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Contracts and Firms' Inflation Expectations

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JEL Classification

C83, D84, D86, E31, L14

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1. Introduction

This paper investigates the nature and determinants of firms' inventory contracts. In particular, we study how firm characteristics, managerial characteristics, and inflation expectations affect the use of contracts. To do this, we conduct a new quantitative survey of firms in New Zealand. We present novel facts about the usage of purchase and sale contracts. These results provide micro data evidence which can inform the calibration of macroeconomic models.

Contractual arrangements are necessary to mitigate opportunism problems and guard against certain types of ex-post inefficiencies in performance. A contract between the firm and its suppliers or its customers involves an agreement on numerous contractual terms and conditions. Among the most important are price, quantity, quality of product, duration of contract, and provisions for adjusting one or more of these contractual provisions over time.

Contracts have important implications in macroeconomics. For example, the staggered contracting model of Taylor (1979a) and the partial adjustment model by Calvo (1983) are the most popular approaches explaining sticky prices and inflation persistence. Further, the literature emphasizes that long-term relationships between sellers and buyers under contractual agreements may substantially reduce the allocative role of prices in producer-to-producer transactions; see for example Barro (1977) and Carlton (1983; 1986; 1991). Joskow (1987) analyses mechanisms for determining prices in long-term contracts.

The conventional wisdom in the literature has come to be that transactions under contracts show a higher degree of price rigidity and that price rigidity increases in the use of medium- or long-term contracts, i.e. the duration of the contract. Intuitively, it can be argued that when the firm sets an optimal price contingent on knowing that the price will then be fixed or contracted for N periods, it is plausible that the firm may seek macroeconomic information (e.g. aggregate inflation) prior to fixing or setting the price. Similarly, it may be useful for firms to track and use macroeconomic information when purchasing inventory under a contractual

arrangement. If the firm is writing new contracts or renegotiating existing contracts quite frequently, it is expected that frequent tracking of macroeconomic information may be useful for their decisions. An alternative view is that firms may not constantly seek macroeconomic information because their sale or purchase prices may be fixed for a long period. These firms do not involve in frequent price setting decisions and they, therefore, may have fewer incentives to track macroeconomic information on a regular basis. This paper presents some unique stylised facts about the relationship between inventory contracts and inflation expectations.

For the current macroeconomic literature, one of the most important challenges that remains is how economic agents form their expectations. In particular, expectations about inflation is of central importance for policymakers. Recent work (for example, Coibion, Gorodnichenko, and Kumar, 2018 and Kumar, Afrouzi, Coibion, and Gorodnichenko, 2015) has documented that firms are largely inattentive to aggregate inflation. They identified a number of incentives that stimulate firms to track information about inflation. In this paper, we extend their findings to show that firm's beliefs about inflation are correlated with their inventory contracts.

Moreover, we add to the literature conducting firm-level surveys in order to understand the source of price stickiness. The seminal contribution in this literature is due to Blinder (1991, 1994) who interviewed 186 firms in the US. These firms are presented with twelve different theories explaining price stickiness. The resulting ranking shows that implicit and explicit contracts are the 4th and 5th most important factor, even before the costs of price adjustments (e.g. menu costs). He also finds that firms who sell more under contracts worry less about adjustment costs. More recently, studies following Blinder's design have been conducted, for example, in the UK (Hall et al., 1997; 2000), Canada (Amirault et al., 2006), Sweden (Apel et al., 2005), the Netherlands (Hoeberichts and Stokman, 2010) and the Euro Area (Fabiani et al.,

2006). They all replicate the findings by Blinder (1991, 1994) that contracts matter for explaining price adjustments at the firm-level. However, those studies neither collect information about the contract usage nor information about expectations. Stahl (2010) is an exception; he collected data from 1,200 German manufacturing firms on whether they use written sales contracts and find that 87 percent do. Finally, Pitschner (2020) studies archived corporate filings and finds that contracts are mentioned as a source for price rigidity.

Our survey collected responses on firms' purchase and sale contracts as well as their beliefs about recent and future inflation. We surveyed 615 firms from four main industries: (i) manufacturing, (ii) professional and financial services, (iii) trade, and (iv) construction and transportation. Almost all firms in this survey purchase or sell products where the price or quantity or both are fixed for some time.

We document several novel facts from this survey. First, firms purchase and sell inventory through contractual arrangements in three ways – fixed price and quantity (fixed P & Q), fixed price only (fixed P), and fixed quantity only (fixed Q). In fixed P and fixed Q contracts, the quantity and price are determined on the spot market, respectively. The fixed P & Q appears to hold the largest share of contracts, i.e. 24 percent and 33 percent for purchases and sales, respectively. While most purchases (approx. 57 percent) are under a contractual agreement, 51 percent of sales are on the spot market (i.e. made without a contract). Further, we find that the average duration of purchase contracts is not very different from the average duration of sale contracts (17 vs. 19 months). Our baseline regressions reveal that firms that involve more on fixed contract purchases or sales, or that purchase or sell on long-term contracts seem to be small, face a high number of competitors, incur lower average profit margins, and charge a lower price relative to their competitors.

Second, we investigate whether the quality of firms' inflation expectations is linked to the way they purchase or sell inventory. To do this, we extracted three measures of firms'

inflation expectations from the survey - backcast of last 12 months ($E\pi^i_{t-12m}$), 12 months-ahead forecast ($E\pi^i_{t+12m}$), and 5 year-ahead forecast ($E\pi^i_{t+5y}$). Consistent with Coibion, Gorodnichenko, and Kumar (2018) and Kumar, Afrouzi, Coibion, and Gorodnichenko (2015), we document upward bias in firms' inflation expectations. On this front, the average 12-months ahead (last 12 months) inflation forecast is around 3.84 percent (3.69 percent). The average long-run (5 years) inflation forecast is around 3.32 percent.[3] The actual inflation at the time of the survey was 0.4 percent. We extend the baseline regressions to include the three measures of inflation expectations. We find that the upward bias in inflation expectations is a feature of firms that do not purchase or sell largely through contracts. Third, we dig deeper into the specific types of purchase and sale contracts and how they are linked to the quality of inflation expectations. To this end, we attain overwhelming empirical evidence that the specific types of sale contracts (fixed P & Q, fixed P, and fixed Q) have strong links to firms' beliefs about inflation. We run a variant of the extended regression by including the average time length of purchase or sale contracts as the dependent variable. On this front, it seems that information about inflation is vital to firms that write long-term contracts. Higher inflation expectations lead to shorter contracts, where the effect on sales contracts is larger than the effect on purchase contracts. Finally, we include firm-level uncertainty (inflation forecast dispersion and employment growth dispersion) and sectoral-level uncertainty (sectoral PPI dispersion) and find that firm-level uncertainty about employment growth and sectoral-level uncertainty affect contract use, while uncertainty about the inflation forecast only affects some sale contracts.

The paper is organized as follows. Section 2 describes the relation to macroeconomic models and section 3 describes the survey framework. Section 4 presents the empirical results. Finally, section 6 concludes.

[3] The medians at 50th percentile for $E\pi^i_{t-12m}$, $E\pi^i_{t+12m}$, and $E\pi^i_{t+5y}$ are 3 percent, 4 percent and 3 percent, respectively.

2. Relation to Macroeconomic Theory

In this section, we want to discuss the role our findings play for macroeconomic modelling.[4] Since the 1970s, contracts have been at the forefront of macroeconomic modelling of wage and price setting. Taylor's (1979a, 1980) model of staggered nominal adjustment and Calvo's (1983) framework are still at the forefront of macroeconomic theory and policymaking (Christiano et al., 2018).[5] In both models, price-setting decisions depend on expectations about the future and the details of the contracts. The basic Taylor (1979a) model gives a two-dimensional equation system for the individual firm-level prices (or wages) and the price level given by

$$x_t = \frac{1}{N}\sum_{j=0}^{N-1} E_t\left[p_{t+j} + mc_{t+j}\right], \qquad (1)$$

$$p_t = \frac{1}{N}\sum_{j=0}^{N-1} x_{t-j}, \qquad (2)$$

where x denotes the price of firm i, mc denotes marginal costs, and p is the (aggregate) price level. Further, E denotes the mathematical expectation operator and N is the length of the price contract. Similarly, the nominal price in Calvo (1983) model is given by the log-linearized equation

$$x_t = \vartheta E_t[p_t + mc_t] + (1-\vartheta)E_t[x_{t+1}], \qquad (3)$$

and the price level is given by

$$p_t = (1-\vartheta)p_{t-1} + \vartheta x_t. \qquad (4)$$

In the Calvo model, the constant probability that a firm can re-set its price is given by ϑ. Both models can be compared when we assume that $N = 1/\vartheta$ (see, e.g. Kiley, 2002). This

[4] Note that the decision of agents to engage in a contract (specifying price and/or quantity) can be modelled via a standard discrete choice problem, where both parties will accept the contract if it is mutually beneficial. We abstract from modelling this problem, see Masten et al. (1991) for an overview.

[5] Our results also relate to the literature on supply chain modelling (e.g. Cachon and Lariviere, 2001) where expectations affect outcomes.

implies that the contract length is equal to the inverse of the Calvo probability (or vice versa). These models have been extended along various dimensions. The important dimension for our research is the generalization to include heterogeneity in contract duration (Taylor, 1979b). Taylor (1979b) finds a peak in the distribution of wage contract lengths around 3 quarters for US time series data. Along this line, various papers have shown that in Taylor-type models with endogenous contract length (Ball, 1987; Romer, 1990) expectations about the price level affect wage, employment, and, hence, output. More recently, Carvalho (2006) and Kara (2015) document the effects of heterogeneity in price stickiness. In this model with multiple Calvo-contracts, expectations about the price level as well as the contract duration affect real variables.

There exists a large literature investigating the stickiness in prices. DSGE models, where typically the Calvo probability is estimated using aggregate time series data, report values around 0.6 which implies a contract length of around 1.6 quarters (see Christiano et al., 2005 and Smets and Wouters, 2007). Papers such as Klenow and Kryvtsov (2008) or Nakamura and Steinsson (2008) use micro-data (producer prices) to study the persistence in prices. They report that prices change, on average, every 7 to 9 months (roughly every 2.5-3 quarters) in the US. We find that contract duration is on average about 6 quarters in New Zealand, which is slightly longer compared to the 5 quarters obtained by estimating the Reserve Bank's DSGE model (see Kamber et al., 2016). Our results imply more price stickiness and, for example, larger effects of monetary policy shocks. Our design in this paper offers a different way to address price stickiness empirically and calibrate New Keynesian DSGE models and combine micro-evidence and macro-modelling.

3. Survey

This survey was conducted between April 2016 and June 2016. We utilized the Equifax New Zealand database to extract details of the firms, e.g., names, contacts, size of workforce, etc.

Firms were classified according to the Australia and New Zealand Standard Industrial Classification (ANZSIC) 2006. The firms in this survey employ six or more workers. We ignored firms that employ less than six workers because they are too small. We considered firms from four main sectors of the economy: (i) manufacturing, (ii) professional and financial services, (iii) trade, and (iv) construction and transportation. Around 5433 firms were randomly chosen from the population of firms in New Zealand. We allowed two-thirds of the population of this survey from manufacturing and professional and financial services because both industries contribute vastly to the national gross domestic product. The remaining population consists of firms from the construction, transportation, and trade industries. In the process of randomization, we controlled for firm size, sectors, and subsectors. We used the Statistics New Zealand data for 2014 to compute the proportion of firms that fall into each employment size group (6 to 19 workers, 20 to 49 workers, and ≥ 50 workers) for each sector. This enables us to match our population with the population of firms in the economy.[6] Table 1A in Appendix presents the firm count by industry and employment size group. In the Appendix, we provide details about survey response, data quality, and data description.

4. Empirical Results

4.1 Baseline Estimates

In this section, we assess the broader determinants of firms' inventory contracts. To do this, we estimate the following regression:

$$Contract_t^i = \alpha + \phi X_t^i + \delta_j + \varepsilon_i, \qquad (5)$$

[6] For instance, the manufacturing industry in 2014 had around 65.5 percent of firms in the employment size group of 6 to 19 workers, 21.8 percent in the 20 to 49 workers and 12.6 percent in greater than 50 workers. Our population in manufacturing industry included similar proportions. The employment size proportions were computed for professional and financial services, trade, construction, and transportation industries and our population was matched accordingly.

where $Contract_t^i$ denotes the shares of inventory purchase or sale contracts of firm *i*, which we regress on the firm-specific characteristics (X_t^i), and controlling for the sector and subsector-specific fixed effects (δ_j). Table 1 presents the regression results using a wide range of variables directly related to the firm (age, employment, share of foreign trade, number of competitors, labor cost, average profit margin and price relative to competitors). The dependent variable in column (1) is the overall share of purchases via contract. Columns (2) to (4) include specific types of purchase contracts viz., fixed P & Q, fixed Q, and fixed P as the dependent variables, respectively. Column (6) includes the overall share of sales via contract. The specific types of sale contracts viz., fixed P & Q, fixed Q, and fixed P are included as dependent variables in columns (7) to (9), respectively. Columns (5) and (10) considers the average time length of purchase and sale contracts as the dependent variable, respectively.[7] The sector and subsector-specific fixed effects are accounted for in all estimated regressions. The regression results can be summarized as follows. First, we find that firm size (measured via age and employment), number of competitors, average profit margin, and price relative to competitors seem to be statistically significant at the conventional levels in all regressions, except the case of purchase contract with fixed Q. The lack of significance for the fixed Q contracts might be due to the relatively small usage of this type of contract in our sample. Firms that engage more on fixed contract purchases or sales, or that purchase or sell on long-term contracts seem to be smaller in size, face more competitors, incur lower average profit margins and charge lower price relative to their competitors.

Second, the share of foreign trade does not seem to play any role in the determination of the contracts or the duration of the contracts. Third, labor costs are statistically significant in the regressions with sale contracts (fixed P & Q, fixed P, and fixed Q) and overall shares of contracts. To this end, firms that incur lower labor costs seem to purchase and sell largely via

[7] The average length of time is based on fixed P & Q contracts.

contracts. Higher labor costs seem to disincentivize firms to sell under contracts. Last, firm-specific characteristics do not seem to play any role in the purchase contracts with fixed Q. Here, we find none of the estimates are statistically significant at the conventional levels.

{Insert Table 1 about here}

4.2 Estimates of Extended Model

In this section, we extend our baseline regressions to include measures of firms forecasts of inflation.

4.2.1 Links Between Contracts and Quality of Inflation Expectations

We run a set of firm-level regressions with the aim to explain the link between contracts and inflation expectations. To be precise, we estimate the following extended regression:

$$Contract_t^i = \alpha + \phi X_t^i + \gamma E\pi_t^i + \delta_j + \varepsilon_i, \qquad (6)$$

where $Contract_t^i$ denotes the overall shares of inventory purchase or sale contracts and $E\pi_t^i$ is the expected inflation. The vector of controls, $X_{i,t}$, contains firm-specific characteristics. All regressions include sector and subsector-specific fixed effects, δ_j, and clustered standard errors at the firm level. Our results are shown in Table 2.

{Insert Table 2 about here}

Columns (1) to (3) include overall shares of purchases made through contracts as the dependent variable. Columns (4) to (6) include overall shares of sale contracts as the dependent variable. The regressions vary in the sense of the measure of expected inflation as the explanatory variable. That is, columns (1) and (4) incorporate backcast of inflation last 12 months ($E\pi_{t-12m}^i$). Columns (2) and (5) use 12-months ahead inflation forecast ($E\pi_{t+12m}^i$). The 5 year-ahead forecast of inflation is used in columns (3) and (6) ($E\pi_{t+5y}^i$).

The estimates of the firm-specific qualities are very consistent with the baseline results, except the labor costs. Labor cost is now statistically significant at the conventional levels across all six regressions. The main finding from these regressions is that firms expected

inflation is negatively correlated with the overall shares of purchase and sale contracts. The three measures of expected inflation ($E\pi^i_{t+12m}, E\pi^i_{t-12m}$ and $E\pi^i_{t+5y}$) have a negative sign and are statistically significant at the one percent level. This implies that firms that make large forecast errors purchase or sell their inventory mainly in the spot market.

Further, when we look at the magnitude of the effects, we find that the size of the effect of inflation expectations is larger for sales contracts than for purchase contracts. Hence, holding all else equal, a firm that expects higher inflation will reduce the usage of contracts, especially the usage of sale contracts. This is intuitive, as more flexibility along the sales dimension will allow to re-set (increase, as firms expect positive inflation) the sales price more frequently.

Our results extend the evidence provided by Kumar, Afrouzi, Coibion, and Gorodnichenko (2015) and Coibion, Gorodnichenko, and Kumar (2018). We show that firms formation of beliefs about inflation is directly linked to the way they purchase or sell inventory. In other words, we show, for the first time, the links between firms inventory purchase and sale contracts and the quality of inflation expectations.[8]

Our findings can be used to provide empirical support to models combining menu and observation costs. Gorodnichenko (2008) builds a model in which firms face menu costs and heterogeneous information sets. Our findings relate to the mechanics in this model as follows: firms with better expectations, i.e. larger information sets, avoid resetting the price more frequently in order to not reveal private information. On the flip side, firms with smaller information sets, or worse inflation expectations, choose to reset prices more often and, hence, these firms write shorter contracts.

A similar approach is used in Alvarez, Lippi, and Paciello (2011). Firms face two types of costs: a fixed cost of adjusting the state and a fixed cost of observing the state. Firms

[8] The over-estimation of inflation by firms lends support to models that deviate from the rational expectation, full information paradigm. Namely, it favours models of noisy information (e.g. Woodford, 2001 and Sims, 2003) and sticky information (e.g. Mankiw and Reis, 2002).

optimally choose when to collect information and the adequacy of its price. During such a "review", firms can reset its price and choose when the next review will take place. In their model, the frequency of reviews and price adjustments depend on the ratio of menu to observation costs and the cost-benefit ratio of observing and/or adjusting the price. They show that with higher inflation rates, the frequency of price adjustments increases while the ratio of the frequency of price reviews to adjustments decreases. This result is similar in nature to our finding that firms with long-term sale contracts have better inflation expectations.

Finally, as explained in section 2, our results also offer a new and different way to calibrate New Keynesian DSGE (sticky price) models and to combine micro-level evidence and macroeconomic modelling. While fitting DSGE models to time series data typically requires more frequent price re-settings compared to what is found in the micro-level literature (e.g. Klenow and Kryvtsov, 2008 or Nakamura and Steinsson, 2008), our results offer a different way to calibrate these models by explicitly pinning down the duration of price setting contracts. For New Zealand, we find that the contract duration is about 6 quarters on average. This is longer compared to the 5 quarters obtained by estimating the Reserve Bank's DSGE model (Kamber et al., 2016). With our calibration, the model would feature more price stickiness and generate larger and more persistent effects of monetary policy shocks.

4.2.2 Digging Deeper Into Contracts and Inflation Expectations

In what follows, we explore the links between specific types of purchase and sale contracts and inflation expectations. To do this, we estimate the extended regression (equation 6) where the dependent variable includes specific types of purchase (fixed P & Q, fixed P, and fixed Q) and sale (fixed P & Q, fixed P, and fixed Q) contracts. Table 3 (Table 4) present the results of the specific types of purchase (sale) contracts. In Table 3, columns (1) to (3) include purchases contract with fixed P & Q as the dependent variable. Columns (4) to (6) consider purchases contract with fixed Q as the dependent variable. Purchases contract with fixed P is the

dependent variable in columns (7) to (9). Our findings reveal that the three measures of inflation expectations ($E\pi^{i}_{t+12m}, E\pi^{i}_{t-12m}$, and $E\pi^{i}_{t+5y}$) have a negative sign and are statistically significant in regressions including purchases contract with fixed P & Q. In regressions where the dependent variable is purchases contract with fixed P, we find only two measures of expected inflation ($E\pi^{i}_{t+12m}$ and $E\pi^{i}_{t+5y}$) are statistically significant. These results imply that firms that track information about inflation largely purchase their inventory via two specific forms of contracts. That is, fixed P & Q and fixed P only. The regressions where the dependent variable is purchase contracts with fixed Q did not yield any statistically significant results. In Table 4, we consider the specific types of sale contracts as the dependent variable. To this end, columns (1) to (3) use sale contracts with fixed P & Q, columns (4) to (6) consider sale contracts with fixed Q, and columns (7) to (9) include sale contracts with fixed P. We find the three measures of expected inflation are statistically significant and are therefore useful determinants of each type of sale contract.

For purchases and sales, we find that higher inflation expectations reduce the usage of contracts. Interestingly, we find the strongest effect on contracts that specify price and quantity. The second largest effect is found for fixed price contracts, with contracts specifying quantity showing the smallest effect. Further, we find that the effect is stronger for purchase contracts specifying P & Q compared to the same type of sales contracts. The opposite holds for contracts specifying the price only. This is different to the findings for total use of purchase and sale contracts (see previous section). This result is surprising as one would expect sales contracts to be more strongly affected in order for firms, in a positive inflation environment, to be able to re-set the price more frequently.

Finally, in all regressions, the firm-specific features are fairly consistent with the baseline results. Overall, these results indicate that the quality of inflation expectations are dominantly featured in specific types of sale contracts.

{Insert Tables 3 and 4 about here}

Moreover, we focus on links between contract duration and the quality of beliefs about inflation. The extended regression (equation 6) now includes the average time length of purchase or sale contracts as the dependent variable.[9] Table 5 present the regression results.

{Insert Table 5 about here}

Columns (1) to (3) report estimates of the average time length of purchase contracts with fixed P & Q. Columns (4) to (6) report estimates of the average time length of sale contracts with fixed P & Q. Again, the firm-specific features in these regressions are very similar to the baseline results.

Interestingly, we find that the three measures of expected inflation have a negative sign and are statistically significant at the one percent level. These results imply that information about inflation is imperative to firms that write long-term contracts. Our findings show that the effect of inflation expectations is stronger on the duration of sales contracts than for purchase contracts. This finding is in line with our intuition: in an environment of positive inflation rates, we expect firms to prefer short sales contracts giving them the opportunity to re-set the contract details, mainly the price, more frequently. The negative sign for purchase contracts is interesting. Along the same line, we would expect that firms who expect higher inflation write longer purchase contracts. This would pin down the price, and accordingly costs, allowing the firm to gain higher profits. One explanation for this finding could be different bargaining powers in purchase and sale decisions.

[9] Due to unavailability of data, we use only one measure of contract duration, i.e. the duration of fixed P & Q contracts.

4.2.3 Links Between Contracts and Uncertainty

It is possible that firm and sectoral shocks may play a vital role in determining whether firms should engage in a contractual arrangement or not.[10] To explore how firm and sectoral shocks affects contracts, we extend equation (6) to include measures of idiosyncratic shocks volatility as explanatory variables. We construct three measures of idiosyncratic shocks volatility that captures the degree of uncertainty at firm or sectoral levels. First, the standard deviation of 12 months-ahead inflation forecast of the firm.[11] Second, the standard deviation of employment growth of the firm.[12] Lastly, the standard deviation of sectoral producer price index (PPI).[13] The results are reported in the Appendix in Tables 3A, 4A, and 5A. Table 3A and Table 4A present estimates of 12 regressions where the dependent variables are purchase and sale contracts of various types including the total share, respectively. The dependent variable in Table 5A is duration of either purchase contract or sale contract. The notes of each table give more details about the estimated regressions. Each regression is estimated by including a measure of uncertainty and the (mean) point forecast of 12 months-ahead inflation. The latter is computed using the responses from probability distribution of 12 months-ahead inflation forecast.

The results suggest that all the three measures of uncertainty are linked negatively with contracts.[14] That is, the higher the uncertainty, the less likely firms will undertake contractual obligations. The three measures of uncertainty seem to be statistically significant at the conventional levels in regressions where the dependent variable is overall share of sale contract. In regressions where the dependent variable is the overall share of purchase contracts,

[10] For example, Gorodnichenko (2008) shows that uncertainty plays an important role in firm decisions. Firms facing high levels of uncertainty will wait to change prices until they receive information about the state of nature from price changes by other firms.
[11] The survey asked firms to forecast 12 months-ahead inflation by assigning probability for various ranges of inflation rate; see questionnaire in the Appendix. Using the probability distributions, we computed the forecast dispersion of individual firms.
[12] We used annualised employment growth of the firm.
[13] The data on sectoral PPI is collated from Statistics NZ.
[14] The estimates of firm controls are not reported to conserve space. They are consistent with our previous results.

the estimates of forecast dispersion are not statistically significant, but the estimates of standard deviation of employment growth and the standard deviation of sectoral PPI are statistically significant at the conventional levels. Furthermore, the estimates of standard deviation of sectoral PPI are statistically significant at conventional levels in most of the other regressions. Moreover, we find evidence that the three measures of uncertainty are negatively related to contract duration, however, the estimates are not statistically significant in majority of the regressions.[15]

Our results relate to the theoretical models by Vavra (2014) and Baley and Blanco (2019). They formulate theoretical predictions using menu-cost models for how uncertainty affects pricing decisions. In both models, two opposing effects exist, but their relative importance is unknown and depends on assumptions made in modelling and parametrization. The first effect is an option value effect, where higher uncertainty widens the inactivity region and, hence, reduces the price adjustment frequency. The second is a volatility effect, where higher uncertainty leads to exiting the inactivity region more often and, hence, increases the price adjustment frequency.

We find that the volatility effect dominates. Put differently, the price adjustment frequency increases when uncertainty increases. According to our findings, higher uncertainty increases the flexibility of pricing decisions and firms write shorter contracts. This result is in line with the predictions of the models in Vavra (2014) and Baley and Blanco (2019). Further, our results confirm the findings in Bachmann et al. (2019). They provide empirical support for these theoretical models by measuring firm-specific volatility and highlighting the effect on price-setting behavior in a sample of German firms. They show that the frequency of price

[15] The estimates of inflation forecast dispersion and standard deviation of employment growth are statistically significant in purchase duration and sales duration regressions.

changes increases with higher uncertainty. Our findings support this in that less contract usage and shorter contracts will lead to more frequent price setting.

6. Conclusion

We conduct a new quantitative survey to explore the nature and determinants of firms' inventory contracts. We investigate whether firms' inflation expectations are robust determinants of their inventory contracts. We surveyed 615 firms across sectors about their contract usage and collected information on firms' forecasts of recent and future inflation.

Our findings can be summarised on four fronts. First, firms' contractual arrangements appear in three forms – fixed P & Q, fixed P, and fixed Q. Purchases and sales through contracts specifying fixed P & Q seem to dominate, i.e. 24 percent and 33 percent for purchases and sales, respectively. We find that firms who use purchase contracts will also use sales contracts (and vice versa). Firms that involve more on fixed contract purchases or sales, or that purchase or sell on long-term contracts seem to be small, face more competitors, incur lower average profit margins and charge lower price relative to their competitors. Second, we find firms over-estimate the recent and future inflation. Third, we look at the specific types of purchase and sale contracts and their relationships with inflation expectations. To this end, we find that all specific types of sale contracts (fixed P & Q, fixed P, and fixed Q) are strongly correlated to firms' beliefs about inflation. We find that firms who do use contracts and who write longer contracts have better inflation expectations. Finally, we find that sector-level uncertainty and firm-level employment growth uncertainty affects contract use, while firm-level inflation uncertainty only matters for sales contracts and duration. Our findings offer a novel way to calibrate sticky price macroeconomic models and inform the development of menu and observation cost price setting models.

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Table 1: Baseline Estimates

$Model: Contract_t^i = \alpha + \phi X_t^i + \delta_j + \varepsilon_i$

Variables	Purchases					Sales				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Total	Fixed P&Q	Fixed Q	Fixed P	Duration	Total	Fixed P&Q	Fixed Q	Fixed P	Duration
Log Age	-14.612***	-7.940***	0.436	-7.109***	-5.121***	-15.556***	-7.384***	-3.031***	-5.141***	-5.467***
	(1.419)	(1.309)	(0.658)	(1.175)	(0.667)	(1.184)	(0.741)	(0.344)	(0.438)	(0.654)
Log Employment	-10.454***	-5.871***	0.191	-4.774***	-3.598***	-9.469***	-4.407***	-1.938***	-3.125***	-3.104***
	(1.168)	(1.137)	(0.552)	(0.993)	(0.604)	(0.944)	(0.618)	(0.289)	(0.361)	(0.503)
Trade	0.022	-0.022	-0.021	0.065	0.016	0.033	0.018	0.006	0.009	0.015
	(0.029)	(0.043)	(0.017)	(0.049)	(0.028)	(0.028)	(0.022)	(0.008)	(0.011)	(0.022)
Competitors	1.309***	0.517**	-0.084	0.876***	0.411***	1.370***	0.702***	0.276***	0.392***	0.607***
	(0.160)	(0.204)	(0.091)	(0.217)	(0.112)	(0.145)	(0.110)	(0.043)	(0.053)	(0.099)
Labor Costs	-0.154**	-0.065	-0.004	-0.084	-0.059	-0.222***	-0.120***	-0.047**	-0.055**	-0.020
	(0.071)	(0.072)	(0.040)	(0.074)	(0.041)	(0.061)	(0.041)	(0.018)	(0.023)	(0.039)
Rel. Price	-5.687***	-4.085***	0.257	-1.859***	-2.039***	-5.688***	-2.907***	-1.168***	-1.613***	-2.025***
	(0.742)	(0.743)	(0.302)	(0.631)	(0.364)	(0.674)	(0.423)	(0.180)	(0.240)	(0.393)
Average Margin	-0.666***	-0.380***	-0.014	-0.271***	-0.188***	-0.563***	-0.323***	-0.073***	-0.166***	-0.211***
	(0.100)	(0.090)	(0.039)	(0.082)	(0.046)	(0.082)	(0.053)	(0.022)	(0.029)	(0.047)
Constant	168.884***	101.156***	2.251	65.477***	55.212***	159.281***	75.051***	32.563***	51.668***	53.915***
	(6.744)	(7.750)	(3.316)	(7.974)	(4.484)	(6.003)	(4.240)	(1.763)	(2.120)	(3.534)
Sector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subsector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	615	615	615	615	615	615	615	615	615	615
R-squared (adj.)	0.886	0.682	0.067	0.626	0.737	0.909	0.846	0.817	0.873	0.770

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE indicates fixed effects. $Contract_t^i$ denotes the shares of inventory purchase and sale contracts. X_t^i includes the firm-specific characteristics. δ_j captures the sector and subsector specific fixed effects. The dependent variable in column (1) is the overall share of purchases via contract. Columns (2) to (4) include specific types of purchase contracts viz., fixed P & Q, fixed Q, and fixed P as the dependent variables, respectively. Column (6) includes the overall share of sales via contract. The specific types of sale contracts viz., fixed P & Q, fixed Q, and fixed P are included as dependent variables in columns (7) to (9), respectively. Columns (5) and (10) considers the average time length of purchase and sale contracts as the dependent variable, respectively

Table 2: Links Between Contracts and Inflation Expectations

$Model: Contract_t^i = \alpha + \phi X_t^i + \gamma E\pi_t^i + \delta_j + \varepsilon_i$

Variables	Purchases: Total			Sales: Total		
	(1)	(2)	(3)	(4)	(5)	(6)
Log Age	-13.369***	-12.140***	-13.772***	-13.934***	-12.476***	-14.581***
	(1.462)	(1.515)	(1.430)	(1.170)	(1.212)	(1.199)
Log Employment	-9.560***	-9.543***	-9.878***	-8.303***	-8.335***	-8.801***
	(1.201)	(1.204)	(1.220)	(0.958)	(0.922)	(0.937)
Trade	0.015	0.013	0.022	0.023	0.022	0.033
	(0.029)	(0.028)	(0.029)	(0.028)	(0.026)	(0.027)
Competitors	1.174***	1.108***	1.234***	1.194***	1.120***	1.283***
	(0.158)	(0.159)	(0.161)	(0.142)	(0.140)	(0.145)
Labor Costs	-0.128*	-0.131*	-0.146**	-0.188***	-0.193***	-0.212***
	(0.070)	(0.070)	(0.070)	(0.059)	(0.058)	(0.059)
Rel. Price	-5.113***	-4.801***	-5.354***	-4.940***	-4.585***	-5.301***
	(0.740)	(0.719)	(0.756)	(0.665)	(0.666)	(0.688)
Average Margin	-0.590***	-0.622***	-0.633***	-0.464***	-0.509***	-0.525***
	(0.099)	(0.095)	(0.100)	(0.081)	(0.077)	(0.083)
$E\pi_{t-12m}$	-2.173***			-2.835***		
	(0.555)			(0.516)		
$E\pi_{t+12m}$		-2.883***			-3.593***	
		(0.627)			(0.499)	
$E\pi_{t+5y}$			-1.648***			-1.914***
			(0.610)			(0.473)
Constant	167.694***	169.071***	169.505***	157.728***	159.514***	160.002***
	(6.704)	(6.660)	(6.695)	(5.750)	(5.577)	(5.847)
Sector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes
Subsector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	615	615	615	615	615	615
R-squared (adj.)	0.889	0.892	0.888	0.916	0.919	0.913

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE indicates fixed effects. $E\pi_{t-12m}$ is backcast of last 12 months inflation. $E\pi_{t+12m}$ is forecast of 12 months-ahead inflation. $E\pi_{t+5y}$ is forecast of 5 year-ahead inflation. $Contract_t^i$ denotes the overall shares of inventory purchase and sale contracts. X_t^i includes the firm-specific characteristics. $E\pi_t^i$ is a measure of expected inflation. δ_j captures the sector and subsector specific fixed effects. Columns (1) to (3) include overall shares of purchases made through contracts as the dependent variable. Columns (4) to (6) include overall shares of sale contracts as the dependent variable.

Table 3: Links Between Purchase Contracts and Inflation Expectations

$Model: Contract_t^i = \alpha + \phi X_t^i + \gamma E\pi_t^i + \delta_j + \varepsilon_i$

Variables	Fixed P&Q			Fixed Q			Fixed P		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Age	-6.990***	-6.354***	-7.482***	0.354	0.300	0.335	-6.732***	-6.087***	-6.625***
	(1.326)	(1.371)	(1.313)	(0.667)	(0.681)	(0.654)	(1.152)	(1.192)	(1.186)
Log Employment	-5.188***	-5.286***	-5.557***	0.132	0.141	0.121	-4.504***	-4.398***	-4.443***
	(1.150)	(1.159)	(1.157)	(0.558)	(0.559)	(0.551)	(0.997)	(0.982)	(0.993)
Trade	-0.028	-0.028	-0.022	-0.020	-0.020	-0.021	0.063	0.061	0.065
	(0.043)	(0.043)	(0.043)	(0.017)	(0.017)	(0.017)	(0.049)	(0.049)	(0.049)
Competitors	0.414**	0.388*	0.476**	-0.076	-0.073	-0.075	0.836***	0.793***	0.833***
	(0.206)	(0.208)	(0.206)	(0.095)	(0.096)	(0.093)	(0.222)	(0.224)	(0.220)
Labor Costs	-0.046	-0.051	-0.061	-0.006	-0.005	-0.005	-0.077	-0.075	-0.080
	(0.071)	(0.071)	(0.071)	(0.041)	(0.040)	(0.040)	(0.074)	(0.074)	(0.074)
Rel. Price	-3.647***	-3.517***	-3.904***	0.219	0.209	0.217	-1.685**	-1.493**	-1.667***
	(0.742)	(0.752)	(0.762)	(0.306)	(0.302)	(0.307)	(0.655)	(0.644)	(0.636)
Average Margin	-0.323***	-0.353***	-0.363***	-0.019	-0.017	-0.018	-0.248***	-0.253***	-0.252***
	(0.089)	(0.088)	(0.090)	(0.040)	(0.040)	(0.040)	(0.081)	(0.080)	(0.081)
$E\pi_{t\text{-}12m}$	-1.659***			0.144			-0.658		
	(0.497)			(0.243)			(0.426)		
$E\pi_{t+12m}$		-1.850***			0.159			-1.192***	
		(0.529)			(0.237)			(0.442)	
$E\pi_{t+5y}$			-0.899*			0.200			-0.949**
			(0.495)			(0.228)			(0.397)
Constant	100.247***	101.276***	101.494***	2.330	2.241	2.176	65.117***	65.555***	65.835***
	(7.674)	(7.733)	(7.723)	(3.326)	(3.315)	(3.325)	(7.947)	(7.960)	(8.006)
Sector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subsector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	615	615	615	615	615	615	615	615	615
R-squared (adj.)	0.687	0.688	0.684	0.067	0.067	0.068	0.627	0.629	0.628

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE indicates fixed effects. $E\pi_{t\text{-}12m}$ is backcast of last 12 months inflation. $E\pi_{t+12m}$ is forecast of 12 months-ahead inflation. $E\pi_{t+5y}$ is forecast of 5 year-ahead inflation. Contract captures the specific types of purchase contract (fixed P & Q, fixed P, and fixed Q). X_t^i includes the firm-specific characteristics. $E\pi_t^i$ is a measure of expected inflation. δ_j captures the sector and subsector specific fixed effects. Columns (1) to (3) include purchases contract with fixed P & Q as the dependent variable. Columns (4) to (6) consider purchases contract with fixed Q as the dependent variable. Purchases contract with fixed P is the dependent variable in columns (7) to (9).

Table 4: Links Between Sale Contracts and Inflation Expectations

$Model: Contract_t^i = \alpha + \phi X_t^i + \gamma E\pi_t^i + \delta_j + \varepsilon_i$

Variables	Fixed P&Q			Fixed Q			Fixed P		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Age	-6.582***	-6.047***	-6.907***	-2.706***	-2.390***	-2.900***	-4.646***	-4.039***	-4.774***
	(0.744)	(0.760)	(0.748)	(0.350)	(0.364)	(0.351)	(0.439)	(0.451)	(0.443)
Log Employment	-3.830***	-3.914***	-4.080***	-1.704***	-1.702***	-1.848***	-2.769***	-2.718***	-2.873***
	(0.628)	(0.614)	(0.616)	(0.288)	(0.287)	(0.293)	(0.376)	(0.357)	(0.359)
Trade	0.014	0.014	0.018	0.004	0.004	0.006	0.006	0.005	0.009
	(0.022)	(0.022)	(0.022)	(0.008)	(0.008)	(0.008)	(0.011)	(0.011)	(0.011)
Competitors	0.615***	0.594***	0.660***	0.241***	0.224***	0.264***	0.338***	0.302***	0.359***
	(0.111)	(0.111)	(0.111)	(0.043)	(0.043)	(0.043)	(0.052)	(0.051)	(0.053)
Labor Costs	-0.104**	-0.108***	-0.115***	-0.040**	-0.041**	-0.045**	-0.045**	-0.045**	-0.051**
	(0.040)	(0.041)	(0.041)	(0.018)	(0.017)	(0.018)	(0.023)	(0.022)	(0.022)
Rel. Price	-2.537***	-2.428***	-2.718***	-1.018***	-0.939***	-1.116***	-1.384***	-1.218***	-1.467***
	(0.421)	(0.423)	(0.429)	(0.179)	(0.179)	(0.184)	(0.240)	(0.241)	(0.242)
Average Margin	-0.275***	-0.300***	-0.305***	-0.053**	-0.062***	-0.068***	-0.136***	-0.147***	-0.152***
	(0.053)	(0.051)	(0.054)	(0.022)	(0.021)	(0.022)	(0.029)	(0.028)	(0.029)
$E\pi_{t\text{-}12m}$	-1.402***			-0.568***			-0.866***		
	(0.314)			(0.142)			(0.175)		
$E\pi_{t+12m}$		-1.559***			-0.748***			-1.286***	
		(0.297)			(0.150)			(0.166)	
$E\pi_{t+5y}$			-0.936***			-0.257*			-0.721***
			(0.286)			(0.132)			(0.159)
Constant	74.283***	75.152***	75.403***	32.251***	32.611***	32.659***	51.194***	51.751***	51.939***
	(4.153)	(4.125)	(4.178)	(1.733)	(1.702)	(1.749)	(2.059)	(1.977)	(2.086)
Sector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subsector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	615	615	615	615	615	615	615	615	615
R-squared (adj.)	0.851	0.852	0.848	0.823	0.828	0.818	0.879	0.886	0.878

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE indicates fixed effects. $E\pi_{t\text{-}12m}$ is backcast of last 12 months inflation. $E\pi_{t+12m}$ is forecast of 12 months-ahead inflation. $E\pi_{t+5y}$ is forecast of 5 year-ahead inflation. Contract captures the specific types of sale contract (fixed P & Q, fixed P, and fixed Q). X_t^i includes the firm-specific characteristics. $E\pi_t^i$ is a measure of expected inflation. δ_j captures the sector and subsector specific fixed effects. For dependent variable, columns (1) to (3) use sale contracts with fixed P & Q, columns (4) to (6) consider sale contracts with fixed Q, and columns (7) to (9) include sale contracts with fixed P.

Table 5: Links Between Contract Duration and Inflation Expectations

$Model: Contract_t^i = \alpha + \phi X_t^i + \gamma E\pi_t^i + \delta_j + \varepsilon_i$

Variables	Purchase			Sales		
	(1)	(2)	(3)	(4)	(5)	(6)
Log Age	-4.674***	-4.227***	-4.746***	-4.701***	-4.043***	-5.044***
	(0.663)	(0.679)	(0.662)	(0.654)	(0.647)	(0.662)
Log Employment	-3.277***	-3.269***	-3.341***	-2.553***	-2.579***	-2.814***
	(0.605)	(0.597)	(0.594)	(0.521)	(0.498)	(0.511)
Trade	0.014	0.013	0.016	0.010	0.010	0.015
	(0.028)	(0.028)	(0.028)	(0.022)	(0.022)	(0.022)
Competitors	0.363***	0.339***	0.378***	0.524***	0.492***	0.570***
	(0.114)	(0.112)	(0.112)	(0.099)	(0.099)	(0.099)
Labor Costs	-0.049	-0.050	-0.055	-0.004	-0.007	-0.016
	(0.040)	(0.040)	(0.040)	(0.038)	(0.038)	(0.038)
Rel. Price	-1.833***	-1.719***	-1.890***	-1.671***	-1.515***	-1.857***
	(0.366)	(0.370)	(0.372)	(0.389)	(0.385)	(0.394)
Average Margin	-0.161***	-0.173***	-0.174***	-0.164***	-0.186***	-0.195***
	(0.046)	(0.045)	(0.046)	(0.046)	(0.045)	(0.047)
$E\pi_{t\text{-}12m}$	-0.782***			-1.339***		
	(0.273)			(0.257)		
$E\pi_{t+12m}$		-1.043***			-1.661***	
		(0.289)			(0.252)	
$E\pi_{t+5y}$			-0.736***			-0.829***
			(0.263)			(0.217)
Constant	54.783***	55.279***	55.489***	53.181***	54.022***	54.227***
	(4.447)	(4.438)	(4.452)	(3.523)	(3.467)	(3.514)
Sector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes
Subsector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	615	615	615	615	615	615
R-squared (adj.)	0.741	0.743	0.741	0.779	0.783	0.773

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE indicates fixed effects. $E\pi_{t\text{-}12m}$ is backcast of last 12 months inflation. $E\pi_{t+12m}$ is forecast of 12 months-ahead inflation. $E\pi_{t+5y}$ is forecast of 5 year-ahead inflation. Contract indicates the average time length of purchase or sale contracts specifying fixed P & Q. X_t^i includes the firm-specific characteristics. $E\pi_t^i$ is a measure of expected inflation. δ_j captures the sector and subsector specific fixed effects. For dependent variable, columns (1) to (3) use the average time length of purchase contracts with fixed P & Q. Columns (4) to (6) use the average time length of sale contracts with fixed P & Q.

APPENDIX – ADDITIONAL DETAILS

1A. Survey Response and Data Quality

The survey was conducted via telephone and the respondents are managers or directors of firms. The information sheet and questionnaire were made available to the respondents about a week prior to the telephone call. The response rate in the survey is around 11 percent. The number of firms in the population of the survey is 5433; out of these many firms we achieved 615 responses. The telephone interview process includes two main phases: (i) recruitment and (ii) interview. The first phase includes seeking potential respondent's interest to participate in the survey. This is a difficult process and usually takes a lot of effort. The second phase includes the actual interview process with the respondents. Here, the Research Assistants made appointments with the respondents and asked questions from the questionnaire. The responses were recorded in the hard copy questionnaire as well as audio-recorded. Later, the audio recordings were checked against the responses recorded in the hard copy questionnaire and then deleted for the purpose of maintaining respondents anonymity. The hard copy responses were then recorded in an Excel spreadsheet. To maintain the quality of the survey, we hired different groups of Research Assistants to perform each of the above tasks as well as independent individuals were hired to verify the responses in the Excel spreadsheet to the hard copy questionnaire. The questionnaire is available in the Appendix.

The sample of firms in this survey is different from Coibion, Gorodnichenko and Kumar (2018). However, the sampling framework in both surveys are quite similar. Both surveys drew the sample from the population of firms in New Zealand. We checked overlap of firms across the two surveys and this is around 40 percent.

We assess the quality of the survey data as follows. First, the survey asked managers to report the age of the firm and details about shareholding and directors. This information can be

verified through the New Zealand Companies Office Register.[16] Information about their age is available online for 586 firms. We find that 95 percent of the responses about reported age in the survey matches the online information.

Second, firms that are public companies provided us with information about the number of shares issued and the number of directors. For almost all firms in this survey, the responses about shareholding and directors match with the online information.

Third, we use firms' website information to conduct further quality checks. Many firms have an online profile that provides their basic details such as ownership, products, prices, and whether they export or not. The survey collected basic details of the firms their main product, second main product, prices of main and second main products, and share of sales from overseas. The survey also collected information about the ownership of the firm, i.e. whether the firm is domestically or foreign-owned. The information about the main product and the second main product of the firm is available online for 552 and 479 firms, respectively. In all cases, their main product and second main product are listed as their selling products. In the survey, there are 118 firms that sell their main products overseas. However, not all firms maintain an online profile of their exports. To this end, we find 69 out of 72 responses match the online information. We find a perfect match between the survey responses and online information for firm ownership. Furthermore, we find that 275 and 257 firms listed prices online for their main product and second main product, respectively. We find a very strong match between the reported prices in the survey and indicated prices on their websites. To this end, 256 (238) firms prices reported in the survey match with the prices indicated online for their main (second main) products.

Last, we performed another quality check to identify whether the managers interviewed in this survey are appropriate individuals to respond to questions about inflation forecasts and

[16] See https://companies-register.companiesoffice.govt.nz/.

the firm's sale and purchase contracts. We find that around 94 percent of the managers in this survey are involved in firms' price and wage setting, and investment decisions. Moreover, we find that around 90 percent of the managers in the survey are involved in decisions related to sale and purchase contracts.

To address the issue of survey representation, we follow Coibion, Gorodnichenko and Kumar (2018) to construct weights to ensure that our results are representative of the whole economy. To do this, we grouped firms into cells defined by firm size and industry. We used 3-digit ANZSIC industry level of aggregation. The firm size groups considered are 6 to 19 workers, 20-49 workers, and 50 or more workers. We computed the total population employment for each cell using the data from Statistics New Zealand. Next, we calculate total employment in a cell for firms that participated in the survey. The weight for a firm in a given cell is set to the total population employment divided by the total sample employment in the cell. Extreme weights are avoided by capping weights at 100 whenever necessary. We find that the use of sampling weights did not change our results. To conserve space, we do not report results using weights.

2A. Data Description

Table 2A in Appendix presents summary statistics of the survey. Panel A presents sample mean and standard deviation of the key characteristics of the firm: age, employment, share of trade, number of competitors, labor share of costs, material share of costs, average profit margin, and price relative to competitors. The average age and employment of the firms are around 41 years and 28 workers, respectively. There are not many firms in the survey that sell their products overseas. On this front, the average sale from overseas is only around 6 percent. Almost all firms in the survey face direct competition in their main product line; the number of competitors faced by firms is around 8 on average. The average labor and material costs are around 44

percent and 28 percent, respectively, and these are proportions of the total revenue. Almost all firms have a positive average profit margin indicating that their sales price exceeds their operating costs. Looking at pricing characteristics of the firms, it appears that the price of firms' main product is around 3 percent higher relative to their competitors. Furthermore, the survey asked about annualised price changes for the main product. The average and median annualised price changes is around 4 percent, respectively. This is consistent with the average price changes reported in Coibion, Gorodnichenko and Kumar (2018) and Kumar, Afrouzi, Coibion and Gorodnichenko (2015). Moreover, the survey collected information about the respondent-specific qualities – see Panel C. The average age of the respondent is around 37 years. Most of them hold university or college diplomas and have been working in the firm for around 8 years. The average income of managers is between NZ$50,000 (approx. USD$33,000) and NZ$74,999 (approx. USD$50,000).

To extract measures of inflation expectations, we follow Coibion, Gorodnichenko, and Kumar (2018) and Kumar, Afrouzi, Coibion, and Gorodnichenko (2015). The survey asked respondents to forecast inflation at three different time horizons as follows:

> 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: …… %
>
> 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: …… %
>
> Over the *next five* years, by how much do you think prices will change overall in the economy? Please provide an answer in percentage terms.
> Answer: …… %

We find an upward bias in firms forecasts of recent and future inflation (see Panel D). The average 12-months ahead (last 12 months) inflation forecast is around 3.84 percent (3.69 percent). The average long-run (5 years) inflation forecast is around 3.32 percent. The median

for 12 months-ahead inflation forecast is 4 percent.[17] Inflation forecasts for the last 12 months and 5 year-ahead has the median value of 3 percent, respectively. The actual consumer price index inflation at the time of the survey was 0.4 percent. The Reserve Bank of New Zealand (RBNZ) forecast for 12 months-ahead (5 years) inflation was 1.3 percent (2 percent). These findings are consistent with Coibion, Gorodnichenko and Kumar (2018) and Kumar, Afrouzi, Coibion and Gorodnichenko (2018).

Figure 1A in Appendix plots the histogram and estimated kernel density function for the 12-months ahead inflation expectations. We observe a multi-modal distribution with peaks around 2, 5, and 7 percent. We also find extreme outliers as high as 15 percent. This speaks to the large amount of heterogeneity in inflation expectations across firms.

The contribution of this paper is to investigate the role of contracts in firms. For this purpose, the survey collected data on the proportion of the main output sold or purchased under contracts of different types. The questions asked in the survey were:

> When purchasing the inventory of your main product line, are buying fixed quantities, or at fixed prices, that are specified in advance in contracts with your supplies, or do you purchase in the spot market, according to your needs at any moment in time? For each of the following please specify the proportion bought under each type of arrangement:
> Supply contract specifies quantity and price:…..%
> Supply contract specifies price, but not quantity: …..%
> Supply contract specifies quantity, with a price determined by the spot market: …..%
> No contract: …..%
>
> We are interested in the proportion of the output of your main product line that is sold under contracts of different types. For each of the following, try to give a proportion of your output sold under the following type of contractual arrangement:
> Contract specifies quantity and price: …..%
> Contract specifies price, but not quantity: …..%
> Contract specifies quantity, with a price determined by the spot market: …..%
> No contract: …..%

Panel B in Table 2A presents the average and standard deviation of the variables directly related to the contract sales and purchases. Firms engage in contractual arrangements for sales and

[17] We consider median value at 50th percentile.

purchases as follows: contracts that specify price and quantity (fixed P & Q), contracts that specify price but not quantity (fixed P), and contracts that specify quantity but not the price (fixed Q). For the latter, the price is determined by the spot market.[18]

For firms purchasing decisions, we find that most products are purchased under a contract (57.31 percent) rather than on the spot market (42.69 percent). When we disaggregate the types of purchase contracts, we find that most purchase contracts specify price and quantity (fixed P & Q) with a share of 32.56 percent of total purchases. Contracts specifying the price only (fixed P) make up 20.67 percent of total purchases and 4.05 of total purchases are executed using a contract that specifies the quantity only (fixed Q).

The nature of sales contracts is slightly different. While purchases are mainly executed via contracts, we find that the average share of inventory sold via contracts is 48.85 percent, with 51.15 percent being sold on the spot market. We also find differences in the composition of contracts among sales. Contracts specifying price and quantity (fixed P & Q) still make up the largest share with 23.58 percent. This is a lower usage of this type of contract for sales than for purchases. Further, sale contracts specifying only the price (fixed P) are quantitatively less important compared to purchase contracts (15.32 percent vs. 20.67 percent) while sale contracts specifying only the quantity (fixed Q) are more often used than before (9.95 percent vs. 4.05 percent).

The difference in purchase and sale contracts characteristics implies that firms are more able to adjust the price along the sales dimension, as they use relatively less contracts that fix the price for sales compared to purchases. However, the finding that the overall share of contracts is smaller for sales than for purchases counteracts this. We argue that our findings indicate that firms like to pin down conditions, mainly the price, along the purchase dimension,

[18] Table 2A also presents the confidence intervals for every contract type obtained by regressing the contract on a constant. We find that the confidence intervals are tight, indicating that the differences in the prevalence of sales and purchase contracts are significant.

but allow for flexibility in sales. They achieve this by using less sales contracts relative to purchase contracts and write sales contracts that less often fix the sales price. A different interpretation is that they face different bargaining positions and are forced into purchase contracts but are not able to write sales contracts. This is an interesting point for future research.

We find that there is strong, positive correlation between the (total) usage of purchase and sales contracts (ρ=0.96 and see Figure 2A). This positive correlation also holds for the contracts specifying price and quantity (fixed P & Q, ρ=0.77) and only the price (fixed P, ρ=0.76), but there is a weak negative relationship for the contract only specifying the quantity (fixed Q, ρ=-0.17). This finding suggests that firms who engage in writing contracts write them equally for purchases and sales.

The survey finds other interesting facts about contracts. For purchase contracts, the suppliers are on the other side of the contract. All suppliers are registered firms. However, the other end of sale contracts is either consumers or firms and the responses for nature of sale contracts vary across sectors. For example, manufacturing firms sell 90 percent of their goods directly to other firms, while retailers sell around 80 percent of their products directly to consumers. Construction has only around 50 percent of their sale contracts attributed to other firms. As a result, the aggregate characteristics for purchase and sale contracts are not same. Furthermore, the survey data focuses on contracts based on firms' main product line. There are other products that firms sell that may also be using similar contract structure.

The survey asked questions about the average time length of fixed P & Q contracts. To this end, the following two questions were asked:

> What is the average length of time of purchase contracts that specify quantity and price? Please provide an answer in number of months for your main product line. …. Months
>
> What is the average length of time of sale contracts that specify quantity and price? Please provide an answer in number of months for your main product line. …. months

The survey respondents were unable to provide accurate data on the duration of other specific types of contracts (fixed P and fixed Q) because such contracts are small in nature. Duration of fixed P & Q contracts is dominant and useful for their purchases and sales. Interestingly, we find that, on average, purchase contracts that specify price and quantity are somewhat similar in duration to sales contracts specifying price and quantity. Given that all firms in our sample expect prices to increase, we would have expected that sales contracts are shorter than purchase contracts. In this case, firms would be able to re-set sales prices more frequently while keeping input prices fixed for a longer time. To be precise, the average length of a purchase contract that specifies fixed P & Q is around 17 months and the average length of a sale contract with similar specifications is around 19 months. We find that firms that write longer sale contracts also write longer purchase contracts. The correlation in our sample is 0.79 between the two durations. It appears that the driving forces of the decision have similar effects across the purchase and the sale dimension. This is to some extent surprising, as market and bargaining power could vary across the two dimensions.

The distributions for purchase contracts, sale contracts and contract durations are provided in Figure 3A, 4A and 5A, respectively. The distributions for different types of sale contracts are somewhat different, however, there is lack of heterogeneity in different types of purchase contracts. The distributions show a fairly consistent pattern with regards to contract durations.

Next, we want to provide some insights into the link between contract details and inflation expectations. For this purpose, Figure 6A in Appendix presents a scatter plot of the total sales under contracts vs. inflation expectations (12 month forecast).[19] The figure reveals a clear relationship: firms that predominantly sell under contracts have much better inflation

[19] A scatter plot with total purchase contracts is also available in the Appendix and shows a similar, but less pronounced, pattern (see Figure 7A in Appendix).

expectations with a mean of 1.94 percent among those firms that sell at least 50 percent of their inventory under contracts. In contrast, for firms below this threshold, the average expected inflation rate is 5.66 percent. The heterogeneity in inflation expectations, measured by the standard deviation, is much smaller in the sample of firms that predominantly use sales contracts compared to those firms who do not (0.54 vs. 1.54).

While we do not observe the information set at the point of signing the sales contract, one possible explanation for this result could be taken from models of rational inattention (Sims, 2003). Along this line, firms that write more contracts have better macroeconomic information, because writing contracts pins down decision margins such as price or quantity for some time, not allowing the firm to re-optimise upon the arrivals of shocks. Therefore, having better macroeconomic information should reduce the likelihood of mistakes.

Figure 8A in Appendix presents the relationship between the duration of sales contracts that specify quantity and price with the expected inflation rate in 12 months.[20] Again, we find a negative relationship where firms that write longer sales contracts (fixed P & Q) have better inflation expectations. For firms that write sales contracts shorter than 20 months, we find a mean expected inflation rate of 5.56 percent, while firms that write sales contracts longer than 20 months have an average expected inflation rate of 1.94 percent. As before, the heterogeneity in expectations also is smaller (standard deviation: 1.63 vs. 0.54) in the sample of firms that write longer sales contracts.[21]

[20] A scatter plot with purchase time (fixed P & Q) is available in the Appendix and shows the same relationship (See Figure 9A in Appendix).

[21] While we do not observe the information set at the time a contract is signed, this finding could be linked to the rational inattention literature, as firms that write longer contracts and therefore commit themselves to a price and quantity for a longer period of time face higher risk due to macroeconomic fluctuations. Better information about the macroeconomic outlook should allow them to make better decisions.

3A. Insights from Sectoral Analysis

Figures 10A to 13A in the Appendix illustrate the scatterplots for overall shares of inventory purchase and sale contracts for each sector – manufacturing, professional and financial services, trade, and construction and transportation. The pattern for overall shares of contracts is fairly consistent across sectors. Next, we run regressions to investigate the relationship between contracts and inflation expectations for each sector. To do this, we estimate equation (6) and the results are reported in Table 6A. The dependent variable in columns (1) to (4) is overall shares of purchase contracts. In columns (5) to (8), the dependent variable is overall shares of sale contracts. We used forecast of 12 months-ahead inflation as a regressor in all regressions. We find that the regression estimates are fairly consistent across sectors and they are comparable to the full sample estimates reported in Table 2. Furthermore, when use other measures of expected inflation (i.e., for last 12 months and next 5 years) as regressors, the regressions yield similar results. These results are not reported to conserve space.

We explore the intensity of contracts across sectors. Table 7A in the Appendix reports the median shares of overall purchase and sale contracts. Sectors such as professional and financial services and trade seem to have the highest median share of purchase and sale contracts. Manufacturing has a median share of purchase and sale contracts of 40 percent and 20 percent, respectively. Furthermore, contractual arrangements of inventory purchases and sales seem to be lower in construction and transportation sector. To this end, the median shares of purchase and sale contracts are 17 percent and 15 percent, respectively. The intensity of contract use in subsectors are not reported for brevity. However, the median shares of purchase and sale contracts for subsectors are fairly consistent to the shares of their respective sector.

Sectoral-level analysis of inflation expectations is well detailed in Coibion, Gorodnichenko and Kumar (2018). In this paper we therefore take a brief look at the size of forecast errors of inflation. The distributions for 12 months-ahead inflation forecast errors are

provided in Figure 14A in the Appendix. Figure 14A includes distributions of forecast errors for all firms as well as for sectors. The size of forecast error is computed by taking the absolute difference between the actual CPI inflation and the firms' forecast of 12 months-ahead inflation. We find that the size of forecast error for full sample is around 2.6 percent on average. The size of forecast error for sectors vary between 2.0 percent and 3.3 percent on average. We note that the size of forecast error is largest for manufacturing and lowest for trade. For sectors such as professional and financial services and construction and transportation, the size of forecast error is around 2.6 percent and 2.2 percent, respectively. Furthermore, it is possible that firms may be forming their expectations of aggregate inflation through their understanding of price changes in their industry. To assess this, we computed forecast errors using the PPI inflation rate. The annualised PPI inflation rate in Q2 2016 was 0.5 percent. We find that the forecast errors computed using the CPI and PPI inflation rates are quite similar. Moreover, we investigated the determinants of inflation bias for all firms as well as for sectors. Table 8A present the regression results. In columns (1) to (5), the dependent variable is absolute forecast error of 12 months-ahead inflation. The computed forecast uncertainty is the dependent variable in columns (6) to (10). These results are quite consistent to Coibion, Gorodnichenko and Kumar (2018). Results reveal that firms that make larger forecast errors have at least one of the following characteristics: older firms, large in size, face lower competition, charge higher price relative to their competitors, or incurs high profit margins. These results hold for all firms and also for the majority of the sectors. In regressions where forecast uncertainty is the dependent variable, only firm age variable is statistically significant for all firms and for majority of the sectors. To this end, older firms appear to be more uncertain about their forecasts of inflation. Furthermore, the respondent characteristics were statistically insignificant at the conventional levels in almost all regression. We therefore excluded them from the regressions

APPENDIX – FIGURES

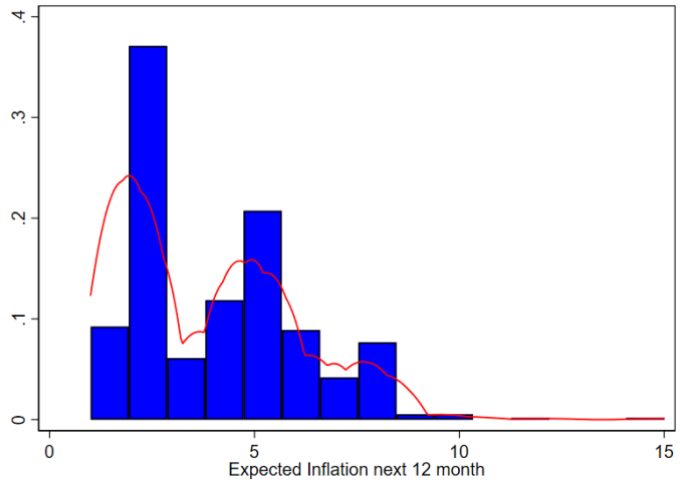

Figure 1A: Histogram of inflation expectations (12 month forecast).

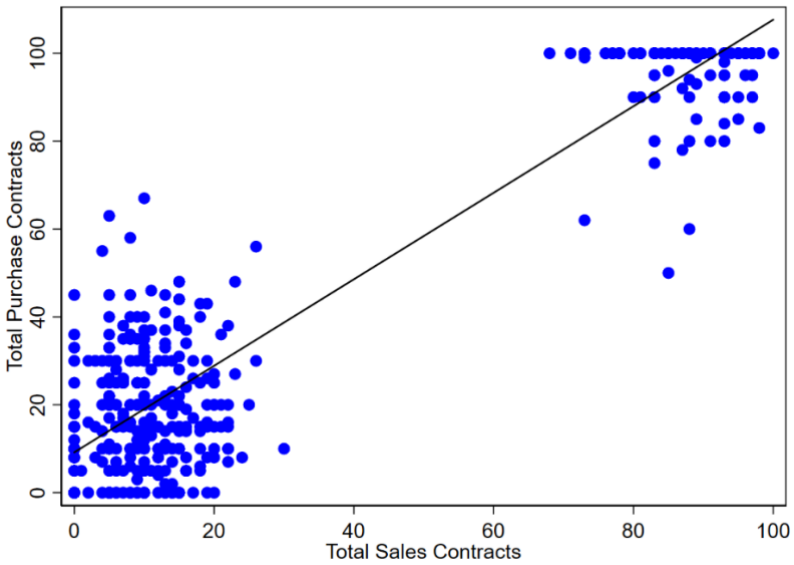

Figure 2A: Scatter plot of total sales vs. total purchase contracts.

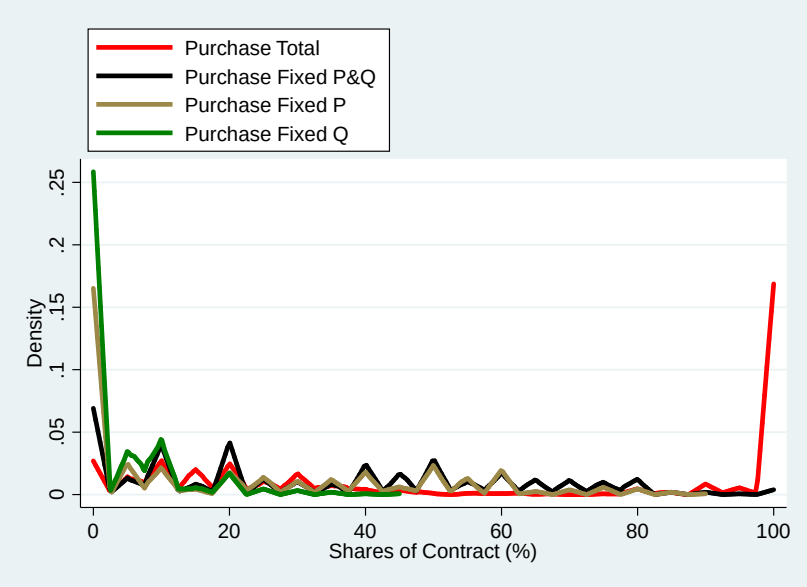

Figure 3A: Distribution of purchase contracts.

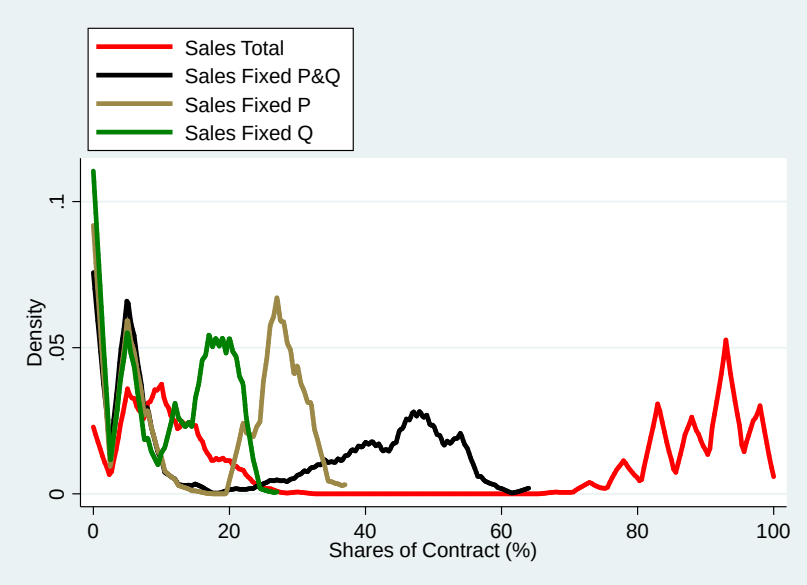

Figure 4A: Distribution of sale contracts.

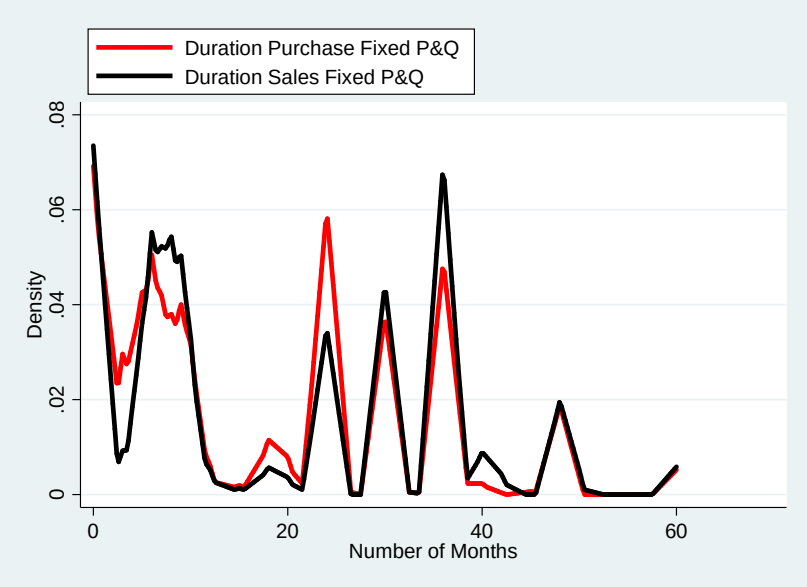

Figure 5A: Distribution of duration of contracts.

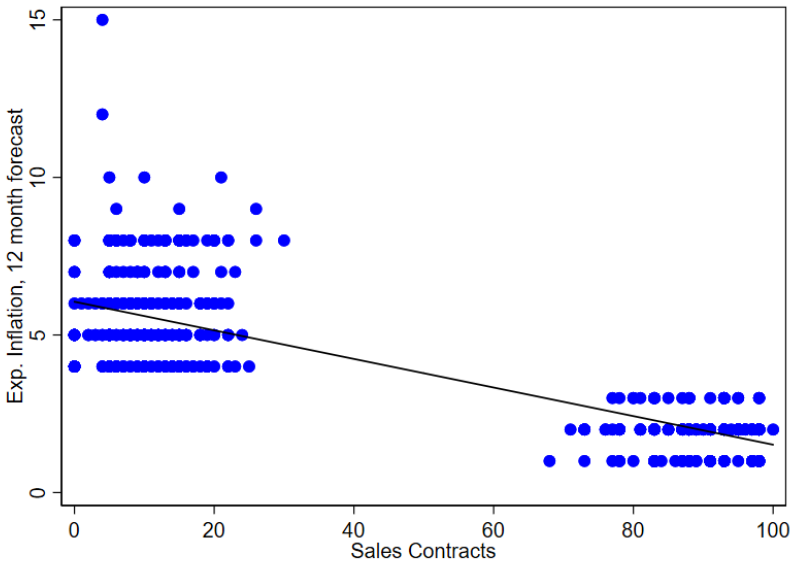

Figure 6A: Scatter plot of sales contracts vs. inflation expectations.

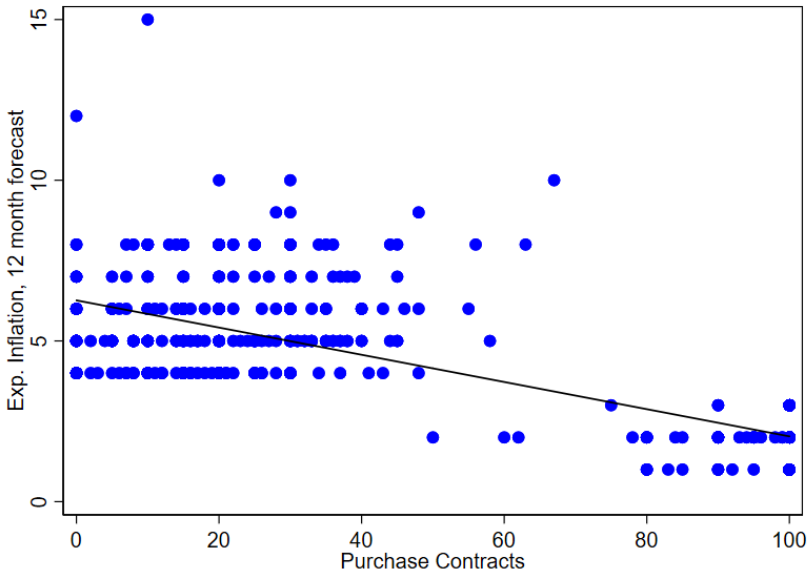

Figure 7A: Scatter plot purchase contracts vs. inflation expectations.

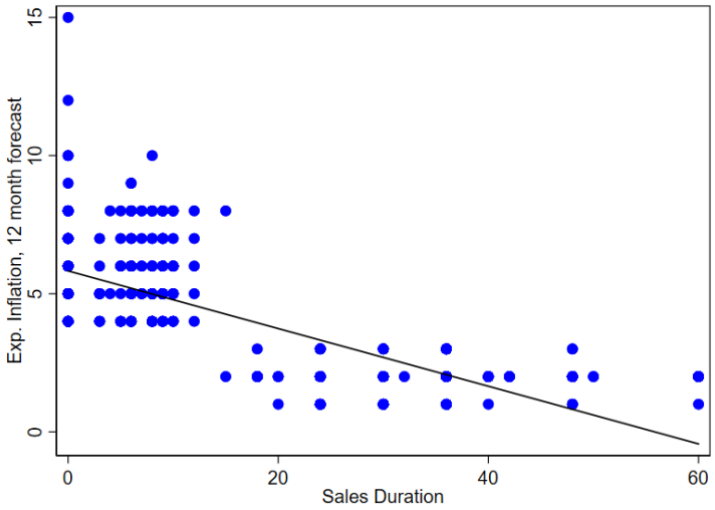

Figure 8A: Scatter plot of sales duration vs. inflation expectations.

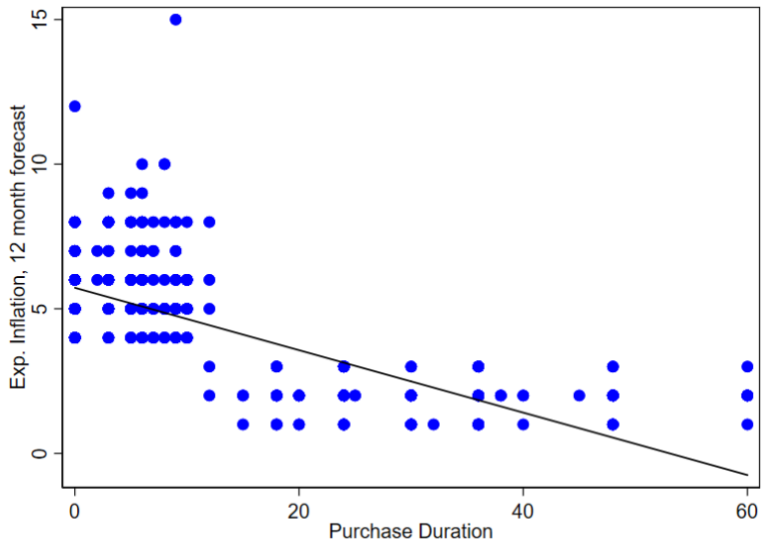

Figure 9A: Scatter plot purchase duration vs. inflation expectations.

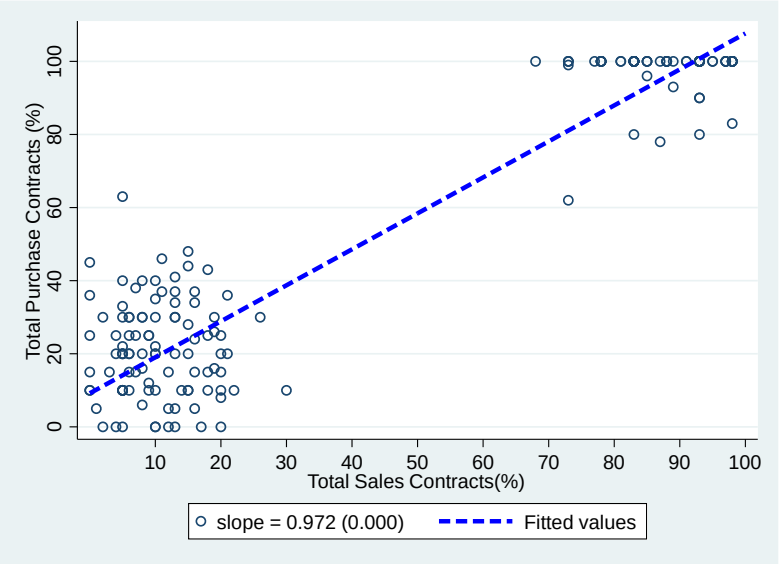

Figure 10A: Scatter plot total purchase contract vs. total sale contract for manufacturing.

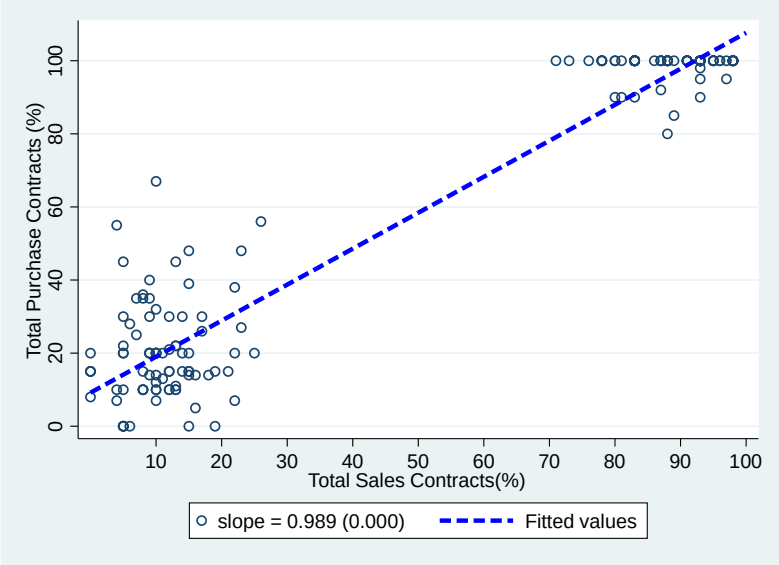

Figure 11A: Scatter plot total purchase contract vs. total sale contract for professional and financial services.

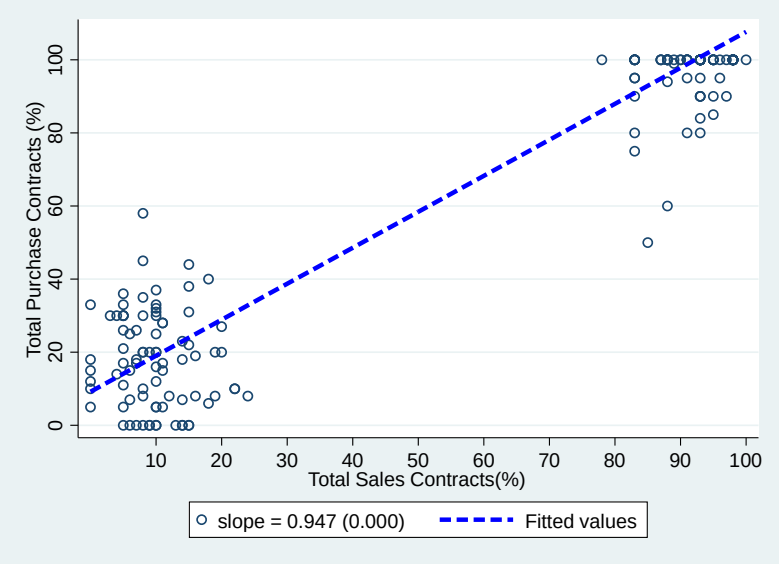

Figure 12A: Scatter plot total purchase contract vs. total sale contract for trade.

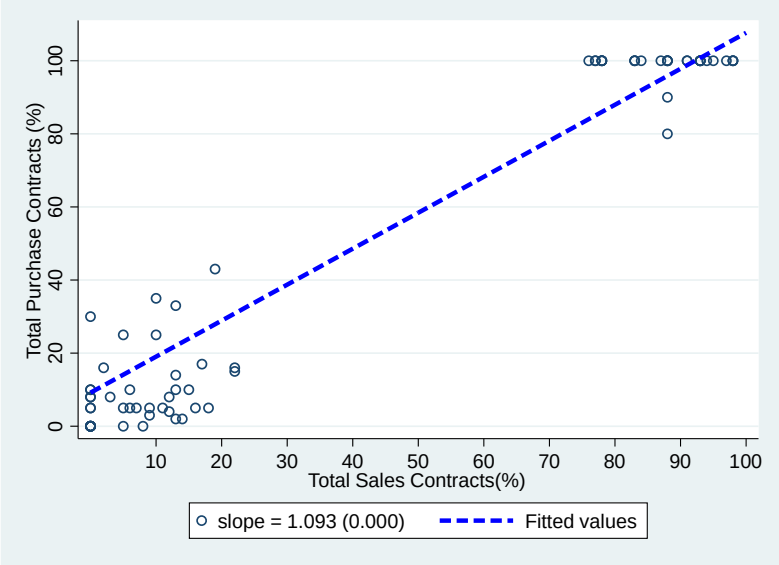

Figure 13A: Scatter plot total purchase contract vs. total sale contract for construction and transportation

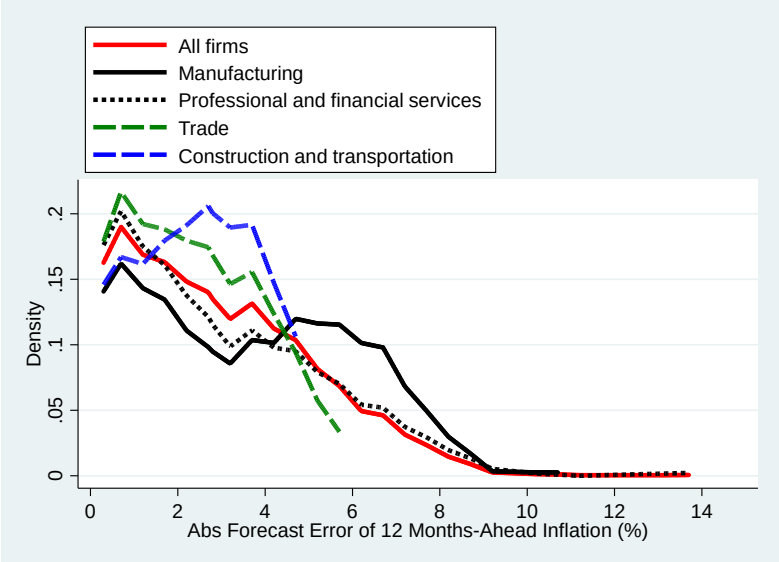

Figure 14A: Distribution of 12 months-ahead inflation forecast error.

APPENDIX - TABLES

Table 1A: Firm Count by Industry and Employment Size Group

	6-19 Workers			20-49 Workers			50+ Workers			Total ≥ 6 Workers		
	Statistics NZ Popn.	Firm Survey Popn.	Firm Survey Resp.	Statistics NZ Popn.	Firm Survey Popn.	Firm Survey Resp.	Statistics NZ Popn.	Firm Survey Popn.	Firm Survey Resp.	Statistics NZ Popn.	Firm Survey Popn.	Firm Survey Resp.
Manufacturing	3527	1187	86	1175	395	60	680	229	37	5382	1811	183
	(65.5%)	(65.5%)	(46.9%)	(21.8%)	(21.8%)	(32.8%)	(12.6%)	(12.6%)	(20.2%)	(100%)	(100%)	(100%)
Construction	3733	324	20	738	64	15	260	23	14	4731	411	49
	(78.9%)	(78.9%)	(40.8%)	(15.6%)	(15.6%)	(30.6%)	(5.5%)	(5.5%)	(28.6%)	(100%)	(100%)	(100%)
Wholesale Trade	2336	204	21	625	55	6	336	29	7	3297	288	34
	(70.9%)	(70.9%)	(61.8%)	(18.9%)	(18.9%)	(17.6%)	(10.2%)	(10.2%)	(20.6%)	(100%)	(100%)	(100%)
Retail Trade	3830	334	66	634	55	22	541	47	23	5005	436	111
	(76.5%)	(76.5%)	(59.5%)	(12.7%)	(12.7%)	(19.8%)	(10.8%)	(10.8%)	(20.8%)	(100%)	(100%)	(100%)
Accommodation and Food Services	4780	416	19	1058	92	4	265	23	8	6103	531	31
	(78.3%)	(78.3%)	(61.3%)	(17.3%)	(17.3%)	(12.9%)	(4.3%)	(4.3%)	(25.8%)	(100%)	(100%)	(100%)
Transport, Postal & Warehousing	1052	91	14	363	32	6	252	22	13	1667	145	33
	(63.1%)	(63.1%)	(42.4%)	(21.8%)	(21.8%)	(18.2%)	(15.1%)	(15.1%)	(39.4%)	(100%)	(100%)	(100%)
Financial & Insurance Services	429	102	52	82	19	15	93	22	10	604	143	77
	(71.0%)	(71.0%)	(67.5%)	(13.6%)	(13.6%)	(19.5%)	(15.4%)	(15.4%)	(12.9%)	(100%)	(100%)	(100%)
Rental, Hiring & Real Estate	890	210	17	150	35	6	49	12	1	1089	257	24
	(81.7%)	(81.7%)	(70.8%)	(13.8%)	(13.8%)	(25%)	(4.5%)	(4.5%)	(4.2%)	(100%)	(100%)	(100%)
Prof., Scientific & Technical	3188	755	27	739	175	14	330	78	13	4257	1008	54
	(74.9%)	(74.9%)	(50%)	(17.4%)	(17.4%)	(25.9%)	(7.7%)	(7.7%)	(24.1%)	(100%)	(100%)	(100%)
Administrative and Support	1102	268	14	323	79	2	271	66	3	1696	413	19
	(65.0%)	(65.0%)	(73.7%)	(19.0%)	(19.0%)	(10.5%)	(16.0%)	(16.0%)	(15.8%)	(100%)	(100%)	(100%)
Total Number of Firms	24867	3891	336	5887	1001	150	3077	551	129	33831	5443	615

Notes: Popn. denotes population. Resp. denotes responses. The percentage share of firms out of total ≥ 6 workers is reported in parentheses. The statistics NZ records are given for 2014. We group firms into four industries: (i) manufacturing, (ii) professional and financial services (financial and insurance services; rental, hiring and real estate; professional, scientific and technical services; administrative and support services), (iii) trade (wholesale trade; retail trade; accommodation and food services), and (iv) construction and transportation (construction; transport; postal and warehousing). The population in our survey includes 5433 firms. Manufacturing and professional and financial services sectors includes 3622 firms, respectively, 1181 firms in each sector. Other sectors include 1811 firms.

Table 2A: Descriptive Statistics (N = 615)

Variables	Unit	Mean	Std. Dev.	Min.	Max.	CI
PANEL A						
Firm Age	Years	42.56	32.75	10	119	
Workers	Number	28.13	25.03	6	120	
Share of Trade	%	6.15	16.43	0	95	
Competitors	Number	8.13	6.01	1	20	
Labor Share of Costs	%	43.57	9.47	20	60	
Material Share of Costs	%	28.30	17.17	0	55	
Average Profit Margin	%	21.15	10.87	5	45	
Price Relative to Competitors	%	2.74	1.50	-2	5	
PANEL B						
Purchases Contract Fixed Quantity	%	4.05	7.03	0	45	[3.50;4.61]
Fixed Price	%	20.67	23.95	0	90	[18.77;22.56]
Fixed Price & Quantity	%	32.56	26.47	0	100	[30.47;34.66]
Purchases Spot Market	%	42.69	41.33	0	100	[39.41;45.96]
Purchases Contract Fixed Price & Quantity - Time	Months	17.49	15.24	0	60	
Sales Contract Fixed Quantity	%	9.95	8.16	0	27	[9.30;10.60]
Fixed Price	%	15.32	12.61	0	37	[14.32;16.32]
Fixed Price & Quantity	%	23.58	21.14	0	64	[21.91;25.26]
Sales Spot Market	%	51.15	40.28	0	100	[47.96;54.34]
Sales Contract Fixed Price & Quantity - Time	Months	19.03	16.13	0	60	
PANEL C						
Managers' Age	Years	37.30	12.91	20	65	
Managers' Qualifications	Categorical	3.22	1.39	1	5	
Managers' Experience in Firm	Years	8.29	6.93	1	40	
Managers' Income	Categorical	2.95	0.83	2	5	
PANEL D						
Expected Inflation (12m ahead)	%	3.84	2.20	1	15	
Expected Inflation (12m back)	%	3.69	2.10	1	15	
Expected Inflation (5y ahead)	%	3.32	1.79	1	15	
Expected Inflation (12m ahead, from distribution)	%	3.07	2.06	-0.6	6	
Forecast Dispersion	%	1.19	0.75	0	9	

Notes: 95 percent confidence interval (CI) obtained from regressing the contract of type i on a constant.

Table 3A: Links Between Purchase Contracts and Uncertainty

Estimated Model: $Contract_t^i = \alpha + \phi X_t^i + \gamma E\pi_{t+12m}^i + \theta K_t^i + \delta_j + \varepsilon_i$

Variables	Purchases: Total (1)	Purchases: Total (2)	Purchases: Total (3)	Purchases: Q&P (4)	Purchases: Q&P (5)	Purchases: Q&P (6)	Purchases: Q (7)	Purchases: Q (8)	Purchases: Q (9)	Purchases: P (10)	Purchases: P (11)	Purchases: P (12)
$E\pi_{t+12m}$	-8.557***	-8.528***	-8.546***	-4.565***	-4.532***	-4.547***	0.234	0.238	0.233	-4.227***	-4.234***	-4.231***
	(0.811)	(0.808)	(0.805)	(0.853)	(0.854)	(0.852)	(0.455)	(0.458)	(0.456)	(0.881)	(0.882)	(0.881)
Std. $E\pi_{t+12m}$	-0.456			-0.693			0.056			0.181		
	(1.112)			(0.904)			(0.390)			(0.674)		
Std. Emp. Growth		-1.422**			-1.241*			-0.423			0.242	
		(0.643)			(0.671)			(0.351)			(0.653)	
Std. Sectoral PPI			-2.410**			-2.539**			-0.996*			1.125
			(1.157)			(1.196)			(0.510)			(1.197)
Constant	155.496***	155.192***	225.479***	94.764***	94.018***	169.147***	2.545	2.766	34.185*	58.187***	58.408***	22.147
	(6.529)	(6.650)	(39.346)	(7.909)	(7.851)	(40.718)	(3.270)	(3.268)	(17.527)	(7.822)	(7.659)	(40.412)
Sector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subsector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	615	615	615	615	615	615	615	615	615	615	615	615
R-squared	0.904	0.905	0.904	0.696	0.697	0.695	0.067	0.070	0.067	0.640	0.640	0.639

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE indicates sector and subsector fixed effects captured by δ_j. Contract denotes the type of purchase contract. The vector of controls, X , contains firm-specific characteristics. $E\pi_{t+12m}$ is the point forecast of inflation 12 months ahead derived from the distribution of inflation expectations. K is a measure of uncertainty. Std. $E\pi_{t+12m,}$ is standard deviation of 12 months-ahead forecast. Std. Emp. Growth is standard deviation of annualised employment growth of the firm. Std. Sectoral PPI is the standard deviation of sectoral producer price index (PPI). The dependent variable in columns (1) to (3) is overall shares of purchase contract. In columns (4) to (6), the dependent variable is purchase contract with fixed P&Q. In columns (7) to (9), the dependent variable is purchase contract with fixed Q. The dependent variable in columns (10) to (12) is purchase contract with fixed P. Estimates of firm characteristics are not reported to conserve space.

Table 4A: Links Between Sale Contracts and Uncertainty

Estimated Model: $Contract_t^i = \alpha + \phi X_t^i + \gamma E\pi_{t+12m}^i + \theta K_t^i + \delta_j + \varepsilon_i$

Variables	Sales: Total (1)	Sales: Total (2)	Sales: Total (3)	Sales:Q&P (4)	Sales: Q&P (5)	Sales: Q&P (6)	Sales: Q (7)	Sales: Q (8)	Sales: Q (9)	Sales: P (10)	Sales: P (11)	Sales: P (12)
$E\pi_{t+12m}$	-10.004***	-9.964***	-9.974***	-5.217***	-5.214***	-5.214***	-1.789***	-1.773***	-1.779***	-2.999***	-2.977***	-2.981***
	(0.592)	(0.593)	(0.592)	(0.427)	(0.427)	(0.427)	(0.198)	(0.198)	(0.198)	(0.241)	(0.242)	(0.242)
Std. $E\pi_{t+12m}$	-1.198*			-0.081			-0.390			-0.727***		
	(0.716)			(0.458)			(0.238)			(0.226)		
Std. Emp. Growth		-0.855*			-0.076			-0.503***			-0.276	
		(0.499)			(0.363)			(0.167)			(0.201)	
Std. Sectoral PPI			-2.029**			0.155			-1.038***			-1.146***
			(0.930)			(0.695)			(0.297)			(0.380)
Constant	144.736***	143.052***	204.239***	66.562***	66.453***	61.143***	30.254***	29.775***	61.263***	47.921***	46.824***	81.834***
	(5.340)	(5.236)	(31.595)	(4.034)	(3.931)	(23.335)	(1.691)	(1.705)	(10.150)	(1.976)	(1.937)	(12.727)
Sector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subsector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	615	615	615	615	615	615	615	615	615	615	615	615
R-squared	0.937	0.937	0.936	0.872	0.872	0.872	0.839	0.841	0.838	0.899	0.898	0.898

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE indicates sector and subsector fixed effects captured by δ_j. Contract denotes the type of sale contract. The vector of controls, X , contains firm-specific characteristics. $E\pi_{t+12m}$ is the point forecast of inflation 12 months ahead derived from the distribution of inflation expectations. K is a measure of uncertainty. Std. $E\pi_{t+12m,}$ is standard deviation of 12 months-ahead forecast. Std. Emp. Growth is standard deviation of annualised employment growth of the firm. Std. Sectoral PPI is the standard deviation of sectoral producer price index (PPI). The dependent variable in columns (1) to (3) is overall shares of sale contract. In columns (4) to (6), the dependent variable is sale contract with fixed P&Q. In columns (7) to (9), the dependent variable is sale contract with fixed Q. The dependent variable in columns (10) to (12) is sale contract with fixed P. Estimates of firm characteristics are not reported to conserve space.

Table 5A. Links Between Contracts Duration and Uncertainty

Estimated Model: $Contract_t^i = \alpha + \phi X_t^i + \gamma E\pi_{t+12m}^i + \theta K_t^i + \delta_j + \varepsilon_i$

Variables	Purchases Duration (1)	Purchases Duration (2)	Purchases Duration (3)	Sales Duration (4)	Sales Duration (5)	Sales Duration (6)
$E\pi_{t+12m}$	-3.095***	-3.080***	-3.090***	-3.845***	-3.807***	-3.809***
	(0.412)	(0.410)	(0.412)	(0.418)	(0.422)	(0.422)
Std. $E\pi_{t+12m}$	-0.197			-1.407***		
	(0.479)			(0.413)		
Std. Emp. Growth		-0.768**			-0.196	
		(0.353)			(0.352)	
Std. Sectoral PPI			-0.427			-1.088
			(0.791)			(0.872)
Constant	50.423***	50.338***	64.011**	49.902***	47.677***	81.346***
	(4.496)	(4.389)	(26.316)	(3.487)	(3.411)	(29.600)
Sector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes
Subsector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	615	615	615	615	615	615
R-squared	0.756	0.757	0.756	0.798	0.795	0.794

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE indicates sector and subsector fixed effects captured by δ_j. Contract denotes the duration of sale or purchase contract. The vector of controls, X , contains firm-specific characteristics. $E\pi_{t+12m}$ is the point forecast of inflation 12 months ahead derived from the distribution of inflation expectations. *K* is a measure of uncertainty. Std. $E\pi_{t+12m,}$ is standard deviation of 12 months-ahead forecast. Std. Emp. Growth is standard deviation of annualised employment growth of the firm. Std. Sectoral PPI is the standard deviation of sectoral producer price index (PPI). The dependent variable in columns (1) to (3) is duration of purchases contract. In columns (4) to (6), the dependent variable is duration of sale contract. Estimates of firm characteristics are not reported to conserve space.

Table 6A: Sectoral-level Estimates of Contracts and Inflation Expectations

$Model: Contract_t^i = \alpha + \phi X_t^i + \gamma E\pi_{t+12m}^i + \delta_j + \varepsilon_i$

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Age	-14.250***	-7.591***	-8.163**	-11.991***	-10.931***	-9.986***	-10.918***	-10.377***
	(2.566)	(2.438)	(3.353)	(3.988)	(1.935)	(2.183)	(2.570)	(3.567)
Log Employment	-7.329***	-8.394***	-7.767***	-14.819***	-5.029***	-7.293***	-7.477***	-15.583***
	(1.899)	(2.369)	(2.036)	(4.429)	(1.437)	(1.683)	(1.505)	(3.965)
Trade	-0.003	0.061	0.013	0.007	0.024	0.012	0.057	-0.040
	(0.035)	(0.099)	(0.050)	(0.062)	(0.035)	(0.093)	(0.044)	(0.072)
Competitors	1.600***	0.740***	0.723**	1.227***	1.710***	0.686***	0.838***	0.880**
	(0.291)	(0.247)	(0.298)	(0.354)	(0.272)	(0.254)	(0.199)	(0.345)
Labor Costs	-0.260**	0.120	-0.107	-0.015	-0.267**	-0.092	-0.126	-0.088
	(0.129)	(0.167)	(0.104)	(0.209)	(0.106)	(0.148)	(0.083)	(0.157)
Rel. Price	-0.956	-5.983***	-6.172***	-3.659**	-2.176*	-5.027***	-5.301***	-3.112**
	(1.244)	(1.169)	(1.424)	(1.390)	(1.304)	(1.107)	(1.009)	(1.245)
Average Margin	-0.402**	-1.326***	-0.526**	-0.154	-0.525***	-0.993***	-0.162	-0.078
	(0.156)	(0.171)	(0.213)	(0.260)	(0.110)	(0.143)	(0.168)	(0.180)
$E\pi_{t+12m}$	-3.621***	-1.384	-7.514***	-7.327***	-3.685***	-3.063***	-9.810***	-6.717***
	(0.876)	(0.932)	(2.112)	(1.753)	(0.606)	(0.903)	(1.472)	(1.455)
Constant	151.968***	152.610***	161.895***	166.694***	131.294***	156.065***	161.533***	157.919***
	(11.135)	(12.838)	(10.561)	(12.986)	(9.739)	(10.817)	(7.871)	(13.106)
Subsector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	183	180	176	76	183	180	176	76
R-squared	0.906	0.902	0.888	0.935	0.927	0.922	0.936	0.938

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE indicates fixed effects. $E\pi_{t+12m}$ is forecast of 12 months-ahead inflation. $Contract_t^i$ denotes the overall shares of inventory purchase and sale contracts. X_t^i includes the firm-specific characteristics. δ_j captures the subsector specific fixed effects. Estimates of manufacturing in columns (1) and (5), professional and financial services in columns (2) and (6), trade in columns (3) and (7), and construction and transportation in columns (4) and (8). The dependent variable in columns (1) to (4) is overall shares of purchase contracts The dependent variable in columns (5) to (8) is overall shares of sale contract.

Table 7A: Intensity of Contracts Across Sectors

	Purchase Contract (median share %)	Sale Contract (median share %)	Number of Observations
Manufacturing	40	20	183
Professional and financial services	90	78	180
Trade	80	83	176
Construction and transportation	17	15	76

Notes: Purchase contract includes the overall shares of purchase contracts. Sale contract includes the overall shares of sale contracts.

Table 8A: Determinants of Inflation Forecast Bias

Model: $|\pi_t - E\pi^i_{t+12m}| = \alpha + \phi X^i_t + \delta_j + \varepsilon_i$

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log Age	0.836***	1.076***	0.888***	0.639***	0.279	0.152***	0.205***	0.104	0.254***	-0.261*
	(0.109)	(0.213)	(0.244)	(0.111)	(0.199)	(0.041)	(0.056)	(0.088)	(0.075)	(0.131)
Log Employment	0.304***	0.336	0.463*	0.279***	0.698***	-0.017	-0.034	0.070	-0.113*	0.375**
	(0.096)	(0.207)	(0.238)	(0.097)	(0.194)	(0.038)	(0.067)	(0.085)	(0.060)	(0.142)
Trade	-0.003	-0.004	0.009*	-0.001	-0.003	-0.000	-0.001	0.003	-0.001	0.000
	(0.002)	(0.003)	(0.005)	(0.002)	(0.003)	(0.001)	(0.001)	(0.004)	(0.002)	(0.003)
Competitors	-0.069***	-0.094***	-0.069***	-0.042***	-0.025	0.001	-0.003	0.000	0.010	0.007
	(0.012)	(0.029)	(0.022)	(0.010)	(0.021)	(0.005)	(0.010)	(0.010)	(0.008)	(0.016)
Labor Costs	0.007	0.002	0.021	0.003	0.004	-0.002	-0.005	-0.010*	0.000	-0.003
	(0.005)	(0.012)	(0.015)	(0.005)	(0.007)	(0.002)	(0.004)	(0.006)	(0.003)	(0.006)
Rel. Price	0.290***	0.330**	0.279**	0.171***	0.279***	0.000	0.018	0.035	-0.047	-0.032
	(0.058)	(0.137)	(0.116)	(0.055)	(0.088)	(0.023)	(0.040)	(0.043)	(0.038)	(0.080)
Average Margin	0.015*	-0.000	0.027*	0.026***	0.002	-0.004	-0.008	-0.004	-0.006	-0.002
	(0.008)	(0.018)	(0.017)	(0.007)	(0.011)	(0.003)	(0.005)	(0.007)	(0.005)	(0.007)
Constant	-0.993*	-2.008**	-2.630**	-1.718***	-1.824***	0.156	0.035	0.362	-0.424	-0.404
	(0.537)	(0.957)	(1.183)	(0.396)	(0.637)	(0.224)	(0.322)	(0.484)	(0.309)	(0.534)
Sector-specific FE	Yes	No	No	No	No	Yes	No	No	No	No
Subsector-specific FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	615	183	180	176	76	591	175	175	168	73
R-squared	0.745	0.735	0.743	0.836	0.829	0.290	0.146	0.230	0.114	0.098

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. $|\pi_t - F^i_t\pi_{t-12}|$is the absolute error of 12 months-ahead inflation forecast, X^i_t includes the firm characteristics, and δ_j controls for the sector or subsector specific fixed effects. Column (1) to (5) includes the dependent variable as absolute forecast error of 12 months-ahead inflation. Columns (6) to (10) include forecast uncertainty as the dependent variable. Results for all firms are reported in columns (1) and (6). The sectoral results are reported as follows: manufacturing in columns (2) and (7), professional and financial services in columns (3) and (8), trade in columns (4) and (9), and construction and transportation in columns (5) and (10).

APPENDIX – Survey Questions (selected)

How many years old is the firm?
Answer: …….years

How many workers are employed full-time in this firm?
Answer: …….workers

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…)?
Answer:

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

What percentage of the firm's revenues in the last 12 months came from sales overseas?
Answer: …… % of sales from overseas

How many direct competitors does this firm face in its main product line?
Answer: …… firms

Considering your main product line, 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.
Answer:

Current Margin		Average Margin	
……	%	……	%

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: …… %

By how much has your firm changed the price of its main product over the last twelve months? Please provide a quantitative answer in percentage terms (e.g. "-X%" for X percent decline in price, "+X%" for X percent increase in price, etc.).
Answer: …… %

When purchasing the inventory of your main product line, are buying fixed quantities, or at fixed prices, that are specified in advance in contracts with your supplies, or do you purchase in the spot market, according to your needs at any moment in time? For each of the following please specify the proportion bought under each type of arrangement:
Supply contract specifies quantity and price:
……..%
Supply contract specifies price, but not quantity:
……..%
Supply contract specifies quantity, with a price determined by the spot market:
……..%

No contract / spot market:
……..%

What is the average length of time of purchase contracts that specify quantity and price? Please provide an answer in number of months for your main product line.
…….. months

We are interested in the proportion of the output of your main product line that is sold under contracts of different types. For each of the following, try to give a proportion of your output sold under the following type of contractual arrangement:
Contract specifies quantity and price:
……..%
Contract specifies price, but not quantity:
……..%
Contract specifies quantity, with a price determined by the spot market:
……..%
No contract:
……..%

What is the average length of time of sale contracts that specify quantity and price? Please provide an answer in number of months for your main product line.
…….. months

When you sell the main product in spot market or under no contract, do you typically sell at a fixed price, or do you negotiate prices with individual customers or offer quantity-discounts? (try to give a proportion of your main product sold under each situation)
Fixed prices: ……% Negotiable prices: ……% Fixed prices with quantity discounts: ……%

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: …… %

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: …… %

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

Percentage Price Changes in 12 Months	**Probabilities**
More than 5%:	**…… %**
From 4 to 5%:	**…… %**
From 3 to 4%:	**…… %**
From 2 to 3%:	**…… %**
From 1 to 2%:	**…… %**
From 0 to 1%:	**…… %**
Less than 0%:	**…… %**
Total (the column should sum to 100%):	**100 %**

Over the *next five* years, by how much do you think prices will change overall in the economy? Please provide an answer in percentage terms.
Answer: …… %
{Randomly allocate firms into two groups. For one group, ask the above question. For second group, ask the above question using the term 'CPI Inflation'}

What is your age?
Answer: …… years

What is your highest educational qualification? (Choose one of the following)

1. Less than high school 2. High school diploma 3. University or college diploma

4. Bachelors or honours degree 5. Graduate studies (Postgrad Dip or Masters or PhD)

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

……**years**

How much is your gross income per annum? (Choose one of the following)

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

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

How much is your contribution or control over the following decisions in your firm? (Please indicate your percentage contribution to each decision making).

a. Price setting decisions of main product line
b. Decisions to hire new workers
c. Decisions to invest in new capital
d. Inventory purchase decisions e.g. contracts
e. Inventory sales decisions e.g. contracts

Has your firm changed the number of employees over the last twelve months and does it expect to change the number of employees over the next twelve months? Please provide a quantitative answer in percentage terms (e.g. "-X%" for X percent decline in employment, "+X%" for X percent rise in employment, etc.) over each period.
Percentage change in the number of employees:
In the last twelve months: …… %
In the next twelve months: …… % (relative to current number)

Has your firm invested in new capital over the last twelve months and does it expect to invest in new capital over the next twelve months? Please provide a quantitative answer for capital expenditures as a share of annual revenues over each period.
New capital expenditures as a share of annual revenues:
In the last twelve months: …… %
In the next twelve months: …… %