + \beta\left|x_{t-1} - F_{t-1}^i x_{t-1}\right| + \delta_j + \varepsilon_i$$

where x is the variable being predicted by firms, F_t^i denotes firm i's belief about variable x, and δ_j is a fixed effect for the industry or sub-industry. The time subscript t denotes the follow-up survey while t-1 denotes the original survey.

Panel A of Table 5 presents results using beliefs about inflation over the last twelve months. Without fixed effects, we find a persistence level of 0.60, with over 30% of the variation in inattention in the follow-up survey being predictable given inattention in the initial survey. 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). We find very similar results in Panel B when we focus on beliefs about inflation over the last three months, with even more explanatory power coming from lagged errors. In Panel C, we reproduce

these results using beliefs about the contemporaneous output gap. 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. In all cases, the persistence of inattention is statistically significantly different from zero at the 1% level.

With the average time between the main survey and the follow-up survey being 5 months, an estimate of 0.6 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). But unlike previous work, we find very slow convergence even 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).

5 Beliefs about future macroeconomic conditions

Our survey includes not just questions about firms' understanding of recent economic conditions but also questions about their expectations of future outcomes. For example, we ask firms to provide quantitative answers about what they expect will happen to prices over the next twelve months. In the follow-up survey, we also enquired about their expectations of future interest rates, unemployment rates and the growth rate of real GDP. These questions allow us to study the quantitative properties of firms' macroeconomic forecasts. We first document simple moments of these forecasts and compare them to those of other economic agents, then assess what can account for the heterogeneity in firm forecasts.

5.1 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. For example, 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 2013).

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, exhibit 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 survey: 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 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.[6]

[6] 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.

Nonetheless, it is clear that inflation forecasts present the largest disparities between firms and professionals.

5.2 What Accounts for Heterogeneity in Firms' Forecasts?

There are large differences in firms' forecasts, especially for future inflation. What accounts for these differences? One possibility is that this reflects peculiarities of our survey questions (and those used for households) relative to those asked of professionals. For example, 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 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. Hence, the phrasing of the question does not appear important for firms, in contrast to previous evidence for households.

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 follow-up survey, we asked all firms to assign probabilities to different bins of inflation outcomes: more than 5%, 4-5%, 3-4%, 2-3%, 1-2%, 0-1%, <0%. We construct point forecasts from the probability distributions by picking the midpoint of each bin, using -1% for the lowest bin and 10% for the highest bin. Despite the fact that there are no bins for inflation rates above 5%, 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 4. 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.

A second possibility is that heterogeneity in inflation forecasts reflects industry differences. Figure 5 plots the distribution of year-ahead inflation forecasts for firms by industry. As was the case for inattention to macroeconomic conditions, there are some large and systematic differences in the distribution of inflation forecasts across industries. For example, approximately fifty percent of firms in Manufacturing, Trade, and Construction and Transportation have inflation forecasts of 5% or less, whereas only twenty percent of firms in Professional and Financial Services have forecasts of 5% or less. Indeed, the distribution of firm forecasts for the latter is noticeably more dispersed than for other industries, with a much larger tail of high inflation forecasts. Appendix Figure 3 documents that there is little variation in distribution of forecasts across the sub-industries within each industry. The only exceptions are food and non-food retailers, whose distribution of forecasts mimic those of the Professional and Financial Services sector.

One of the possible reasons for these large industry differences in inflation forecasts is that there are also large differences in beliefs about recent inflation across industries (as documented in Figure 4) and one would expect firms' beliefs about recent inflation to affect their beliefs about future inflation. Jonung (1981), for example, 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. To determine the potential importance of beliefs about recent inflation in explaining differences in forecasts of future inflation, we estimate the following regressions:

$$F_t^i \pi_{t+12,t} = \alpha + \beta F_t^i \pi_{t,t-12} + \gamma F_t^i \pi_{t,t-3} + \delta_j + \varepsilon_i$$

where $F_t^i \pi_{t+12,t}$ denotes the 12-month ahead inflation forecast of firm *i*, which we regress on the firm's belief about inflation over the previous twelve months ($F_t^i \pi_{t,t-12}$) and their belief ove inflation over the previous three months ($F_t^i \pi_{t,t-3}$) allowing for industry or sub-industry fixed effects (δ_j). We report results of these regressions in Panel A of Table 7. Columns (1) through (3) compare the relative importance of beliefs over recent 12-month and 3-month inflation. While both are statistically significant predictors of firms' beliefs about future 12-month inflation, both individually and jointly, much more predictive power comes from firms' beliefs about recent 12-month inflation. Similar results obtain in Panel B when we use firms' beliefs about inflation over the next three months as the regressand. When we include industry or sub-industry fixed effects (columns 4 and 5), we find little change in the estimated coefficients on firms' beliefs about recent inflation and the R^2's go up only modestly. This implies that much of the differences in inflation forecasts across industries identified in Figure 5 can be accounted for by differences in firms' perceptions of recent inflation across these industries. Equivalently, there is a very strong correlation between firms' beliefs about past and future inflation, as found for households by Jonung (1981). This result

holds for both firms' short run inflation forecasts (3-month horizons) and medium-run forecasts (1-year ahead).

With about a third of the variation in inflation forecasts being accounted for by firms' beliefs about recent inflation, much of the variation in inflation forecasts is therefore not accounted for by different backcasts. Another way to see this is to consider the distribution of inflation forecasts among all firms versus "informed" firms, i.e. those firms whose inflation errors over the most recent twelve months were less than or equal to 2 percentage points (49% of firms). Figure 6 illustrates these two distribution. Even among informed firms, there remains wide variation in beliefs about future inflation, with more than 35% of these firms believing that inflation over the subsequent twelve months would exceed 4%. The mean forecast of 12-month ahead inflation among informed firms is still 4.9% with a cross-sectional standard deviation of 3.7%. Hence, even among informed firms, inflation expectations continue to differ sharply from those of professional forecasters.

To assess the broader determinants of the cross-sectional heterogeneity in firms' inflation forecasts, we consider similar regressions as for firm inattention but with forecasts of future inflation as dependent variables:

$$F_t^i \pi_{t+12,t} = \alpha + \beta F_t^i \pi_{t,t-12} + \gamma F_t^i \pi_{t,t-3} + \mu X_t^i + \delta_j + \varepsilon_i$$

where X_t^i consists of the same set of firm variables as in Table 4, including controls for firm characteristics, the degree of competition and profitability, and pricing characteristics of the firm. We augment this regression with measures of the firms' beliefs about recent inflation.

Results are presented in Table 8 without fixed effects (column 1), with industry or sub-industry fixed effects (columns 2 and 3 respectively), and with sampling weights (column 4). A key feature of this table is that the coefficients on backcasts are approximately half of those found in Table 7. This implies that those variables which accounted for the degree of inattention (e.g. firm size, number of competitors, duration until the next price change, and slope of the profit function) determine both inattention to past conditions and expectations of future inflation so that controlling for these variables significantly reduces the predictive power of beliefs of past inflation in explaining beliefs about future inflation. Indeed, we find broadly the same pattern of predictive power for future inflation as for inattention to past conditions: firm size, number of competitors, the duration until the next price change, and the slope of the profit function are the key explanatory variables for firms' inflation forecasts. Columns 5 and 6 verify that the same results obtain in the follow-up survey as well as using 3-month ahead inflation forecasts in the main survey. Column 7 restricts the sample to "informed" firms, i.e. firms whose errors about inflation over the last twelve months were less than 2%. We find the same results for firm size, duration until the next price change and the slope of the profit function. The number of competitors becomes statistically insignificant,

which implies that this variable affects inflation expectations primarily through its effect on beliefs about past inflation.

The relationship between duration until the next price change, the number of competitors and the slope of the profit function with respect to both inflation backcasts and forecasts is presented visually in Figure 7. Panel A plots average beliefs about past 12-month inflation against expected future inflation for subsets of firms grouped by the number of months until the next price change. Firms who expect to change their prices within the next three months have mean beliefs of past inflation of slightly over four percent and mean forecasts of just under six percent. Firms who don't expect to change their prices for over a year believe, on average, that inflation was around 8.5% over the previous twelve months and expect inflation to be over 11% over the next twelve months, with intermediate price durations strictly between these two extremes. Similar patterns occur with the number of competitors, as shown in Panel B. Firms with more than 20 competitors had average inflation backcasts of 4.2% and forecasts of just under 5%, while those with five or fewer competitors averaged backasts of 6.5% and forecasts of 9.5%, with intermediate numbers of competitors leading to intermediate backcasts and forecasts. The steepness of the profit function affects backcasts and forecasts of inflation in a similar fashion. Firms in the bottom tercile of the steepness distribution (i.e. the flattest slopes) have relatively high inflation forecasts and backcasts on average (more than 8% and 6% respectively) while those in the top tercile (the steepest slopes) have much lower beliefs about both future and recent inflation (around 5% and 4.5% respectively). These results are all consistent with rational inattention motives: firms with incentives to track macroeconomic conditions –either because they face many competitors, because they expect to change their prices soon, or because they sustain relatively larger losses from poor price choices– appear to have systematically better information, both about recent and future economic conditions.

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 since.

Inattention among firms varies along some predictable dimensions. Larger firms are, if anything, less attentive than smaller firms, have less precise information about recent economic developments, and predicted much higher rates of inflation in the future. We also find that firms engaged in professional and

financial services, such as banks, consulting firms, and law firms, also have worse information on average about both recent and future economic conditions. Given that most advanced economies like the U.S. or U.K. have larger firms and larger service sectors than New Zealand, our results suggest that the degree of inattention to macroeconomic conditions is likely to be even higher in other developed economies.

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 therefore be more valuable, also have better information on average.

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	
	Initial Survey	Followup Survey	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	716	14.5	28.6	48.0	4.4	26.6	32.3	7.4	5.9	5.6
Manufacturing	997	279	16.8	32.7	39.3	10.7	21.3	28.1	6.4	5.7	5.9
Chemicals and metals	213	78	16.0	32.1	38.4	13.2	22.6	29.0	6.6	5.9	6.3
Equipment and machinery	164	30	15.9	28.3	38.3	11.3	23.3	28.8	5.7	5.0	5.9
Food and beverage	261	60	18.3	35.5	40.2	9.0	20.4	27.2	6.0	5.3	5.6
Paper/wood, printing and furniture	139	32	15.3	31.4	39.6	8.0	20.3	28.2	6.6	6.1	5.5
Textile and clothing	220	79	17.5	34.3	39.6	11.7	20.3	27.6	6.9	6.1	6.3
Trade	837	123	8.5	23.9	44.5	2.8	20.5	26.8	7.6	4.5	6.1
Car, supermarket and food retailing	116	20	9.5	27.8	40.8	2.4	18.5	26.5	6.3	2.9	4.8
Hotel and food services	305	37	8.2	25.6	41.3	4.2	16.3	26.8	5.5	2.8	5.2
Other store retailing	181	39	8.3	22.5	49.5	0.0	25.2	27.9	11.2	7.2	7.2
Wholesale trade	235	27	8.4	22.3	42.4	5.7	18.5	25.5	5.3	3.2	6.2
Professional and financial services	1,146	278	17.0	28.9	57.7	0.6	37.0	41.1	7.6	6.9	5.0
Accounting services	186	52	18.9	34.6	58.6	0.5	36.3	41.0	7.3	8.0	4.7
Finance	151	34	12.8	21.1	56.4	0.0	40.0	44.0	6.7	6.2	4.1
Insurance	156	37	16.7	28.8	57.0	0.9	39.4	42.5	7.7	6.7	5.0
Aux. finance and insurance	125	24	11.5	20.9	56.9	0.2	40.3	43.5	6.6	5.0	4.2
Legal services	139	52	21.3	36.5	58.5	1.4	37.5	41.3	8.0	7.5	4.8
Rental, hiring and real estate	163	30	18.4	26.6	59.1	0.3	33.5	37.7	7.9	6.3	6.0
All other professional services	226	49	18.0	30.9	57.5	0.9	34.1	39.1	8.4	7.5	5.4
Construction and transportation	170	36	12.6	25.5	50.0	0.0	18.4	24.7	10.8	8.4	6.2

Notes: The table presents the number of firms in each industry and sub-industry category in the main survey (first column) and follow-up survey (second column). Other columns are mean values across all firms in each industry or sub-industry of specific variables listed. See section 2 for details. 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 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 the main and follow-up surveys. The regressor is the expected percent change in the next price review reported in the main survey. 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 define 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 for details.

Table 3: Correlation of Inattention across Macroeconomic Variables

Inattention to:	Output gap		Output gap		Unemployment		Interest rate	
Survey:	Main	Main	Follow-up	Follow-up	Follow-up	Follow-up	Follow-up	Follow-up
Abs. Value of Inflation Errors	0.76***	0.97***	0.42***	0.59***	0.03***	0.02**	0.03***	0.02*
	(0.05)	(0.06)	(0.08)	(0.11)	(0.01)	(0.01)	(0.01)	(0.01)
Sub-Industry Fixed Effect	N	Y	N	Y	N	Y	N	Y
R^2	0.09	0.18	0.04	0.09	0.02	0.07	0.01	0.03
N	3,150	3,150	716	716	716	716	716	716

Notes: The table reports regressions of firms' absolute errors for variables indicated in top row on firms' absolute errors for inflation over preceding twelve months. Sub-industry fixed effects are as defined in Table 1. "Main" indicates that regression is done using data from the main survey while "Follow-up" refers to data from the follow-up survey. Robust standard errors are reported in parentheses. ***,**, * denotes statistical significance at 1%, 5%, and 10% levels respectively. See section 4.1 for details.

Table 4: Determinants of Firm Inattention

	Dependent variable: Absolute value of firm errors about past 12-month inflation							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age	0.25***	-0.05					0.03	-0.15*
	(0.10)	(0.09)					(0.09)	(0.09)
Employment	1.18***	1.25***					0.46***	0.83***
	(0.10)	(0.09)					(0.12)	(0.11)
Labor's share of costs	0.14***	0.00					0.11***	-0.00
	(0.01)	(0.01)					(0.01)	(0.01)
Trade Share	-0.01***	0.01**					-0.00	0.01***
	(0.00)	(0.00)					(0.00)	(0.00)
Number of Competitors			-0.06***	-0.06***			-0.02***	-0.02***
			(0.00)	(0.00)			(0.01)	(0.01)
Avg. margin			0.11***	0.01			0.07***	-0.01
			(0.01)	(0.01)			(0.01)	(0.01)
Price rel. to competitors			0.06***	0.01*			0.03***	0.01
			(0.01)	(0.01)			(0.01)	(0.01)
Firm's past price changes					-0.01**	-0.02***	-0.01**	-0.01***
					(0.01)	(0.01)	(0.01)	(0.01)
Industry PPI inflation					-0.08***	-0.03***	-0.03***	-0.03***
					(0.01)	(0.01)	(0.01)	(0.01)
Expected size of price change					-0.06***	-0.02*	-0.03**	-0.01
					(0.01)	(0.01)	(0.01)	(0.01)
Duration until price change					0.26***	0.16***	0.15***	0.10***
					(0.02)	(0.01)	(0.02)	(0.01)
Abs. slope of profit function					-0.69***	-0.71***	-0.45***	-0.46***
					(0.11)	(0.09)	(0.10)	(0.09)
Industry FE	N	Y	N	Y	N	Y	N	Y
R^2	3,150	3,150	3,149	3,149	3,147	3,147	3,146	3,146
N	0.22	0.42	0.15	0.39	0.13	0.41	0.29	0.44

Notes: The table reports estimates of firms' absolute errors about inflation over the preceding twelve months from the main survey. Industry fixed effects are defined as in Table 1. Robust standard errors are reported in parentheses. ***,**, * denotes statistical significance at 1%, 5%, and 10% levels respectively. See section 4.2 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 survey	(1)	(2)	(3)	(4)
Panel A: Inflation over the previous 12 months				
Abs. error for inflation in the main survey	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 3 months				
Abs. error for inflation in the main survey	0.620***	0.517***	0.523***	0.729***
	(0.037)	(0.047)	(0.046)	(0.052)
Observations	716	716	716	712
R^2	0.479	0.515	0.534	0.679
Panel C: Output Gap				
Abs. error for output gap in the main survey	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

Notes: The table reports regressions of firms' absolute errors for inflation over the last twelve months (Panel A), inflation over the last three months (Panel B), or the contemporaneous output gap (Panel C) in the follow-up survey on firms' errors over the same variables in the main survey. 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 4.3 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 5.1 for details.

Table 7: Beliefs about Future and Past Inflation

Industry FE	N	N	N	Y	N	N
Sub-Industry FE	N	N	N	N	Y	N
Weights	N	N	N	N	N	Y
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: 12-Month Ahead Inflation Forecasts						
$F_t^i \pi_{t,t-12}$	0.602***		0.515***	0.449***	0.428***	0.191***
	(0.034)		(0.036)	(0.036)	(0.035)	(0.041)
$F_t^i \pi_{t,t-3}$		0.518***	0.249***	0.246***	0.243***	0.126**
		(0.041)	(0.040)	(0.040)	(0.039)	(0.051)
Observations	3,150	3,150	3,150	3,150	3,150	3,137
R^2	0.182	0.09	0.199	0.264	0.329	0.053
Panel B: 3-Month Ahead Inflation Forecasts						
$F_t^i \pi_{t,t-12}$	0.606***		0.478***	0.330***	0.326***	0.416***
	(0.024)		(0.026)	(0.027)	(0.027)	(0.046)
$F_t^i \pi_{t,t-3}$		0.615***	0.365***	0.238***	0.236***	0.314***
		(0.031)	(0.031)	(0.032)	(0.032)	(0.049)
Observations	3,150	3,150	3,150	3,150	3,150	3,137
R^2	0.277	0.191	0.332	0.376	0.38	0.325

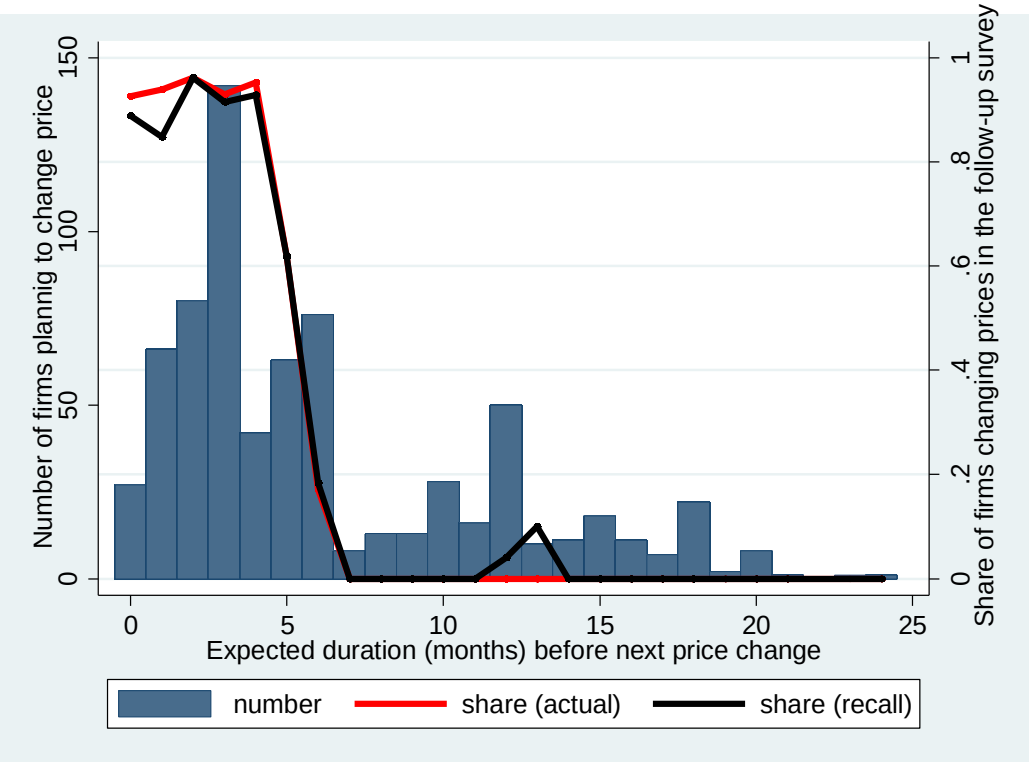
Notes: The table reports estimates of firms' forecasts of inflation over the next twelve months (Panel A) or three months (Panel B) on their backcasts of inflation over previous 12 months ($F_t^i \pi_{t,t-12}$) and 3 months ($F_t^i \pi_{t,t-3}$) from the main survey. Constant is included but not reported. Industry and sub-industry fixed effects are defined as 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 5.2 for details.

Table 8: Determinants of Inflation Forecasts

	12-Month Forecasts, All Firms in Main Survey				Follow-up Survey	3-Month Forecasts	Informed Firms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$F_t^i \pi_{t,t-12}$	0.29***	0.26***	0.24***	0.09*	0.01	0.18***	0.02
	(0.03)	(0.03)	(0.03)	(0.05)	(0.07)	(0.03)	(0.09)
$F_t^i \pi_{t,t-3}$	0.12***	0.10***	0.10***	0.03	0.16*	0.12***	0.04
	(0.04)	(0.04)	(0.04)	(0.05)	(0.08)	(0.03)	(0.05)
Age	0.50***	0.47***	0.43***	0.37*	-0.16	-0.09	0.24*
	(0.13)	(0.14)	(0.13)	(0.22)	(0.23)	(0.10)	(0.13)
Employment	1.22***	1.32***	1.13***	0.76***	1.18***	1.12***	0.42**
	(0.16)	(0.16)	(0.15)	(0.28)	(0.29)	(0.12)	(0.17)
Labor's share of costs	0.05***	-0.06***	-0.02	-0.03	-0.00	-0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)	(0.01)	(0.01)
Trade Share	-0.03***	-0.01**	-0.01**	0.00	-0.01	-0.02***	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
Number of Competitors	-0.03***	-0.04***	-0.04***	-0.02	-0.02	-0.03***	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Avg. margin	0.09***	-0.02	-0.00	0.00	0.00	-0.01	0.04***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)	(0.01)	(0.01)
Price rel. to competitors	0.03**	0.01	0.01	0.01	-0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Firm's past price changes	-0.00	-0.01	-0.01**	-0.01	0.00	-0.01**	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)
Industry PPI inflation	-0.05***	-0.00	0.04***	0.08**	-0.02	-0.00	0.01
	(0.01)	(0.01)	(0.01)	(0.04)	(0.02)	(0.01)	(0.01)
Expected size of price change	-0.03	-0.02	0.00	0.03	0.02	-0.00	-0.00
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.01)	(0.02)
Duration until price change	0.03	0.06***	0.11***	0.11***	0.09*	0.12***	0.07***
	(0.02)	(0.02)	(0.02)	(0.04)	(0.05)	(0.02)	(0.03)
Abs. slope of profit function	-0.80***	-0.74***	-0.67***	-0.06	-0.45***	-0.26***	-0.37***
	(0.11)	(0.12)	(0.12)	(0.21)	(0.12)	(0.10)	(0.10)
Industry FE	N	Y	N	N	N	N	N
Sub-Industry FE	N	N	Y	Y	Y	Y	Y
Sampling Weights	N	N	N	Y	N	N	N
R^2	3,149	3,149	3,149	3,136	716	3,149	1,534
N	0.32	0.36	0.42	0.30	0.39	0.46	0.39

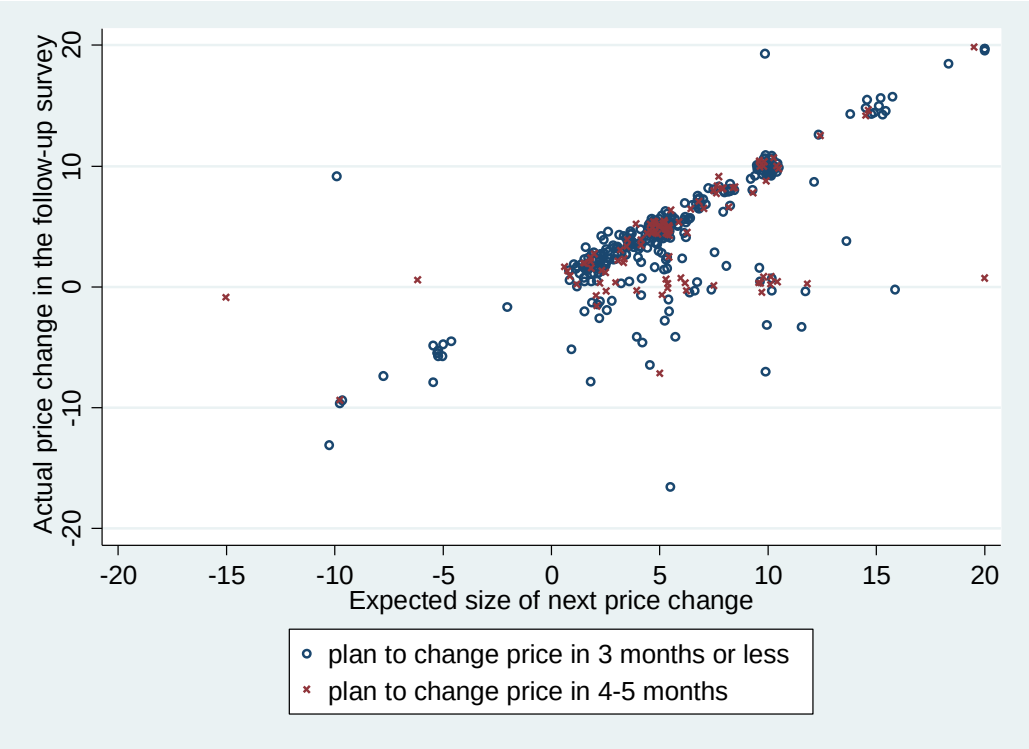
Notes: The table reports estimates of firms' forecasts of inflation over the next twelve months from the main survey, except (5) when forecasts are from the follow-up survey and column (6) when three-month ahead forecasts from the main survey are used. In column (7), we restrict the sample of firms to those whose absolute errors for inflation over the precedine twelve months were less than 2% points ("informed" firms). The first two rows of coefficients refer to backcasts of inflation over the previous 12 months ($F_t^i \pi_{t,t-12}$) and 3 months ($F_t^i \pi_{t,t-3}$). Industry and sub-industry fixed effects are defined as in Table 1. Robust standard errors are reported in parentheses. ***,**, * denotes statistical significance at 1%, 5%, and 10% levels respectively. See section 5.2 for details.

Figure 1: Predicted Duration of Current Price Spell vs. Actual Duration in Survey Data



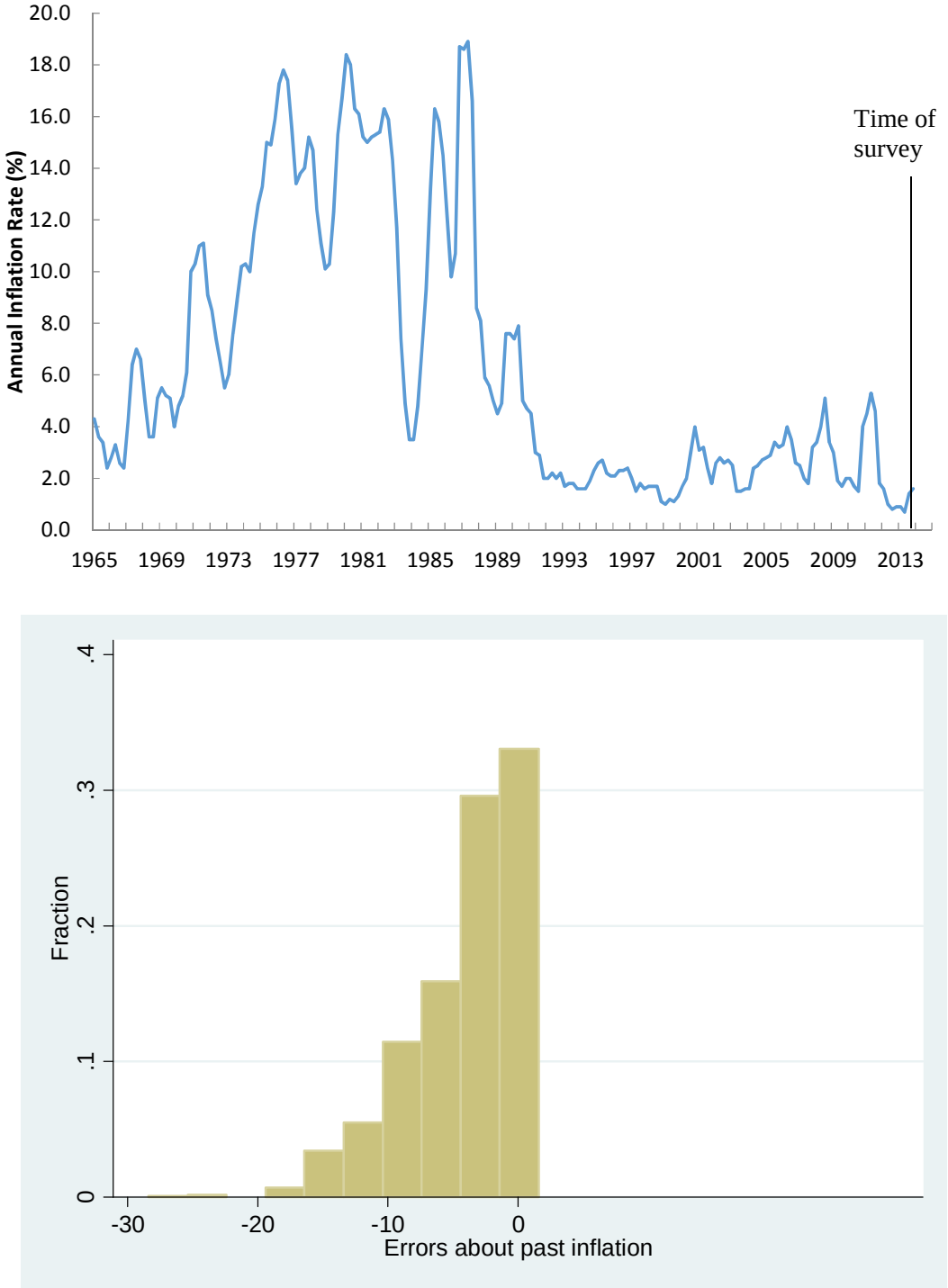
Notes: The bars (left axis) show the number of firms reporting a given expected duration before next price change in the main survey. The lines show the fraction of firms who actually adjusted their prices between the follow-up survey and the main survey, grouped by each duration. The red line measures 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.

Figure 2: Predicted Size of Price Change vs. Actual Price Change in Survey Data



Notes: The figure 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 3 for details.

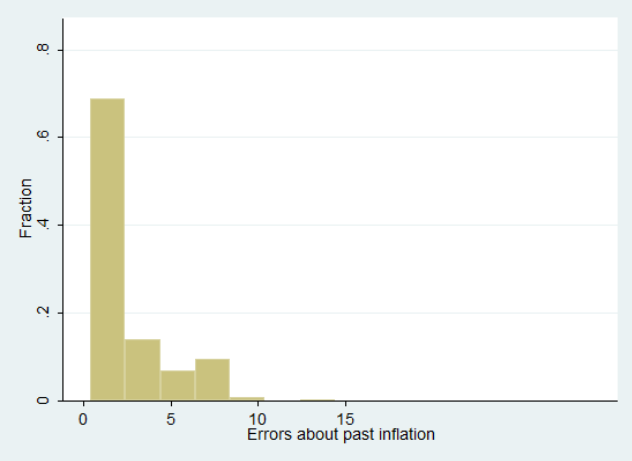
Figure 3: Inflation and Beliefs about Past Inflation



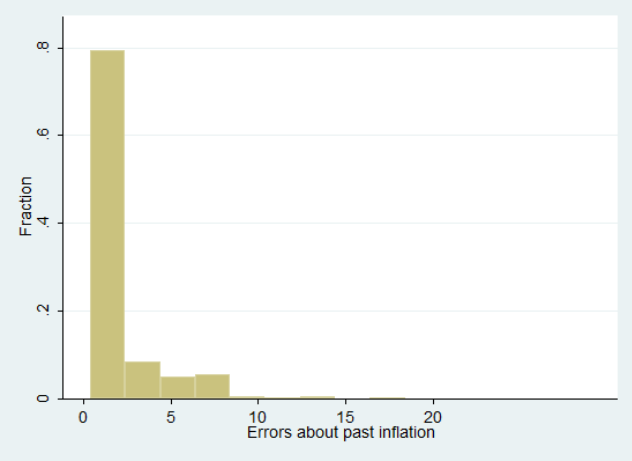
Notes: The top figure plots annual CPI inflation for New Zealand up to the date of the main survey. The bottom figure plots the distribution of firms' inflation errors: the difference between annual inflation at the time of the survey and firms' reported belief about this rate. See section 4.1 for details.

Figure 4: Distribution of Inflation Errors by Industry

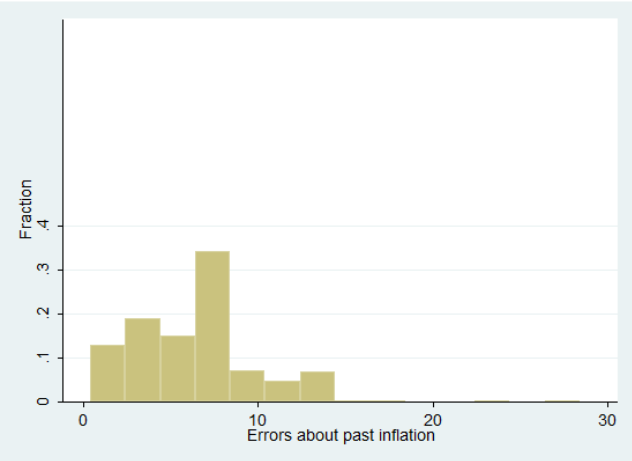
Panel A: Manufacturing



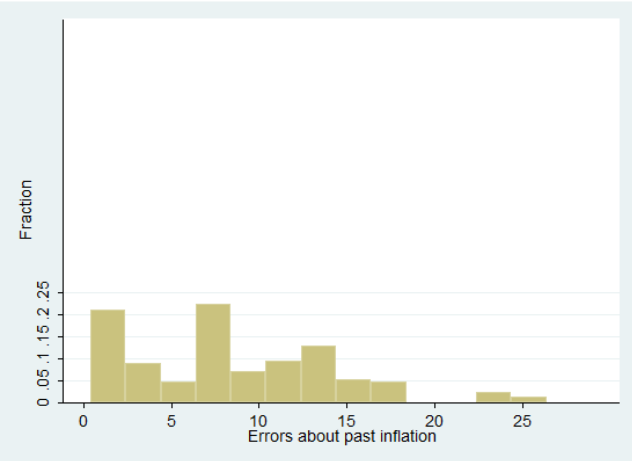
Panel B: Trade



Panel C: Professional and Financial Services



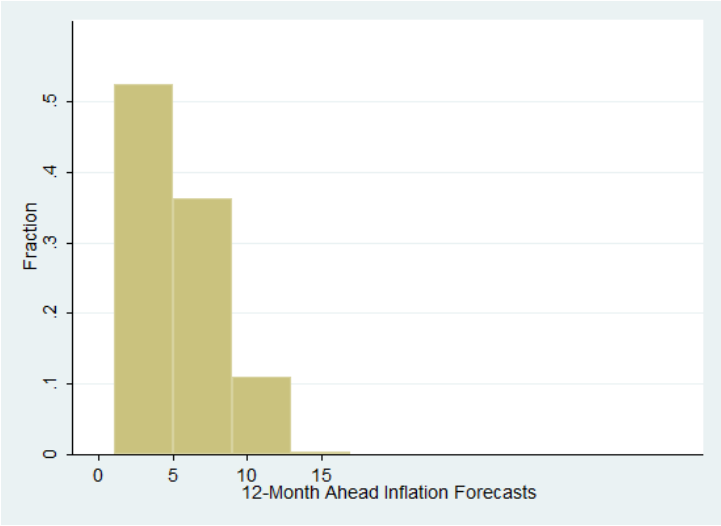
Panel D: Construction and Transportation



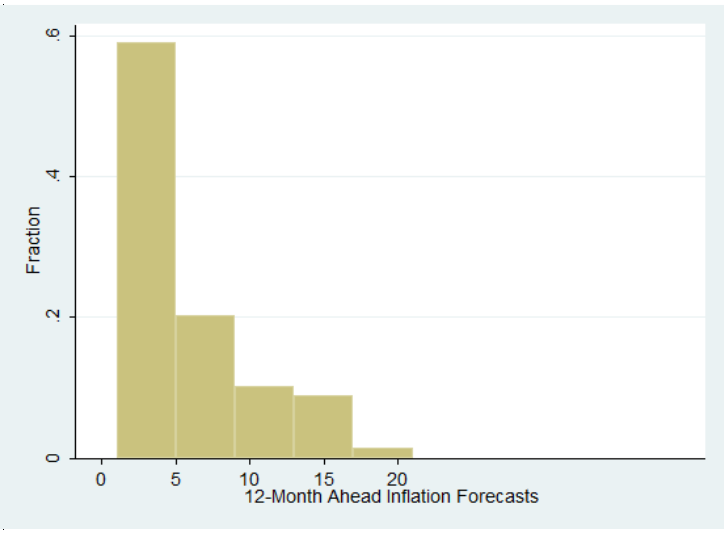
Notes: Each panel plots the distribution of the absolute values of firms' errors about inflation over the preceding twelve months by industry, as defined in Table 1. Data is from the main survey. See section 4.2 for details.

Figure 5: Distribution of 12-Month Ahead Inflation Forecasts by Industry

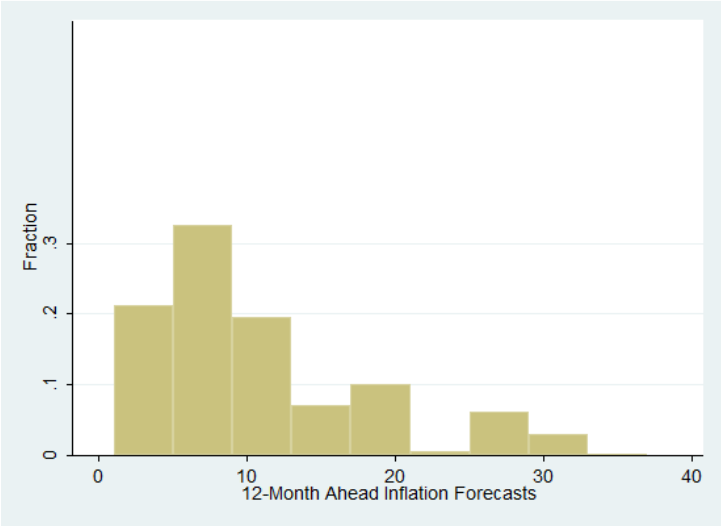
Panel A: Manufacturing



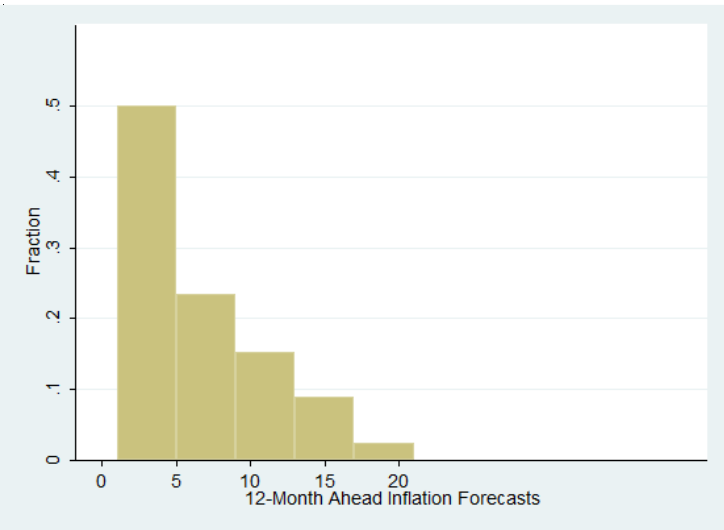
Panel B: Trade



Panel C: Professional and Financial Services



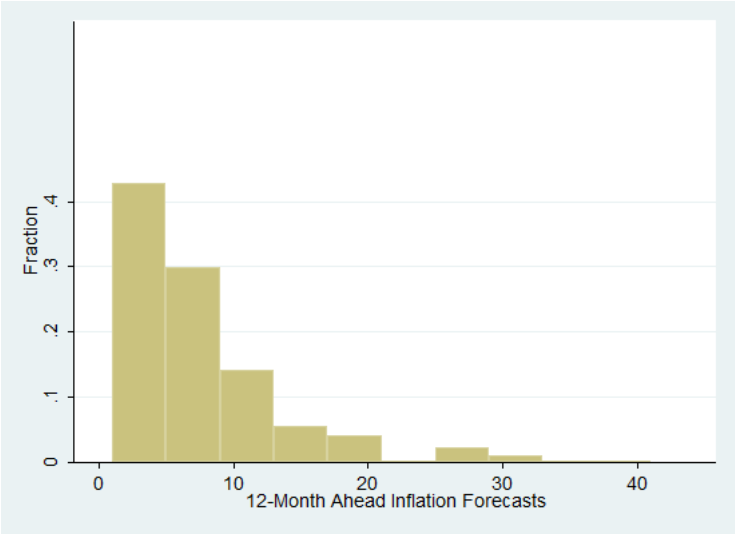
Panel D: Construction and Transportation



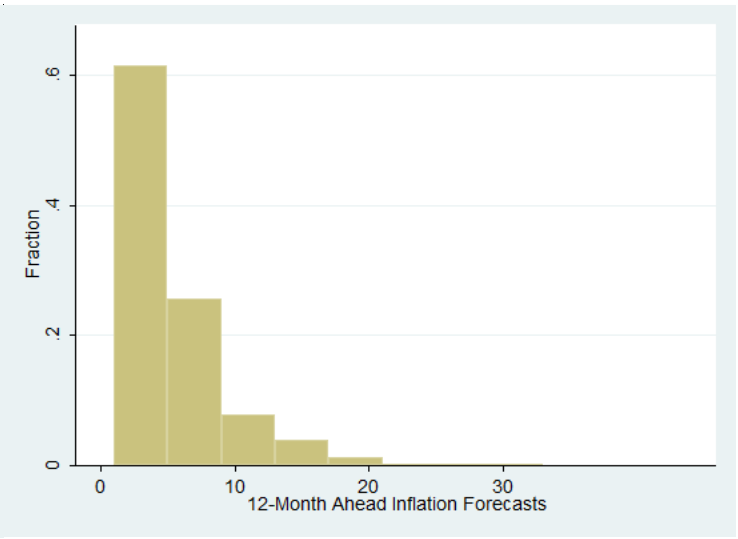
Notes: Each panel plots the distribution of the firms' forecasts of inflation over the next twelve months by industry, as defined in Table 1. Data is from the main survey. See section 5.2 for details.

Figure 6: Distribution of Inflation Expectations across Firms

Panel A: All Firms



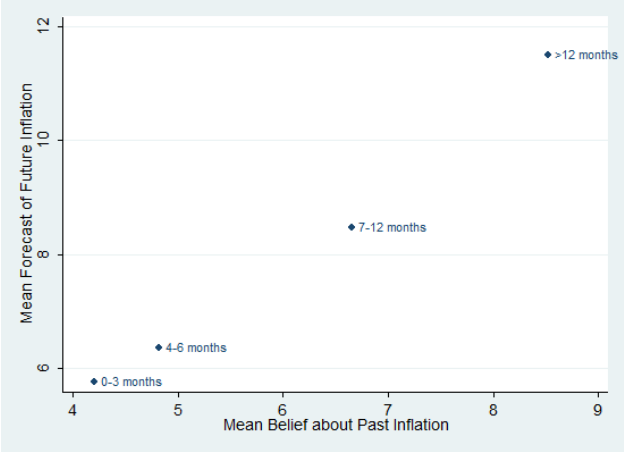
Panel B: "Informed" Firms



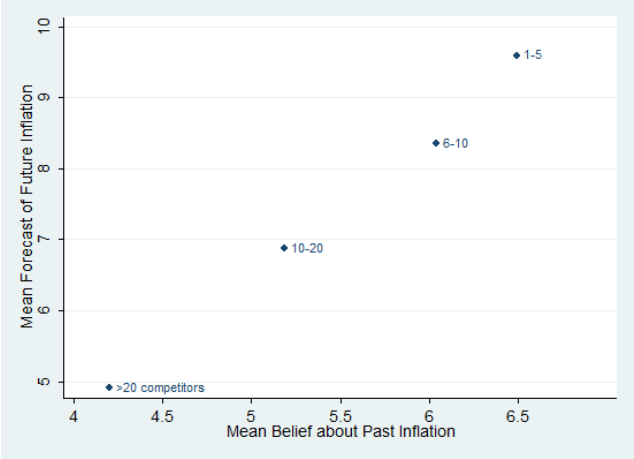
Notes: The two panels plot distributions of firms' inflation forecasts over the next twelve months from the main survey. Panel A plots the distribution for all firms in the survey while Panel B restricts the sample to firms whose absolute errors about inflation over the preceding twelve months were less than 2% points ("informed" firms). See section 5.2 for details.

Figure 7: Inflation Backcasts and Forecasts by Firm Characteristic

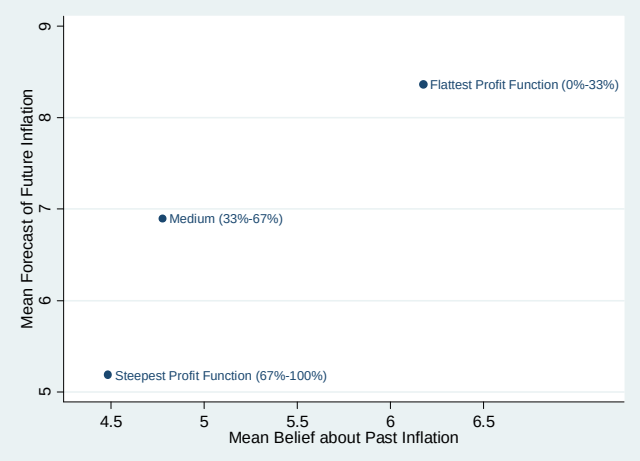
Panel A: Months until Next Expected Price Change



Panel B: Number of Competitors



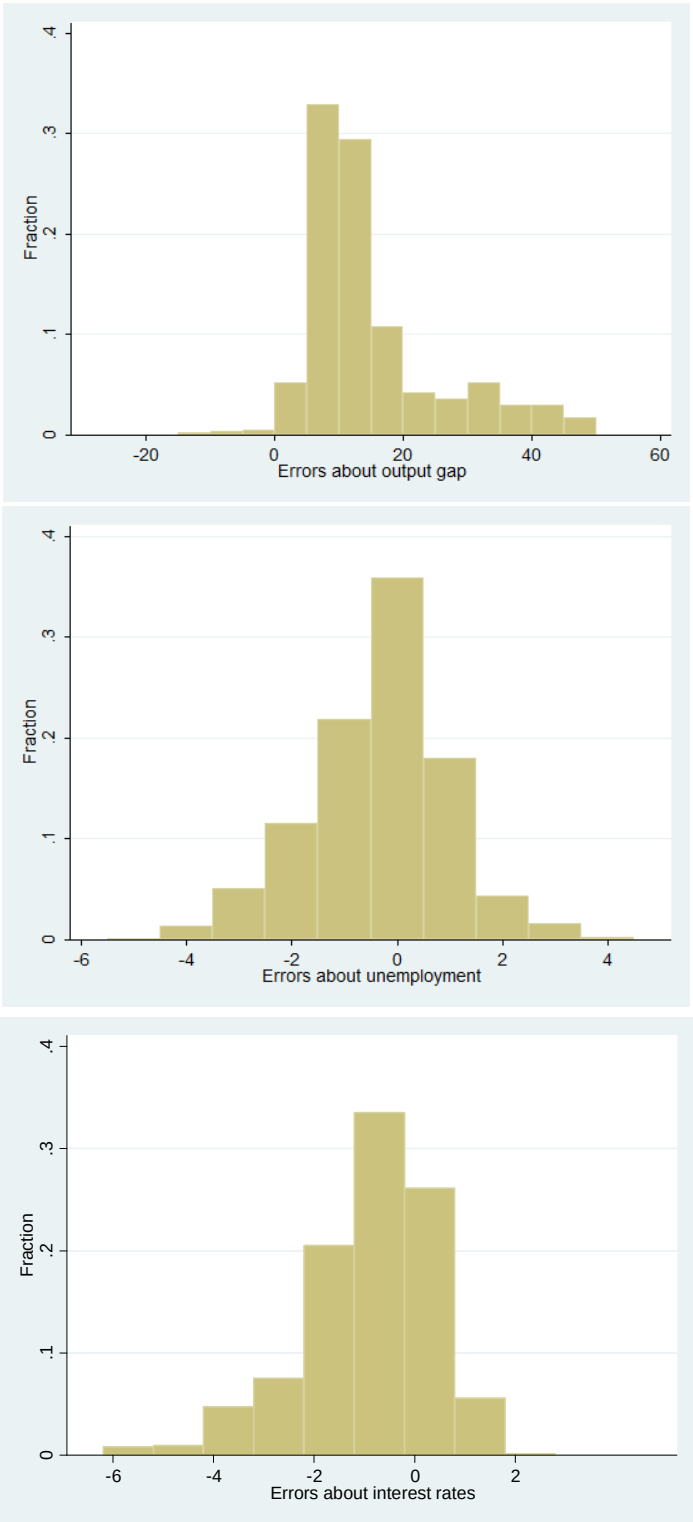
Panel C: Steepness of the Profit Function



Notes: Each panel plots mean backcasts and forecasts of inflation for firms grouped by firm characteristics in the main survey. In Panel A, firms are grouped by months until next expected price change, in Panel B by the number of competitors, and in Panel C by the tercile of the distribution of the steepness of the profit function. See section 5.2 for details.

APPENDIX

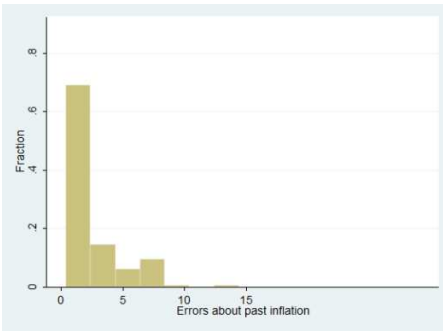
Appendix Figure 1: Dispersion in firms' beliefs about macroeconomic variables



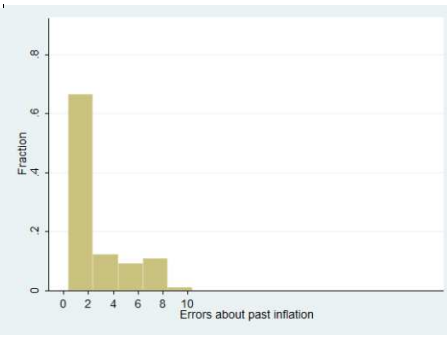
Notes: Each panel plots the distribution of the absolute values of firms' errors about different macroeconomic variables. The top figure uses errors about the contemporaneous value of the output gap from the main survey. The middle figure uses errors about contemporaneous unemployment rates from the follow-up survey. The bottom figure uses errors about 1-year interest rates from the follow-up survey. See section 4.1 for details.

Appendix Figure 2: Distribution of Errors about Recent Inflation by Sub-Industries

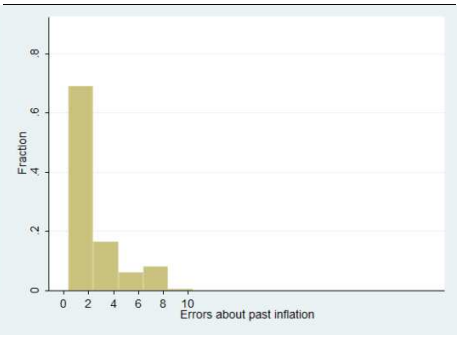
Manuf: Chemicals and Metals



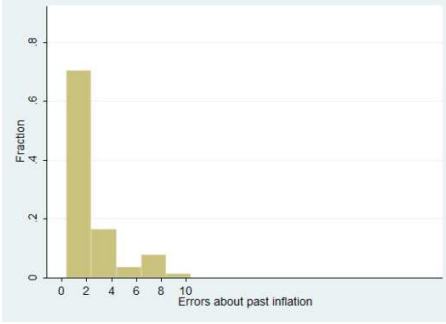
Manuf: Equipment and Machinery



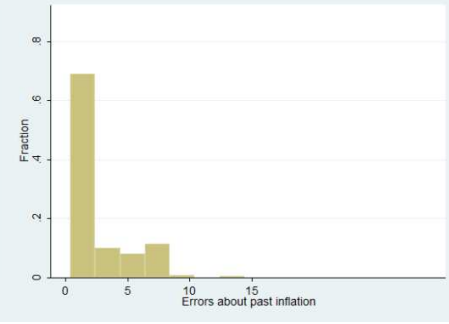
Manuf: Food and Beverage



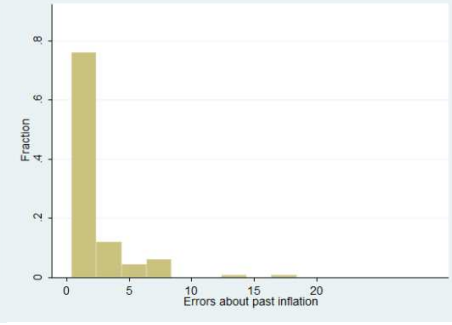
Manuf: Paper/Wood Products



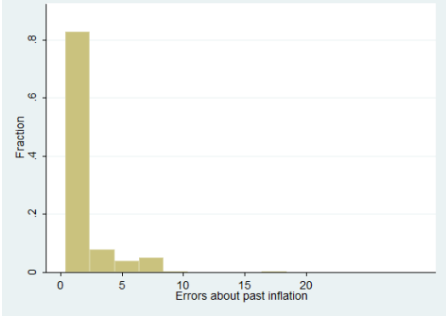
Manuf: Textile and Clothing



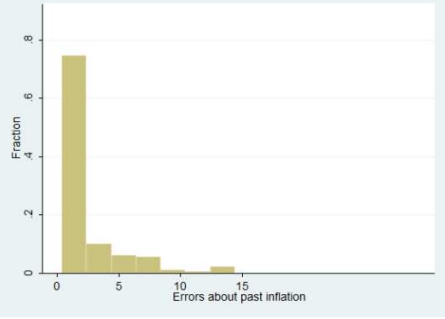
Trade: Supermarket/Food Retail



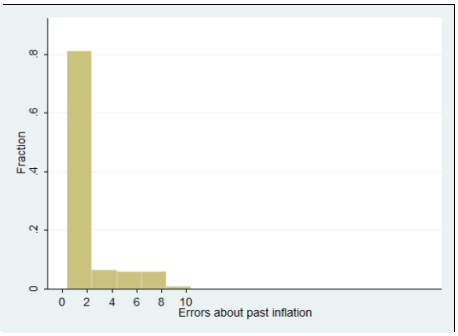
Trade: Hotel and Accomodations



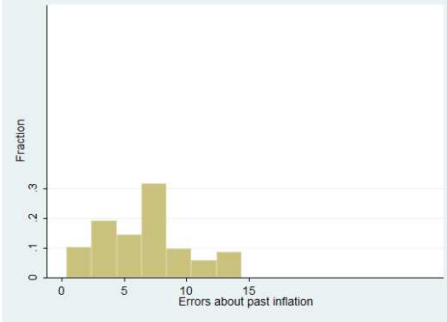
Trade: Other Retail



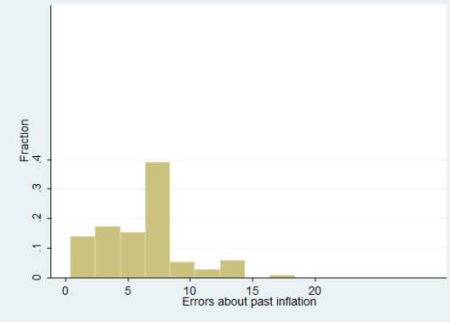
Trade: Wholesale Trade



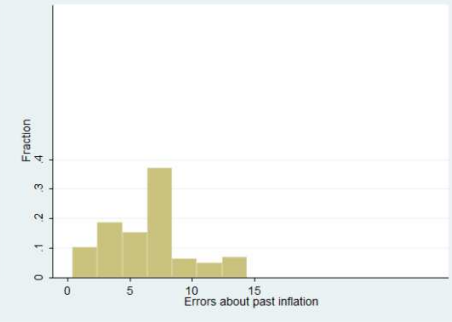
FIBS: Accounting



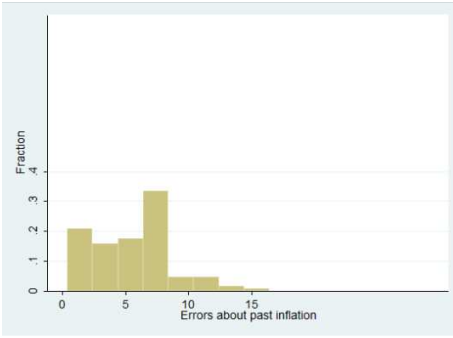
FIBS: Finance



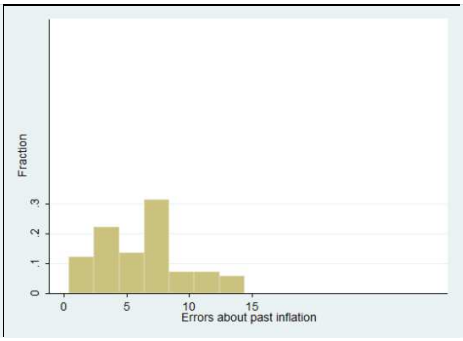
FIBS: Insurance



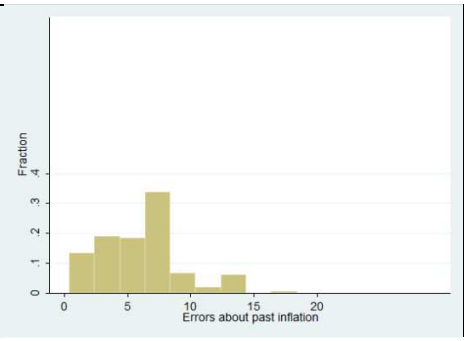
FIBS: Aux. Finance/Insurance



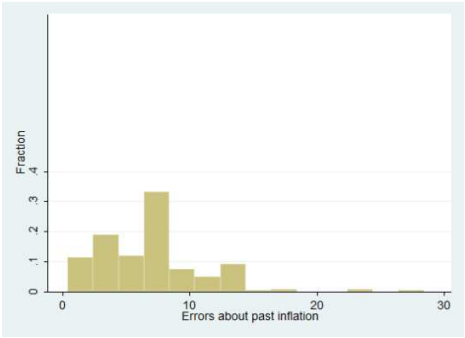
FIBS: Legal Services



FIBS: Rental and Hiring Services



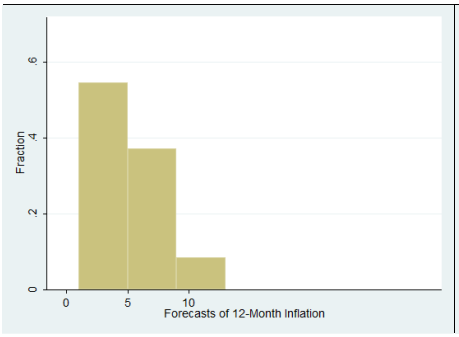
FIBS: Other Professional Services



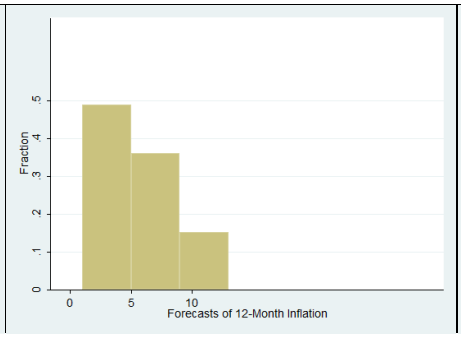
Notes: Each figure plots the distribution of the absolute values of firms' errors about inflation over the preceding twelve months by sub-industry, as defined in Table 1. Data is from the main survey. See section 4.2 for details.

Appendix Figure 3: Distribution of Inflation Forecasts by Sub-Industries

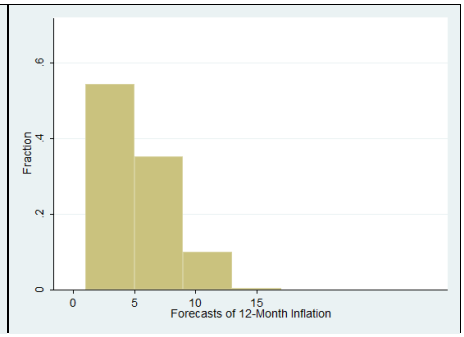
Manuf: Chemicals and Metals



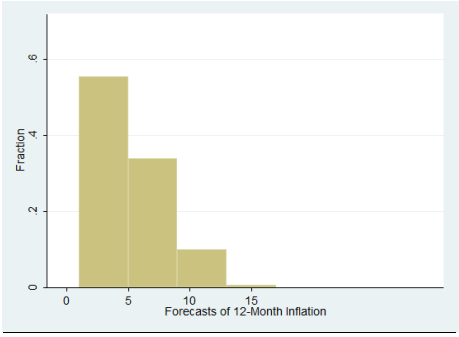
Manuf: Equipment and Machinery



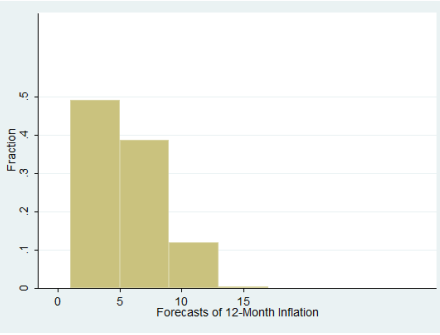
Manuf: Food and Beverage



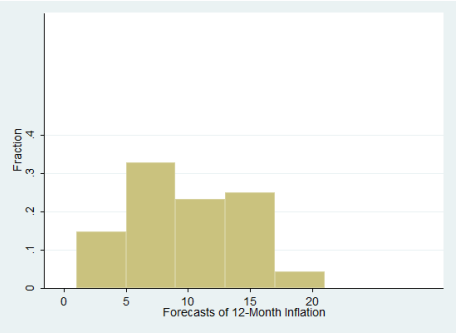
Manuf: Paper/Wood Products



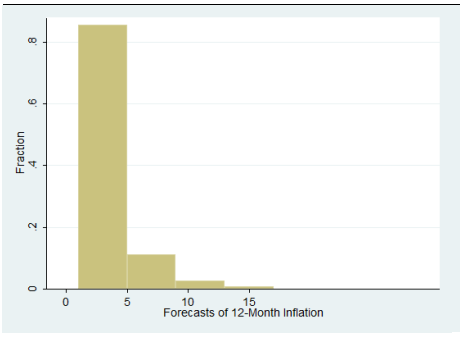
Manuf: Textile and Clothing



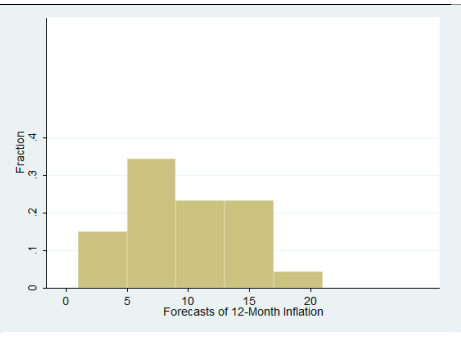
Trade: Supermarket/Food Retail



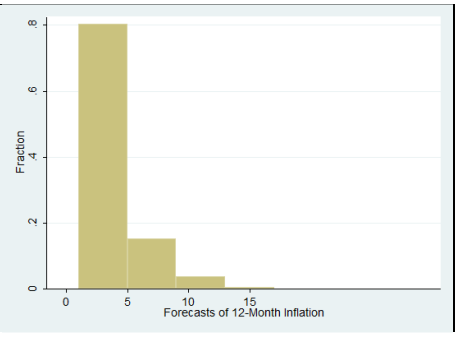
Trade: Hotel and Accomodations



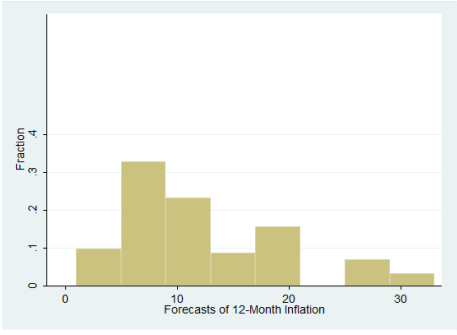
Trade: Other Retail



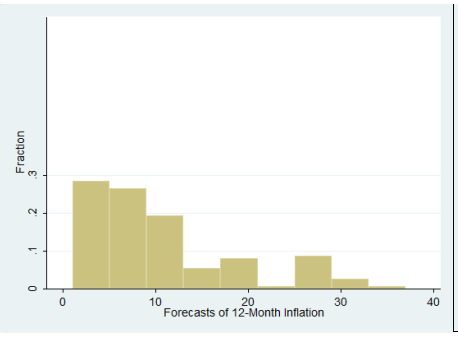
Trade: Wholesale Trade



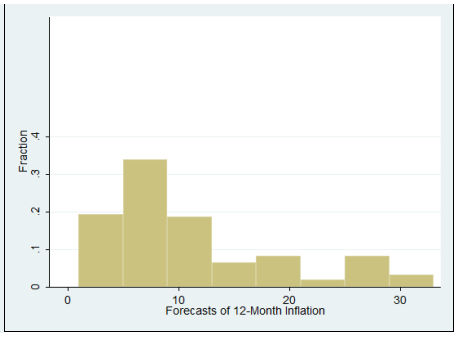
FIBS: Accounting



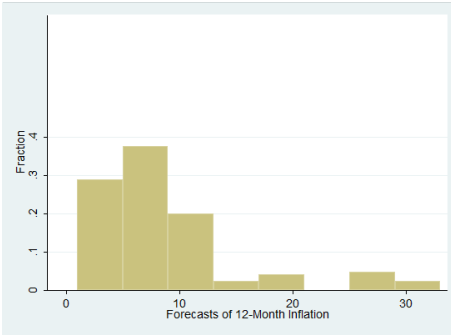
FIBS: Finance



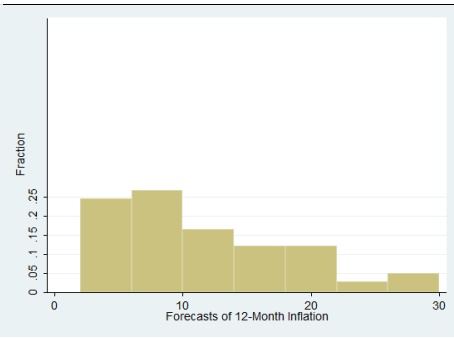
FIBS: Insurance



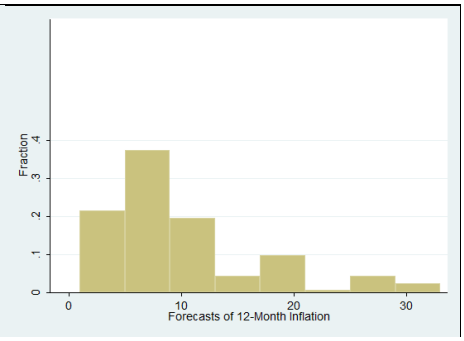
FIBS: Aux. Finance/Insurance



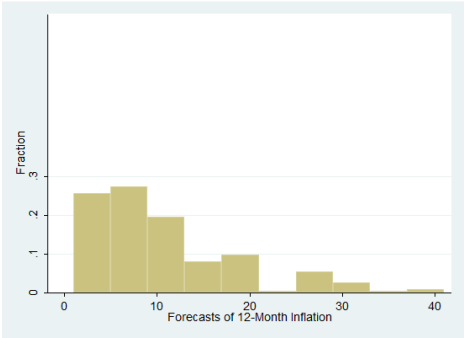
FIBS: Legal Services



FIBS: Rental and Hiring Services



FIBS: Other Professional Services



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

Appendix Table 1: Robustness of Determinants of Inattention

	Baseline	Sub-Ind. FE	Errors≤5%	Sampling Weights	Followup Survey	Output Gap Errors
	(1)	(2)	(3)	(4)	(5)	(6)
Age	-0.15*	-0.15*	0.06	-0.22	0.28	1.18***
	(0.09)	(0.09)	(0.04)	(0.16)	(0.18)	(0.22)
Employment	0.83***	0.81***	0.19***	0.82***	0.90***	3.83***
	(0.11)	(0.11)	(0.05)	(0.17)	(0.21)	(0.24)
Labor's share of costs	-0.00	0.00	0.01**	-0.00	0.00	0.03*
	(0.01)	(0.01)	(0.00)	(0.01)	(0.02)	(0.02)
Trade Share	0.01***	0.01**	0.01***	0.03**	0.00	0.05***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
Number of Competitors	-0.02***	-0.02***	-0.01**	0.00	-0.02**	-0.04***
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)
Avg. margin	-0.01	-0.00	0.01***	-0.00	-0.02	0.06***
	(0.01)	(0.01)	(0.00)	(0.01)	(0.02)	(0.02)
Price rel. to competitors	0.01	0.01	0.00	0.01		0.04***
	(0.01)	(0.01)	(0.00)	(0.01)		(0.02)
Firm's past price changes	-0.01***	-0.02***	-0.00	-0.01		-0.04***
	(0.01)	(0.01)	(0.00)	(0.01)		(0.01)
Industry PPI inflation	-0.03***	-0.03***	-0.00	-0.09***	-0.02	-0.07**
	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.03)
Expected size of price change	-0.01	-0.01	-0.00	-0.04**		-0.04
	(0.01)	(0.01)	(0.01)	(0.02)		(0.03)
Duration until price change	0.10***	0.11***	0.02***	0.05**		0.38***
	(0.01)	(0.02)	(0.01)	(0.03)		(0.04)
Abs. slope of profit function	-0.46***	-0.45***	-0.15***	-0.20	-0.09	-1.61***
	(0.09)	(0.09)	(0.04)	(0.17)	(0.10)	(0.21)
Industry FE	Y	N	Y	Y	Y	Y
Sub-Industry FE	N	Y	N	N	N	N
N	3,146	3,146	2,262	3,133	715	3,146
R^2	0.44	0.45	0.30	0.48	0.49	0.45

Notes: The table reports estimates of firms' absolute errors about inflation over the preceding twelve months from the main survey, except for column (5) which uses data from the follow-up survey and column (6) which uses absolute errors about the output gap. Column (3) restricts the sample to firms whose absolute errors about inflation over the preceding twelve months were less than 5% points. Column (4) uses sampling weights in the estimation. Industry and sub-industry fixed effects are defined as in Table 1. Robust standard errors are reported in parentheses. ***,**, * denotes statistical significance at 1%, 5%, and 10% levels respectively. See section 4.2 for details.

Appendix 1: Survey questions used in the paper

Main Survey

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

Answer: …… %

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.

Answer: …… %

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:	**……**	**%**

Follow-up Survey

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) ☐		

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.

Answer:	**……**	**%**

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:	**……**	**$**	**……**	**$**

Please report when and by how much you expect to next change the price of your main product and your second main product. Please provide a numerical answer in months for the durations (e.g. "0" for within the next month, 1 for one month from now, …) and a percentage answer for the size of the price change (e.g. "+10%" for a 10% increase in price or "-10%" for a 10% decrease)

	Months until next price change	**Expected size of next price change**
Main product:	**…… months**	**…… %**
Second main product:	**…… months**	**…… %**

Using the following frequencies, please identify how often this firm (formally) reviews the price of its main product and its secondary main product: 1- daily, 2- weekly, 3- monthly, 4- quarterly, 5- half-annually, 6- annually, 7- less frequently than annually.

	Frequency of price reviews
Main product:	**……**
Second main product:	**……**

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

Answer:	**……**	**%**

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.

Answer:	**……**	**%**

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 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**	**%**

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. Verify 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 50 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.

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

21. 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:

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

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 4.1. 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)

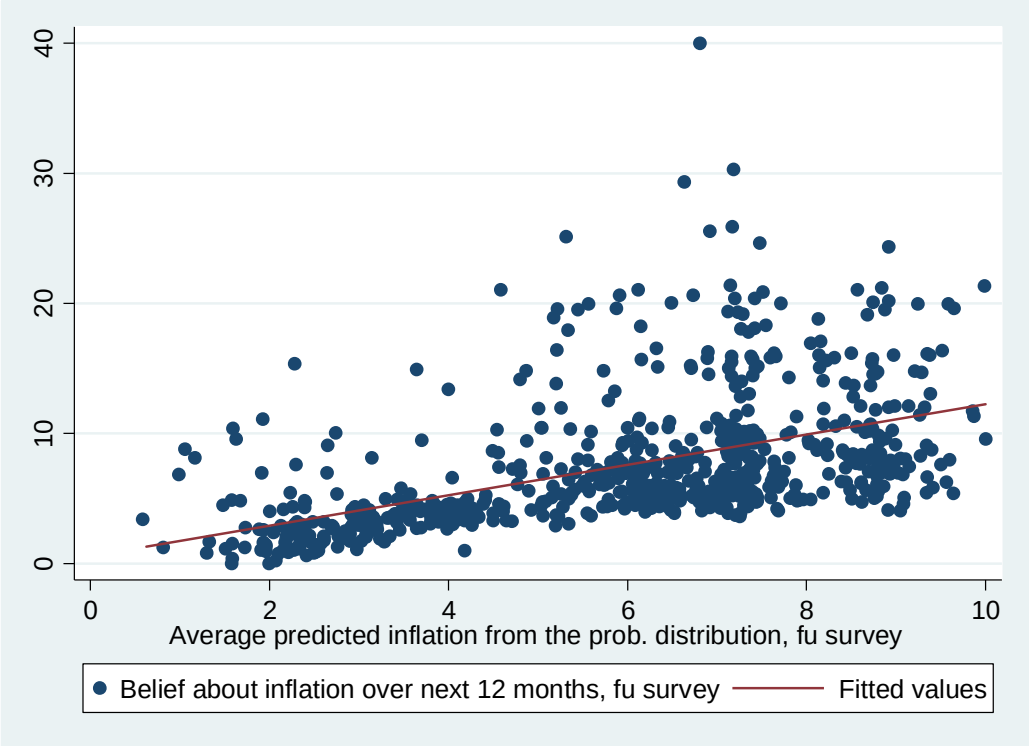
Notes: the table reports the difference between the mean response to a question in alternative formulation and the mean response in the baseline formulation of the question. The sample of firms used for the baseline formulation is constrained to cover only industries (3-digit level) that are populated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

Appendix 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 follow-up survey.