

# PRICE-SETTING BEHAVIOUR IN NEW ZEALAND

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## Abstract

When and why firms change prices is key to the evolution of inflation, and has significant bearing on the monetary transmission mechanism. New evidence presented here from a comprehensive survey of over 5300 firms provides insight into price-setting behaviour in New Zealand. The majority of firms use mark-up based pricing, although a significant minority are influenced by competitors' prices. Few firms use purely state-dependent pricing, with the majority using some combination of state- and time-dependent strategies. Price stickiness occurs at both stages of the price-setting process; the median firm reviews prices twice per year, but changes only once. Explicit and implicit contracts and co-ordination failure are the most recognised causes of price stickiness but the physical costs involved have little impact. Sectors with higher competition, a higher share of intermediates in gross output, and a higher share of household customers tend to reset prices more frequently. Sectors with many repeat customers, or a high share of sales to the government exhibit greater price stickiness. Overall, price stickiness is more a feature of intermediate goods, rather than the retail sector. The considerable diversity in price-setting behaviour both between and within sectors, and the asymmetric responses to shocks suggest caution should be used when interpreting the results of linearised models based on representative agents.

## 1. Introduction

Setting the price for its product or service is one of the most important economic decisions faced by a firm. An incorrect price can potentially alienate customers, reduce competitiveness, or deliver lower profits than potentially possible. Similarly, the price-setting behaviour of firms across the economy will determine inflation dynamics, and how the economy responds to shocks. Furthermore, stickiness in prices plays a crucial role in providing interest rates with leverage over the real economy, enabling monetary policy makers to carry out stabilisation.

These factors make understanding firms' price-setting behaviour of vital importance to central banks. The move towards the microeconomic foundation of macroeconomic models has given further impetus to the necessity of understanding when firms change prices, and the reasons they sometimes choose not to. Progress has been made over recent years with more detailed studies of firm-level price data and behavioural surveys, in particular following on from Blinder (1991) and Blinder *et al.* (1998).

This paper presents the results of the first such survey for New Zealand, and the first that comprehensively surveys all sectors in the economy. Previous surveys have excluded certain sectors, most notably the primary sector which is relatively important for New Zealand. The survey was carried out in 2010 under the auspices of Statistics New Zealand's

annual *Business Operations Survey*. The sample was stratified to match the population of private sector enterprises in New Zealand.

The results point to a wide divergence in behaviour both within and between sectors. Nonetheless, observed price stickiness observed in macroeconomic relationships appears to derive from rigidities at both the price review and price change stages of the price-setting process. The median New Zealand firm reviewed prices two times over the previous financial year, and changed it once. These figures are in line with other recent behavioural surveys.

Explicit and implicit contracts were the most cited reason for a firm choosing to not increase its price, along with co-ordination failure where a firm worries its competitors will not follow suit. Physical costs involved in changing prices were not viewed as important. But there is likely to be some form of lump sum costs involved in changing prices, since large firms reset prices more frequently than small ones.

The divergence in price stickiness between sectors can in part be explained by the proportion of repeat customers, the importance of competitors' prices and the share of intermediate goods in output. Where repeat customers were numerous, firms are clearly reluctant to change prices, for fear of alienating regular clients. Conversely, higher competition and a greater share of intermediate goods, and hence likely higher fluctuations in the cost of production, were more likely to increase the frequency of price resets.

## **2. Previous literature**

There is no lack of papers on the subject of price stickiness. Indeed, it is arguably the difficulty in determining its source that has led to the proliferation of theories in the literature. Section 5.5 below sets out some of the major theories explaining price theories, before examining the evidence for them in New Zealand.

In terms of determining the impact of price rigidities on inflation dynamics, there are three main strands in the literature. The first strand uses macroeconomic models to estimate the extent of price rigidity within an economy. In general, these models require a large degree of price stickiness in order to match the degree of persistence found in real-world data. For example, Smets and Wouters (2003) estimate a DSGE model for the euro area and find coefficients that imply that the average price duration is two and a half years. That said, there are some estimates of much more flexible prices, such as Christiano, Eichenbaum and Evans (2005) who estimate an average price duration for the United States of 6 months.

A second strand of the literature examines firm-level prices, usually those collected for the calculation of consumer or producer price indices. Examples include Bils and Klenow (2004), Klenow and Kryvtsov (2008) and Nakamura and Steinsson (2008) for the United States, Dhyne *et al.* (2006) and Vermeulen *et al.* (2007) for the euro area and Bunn and Ellis (2012a, 2012b) for the United Kingdom. See Klenow and Malin (2010) for an excellent summary of this strand of the literature.

Typically, these data suggest a much more frequent resetting of prices than found by the macroeconomic models. For example, Bils and Klenow (2004) find that a quarter of US

consumer prices change each month and Bunn and Ellis (2012b) find 19 percent of UK consumer prices reset each month. Supermarket reference prices are even more flexible, with 44 percent of UK supermarket prices (excluding fresh produce) changing each month (Bunn and Ellis, 2012b). Prices appear to be somewhat stickier in the euro area, but even so 15 percent of consumer prices reset each month (Dyhne *et al.*, 2006), much faster than would be consistent with Smets and Wouters (2003). This divergence in findings between these methods has been characterised as ‘fast micro, slow macro’ price resets.

However, while the analysis of the micro data can help with understanding the frequency and size of price adjustments, it does less to help with understanding the reasoning behind the price changes, or lack thereof. A firm which leaves prices unchanged because the optimal price remained unchanged and a firm which leaves prices unchanged because of some form of rigidity are observationally equivalent. One way of determining the difference is to ask firms themselves about their behaviour.

Behavioural surveys of firms are not new to Economics. Hall and Hitch (1939) carried out a survey of UK entrepreneurs, mostly in the manufacturing sector. Based on their findings, they proposed the kinked demand curve faced by oligopolists, now ubiquitous in microeconomic textbooks. But surveys fell out of favour in the profession, and there followed a long hiatus. Blinder (1991) and Blinder *et al.* (1998) resurrected the use of surveys to understand pricing decisions, in a move which initially met with resistance.

However, the success of this original survey in providing information on price-setting behaviour, and the sources of price stickiness, has led to a large number of follow-up surveys in other countries. These include, among others, surveys for the United Kingdom (Hall, Walsh and Yates, 1997, and Greenslade and Parker, 2008, 2012)<sup>1</sup>, Sweden (Apel, Friberg and Halstern, 2005), Canada (Amirault, Kwan and Wilkinson, 2006), the euro area (Fabiani *et al.*, 2006), and Australia (Park, Rayner and D’Arcy, 2010).

One of the most startling discoveries by these surveys is the considerable diversity in price-setting behaviour, both between and within sectors. Not only does the median number of price changes vary considerably between sectors, but it is possible to find within the same sector firms that reset prices daily and others that reset on an annual basis. This diversity is present in the timing of both price reviews and price changes, suggesting that rigidities occur at both stages of the price-setting process.

Studies of price-setting behaviour in New Zealand have to date been rare. Buckle and Carlson (2000) use survey responses to Quarterly Survey of Business Opinion (QSBO), carried out by the New Zealand Institute of Economic Research. They find that large firms (as measured by number of employees) change prices more frequently than smaller firms, which they attribute to lump sum menu costs, which are proportionately more costly for smaller firms.

Coleman and Silverstone (2007) also use data from the QSBO, finding a considerable diversity in price-setting behaviour. Around a third of firms changed price in the previous

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<sup>1</sup> The earlier survey concentrated on the manufacturing sector. In what follows, the results from Greenslade and Parker (2008) will be shown, which better represent the industrial structure of the UK economy.

quarter, but 17 percent of firms had not changed price in the previous eight quarters. The mean time between price changes was about eight and a half months. Smaller firms changed prices less frequently than larger firms, confirming the earlier work by Buckle and Carlson. Firms in retail and wholesale changed prices more frequently than service sector firms or manufacturers.

These results, from observations of price changes by respondents are similar in nature to the second strand of literature mentioned above. However, Coleman and Silverstone were also able to determine some factors that were likely to cause a change in prices by using firms' responses to other questions in the survey. They found that firms were more likely to change prices following a change in costs than a change in demand. Furthermore, an increase in demand raised the probability of changing prices by 4 percent, compared with the 16 percent increased chance of a price change following a drop in demand.

Finally, Coleman and de Veirman (2011) examine the reported use of temporary discounting in the microdata underlying the Consumers Price Index in New Zealand. They find around 30 percent of the items in the index, as measured by index weights, regularly have temporary discounts, but 50 percent of the items rarely used discounting. Discounting was found to increase with lower demand, as measured by the deterioration in the output gap, although the shortness of the time series makes concrete conclusions difficult.

This paper extends the earlier work of Coleman and Silverstone for New Zealand, using a purpose-designed survey of price-setting behaviour. In keeping with the previous surveys in this literature, the survey contains a number of behavioural questions to test the validity of certain economic theories. In particular, these questions aid in the understanding of the price-setting process and the causes of price stickiness.

### **3. Characteristics of firms in the survey**

#### *3.1 Survey design*

The data used here originate from the 2010 Business Operations Survey carried out by Statistics New Zealand in August 2010.<sup>2</sup> The target population was businesses on Statistics New Zealand's Business Frame that had an annual GST turnover greater than NZD 30,000 and had at least 6 employees. Firms operating in public administration and safety were excluded, as were local government enterprises, the central bank and non-profit institutions in the service of households.

The final estimated population size of firms was 35,307 enterprises. The sample design was a two-level stratification, firstly by Australia and New Zealand Standard Industrial Classification 2006 (ANZSIC06) industrial sector and then by firm size within each sector, as determined by number of employees. The four employment size groups were small (6-19 employees), medium 1 (20-29 employees), medium 2 (30-49 employees) and large (50+ employees).

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<sup>2</sup> See [http://www.statistics.govt.nz/browse\\_for\\_stats/businesses/business\\_growth\\_and\\_innovation/business-op-survey-2010-tables.aspx](http://www.statistics.govt.nz/browse_for_stats/businesses/business_growth_and_innovation/business-op-survey-2010-tables.aspx) for a full description of the survey.

The survey was sent to a random sample of firms within this sampling frame. Firms were asked to report on the most recent completed financial year ahead of the sampling date. The survey had 5369 replies, a response rate of 81.8 percent. The results have been weighted by Statistics New Zealand to represent the population, and are published either by industry or by employment size. However, the published results by employment size use a different reporting size than that used for stratification, namely: small (6-19 employees), medium (20-49 employees), large (50-99 employees) and very large (100+ employees).

The number of respondents is markedly larger than previous surveys of pricing behaviour, and the response rate also higher (Table 1). Many previous studies also used business contacts of the central banks carrying out the survey, which could potentially bias the results, particularly given that such contacts are often biased towards larger companies.

**Table 1: Respondents to previous price-setting surveys**

Country	Authors	Sample frame	Respondents (response rate, %)
Canada	Amirault <i>et al.</i> (2006)	CB contacts	170 (100) <sup>(a)</sup>
Euro area <sup>(b)</sup>	Fabiani <i>et al.</i> (2006)	various	11,150 (46)
New Zealand		Nat. Stat. Inst.	5369 (82)
Sweden	Apel <i>et al.</i> (2005)	Nat. Stat. Inst.	626 (49)
United Kingdom	Greenslade & Parker (2012)	CB contacts	693 (30)
United States	Blinder <i>et al.</i> (1998)	3 <sup>rd</sup> party database	200 (61)

(a) The Canadian survey was carried out by interview, the number of firms that refused to be interviewed is not known. (b) The individual country surveys ranged from 330 to 2070 respondents. The response rate ranged from 30 percent to 69 percent.

### 3.2 Relevance of survey questions for price-setting behaviour of respondents

Economic theory on pricing concentrates on profit-maximising firms that are able to determine their own price. Previous studies, e.g. Blinder *et al.* (1998) Amirault *et al.* (2006), Greenslade and Parker (2012), have consequently excluded firms in certain sectors from their sample, notably in primary industries and in the health and education sectors. Prices in primary industries (agriculture, fishing, forestry and extraction) tend to be set by the balance of supply and demand in international markets and firms are assumed to be price-takers. Similarly, firms operating in the health and education sectors will often have some form of regulatory control over pricing.

The New Zealand survey included these sectors in its sampling frame. However, all firms were asked who reviews and sets the prices (table 2). For the primary sectors, the assumption made by previous papers appears valid – less than half of these firms set their prices. Three quarters of firms surveyed in the health and education sectors set their own prices, although the survey excludes local government enterprises, such as public hospitals, which will account for a large share of activity in those sectors. The share of businesses that set their own prices within the other sectors is much higher – reaching 95 percent for industry and construction. In the following analysis, the data presented relate to those firms that are responsible for setting their own prices.

**Table 2: Who reviews and sets the prices?**

	The business	A parent business	Other
Primary sectors	48	10	42
Industry	95	3	2
Construction	95	2	3
Trade	81	11	8
Private services	87	9	4
Government services	74	6	20
<b>Overall</b>	<b>82</b>	<b>8</b>	<b>10</b>

Note: sectors have been grouped using the terminology favoured by Fabiani et al. (2007). Industry contains firms in manufacturing and electricity gas and water supply. Trade contains firms in the retail and wholesale sectors. Government services are those operating in education and training and health and social assistance. Private services are firms operating in: accommodation and food services; transport postal and warehousing; information media and telecommunications; financial and insurance services; rental, hiring and real estate services; professional, scientific and technical services; administrative and support services; personal services; other services.

In answering the survey, businesses were asked to concentrate on their main product or service, a practice common among previous price-setting surveys. To ensure the survey gave an accurate picture of price-setting behaviour, firms were asked whether the price setting for the main product was representative of all their products. A quarter of firms only had one product or service, and a further 62 percent used the same pricing behaviour across products or services (table 3). Only 14 percent of firms had a different pricing strategy across products or services. By industry, differentiated pricing strategies were more common in retail and wholesale, where a fifth of firms priced secondary products different from the main product.

**Table 3: Pricing for main product or service is representative of other products**

	Yes	No	Business only sells one product
<b>Firm size</b>			
Small	60	15	25
Medium	64	13	23
Large	68	14	19
Very large	75	13	11
<b>Sector</b>			
Industry	76	9	15
Trade	76	19	5
Private services	60	14	27
<b>Overall</b>	<b>62</b>	<b>14</b>	<b>24</b>

### 3.3 Customer groups

In terms of customers, there appears to be a large amount of transactions between firms. Two thirds of respondents identified other businesses as customers for the main product or service (table 4). Of those business customers, firms outside of the business group were the largest customer type, followed by retailers and wholesalers. A tenth of firms sold their product or service to other businesses within the same group. Households were the next large customer group, with 44 percent of respondents. Only 7 percent of firms sold their primary product or service to the government. The large share of transactions between firms means that stickiness in wholesale prices plays an important role in nominal rigidities in the

economy, and a focus solely on consumer prices may underestimate the extent of price stickiness in the economy.

There is considerable diversity between firms, both by size and by sector. Firms in the industry sector were much less likely to sell to individuals or households, with 80 percent of these firms selling to other businesses. A quarter of firms in the health and education sectors sold their product or service to the government. In terms of firm size, smaller firms were more likely to sell direct to households, whereas a higher proportion of larger firms sold to retailers and other businesses.

**Table 4: Customer group that pays for the good or service<sup>(a)</sup>**

	Individual or household	Other business outside business group	Retailer or wholesaler outside of group	Business within business group	Government
<b>Firm size</b>					
Small	47	30	15	9	6
Medium	35	34	18	10	10
Large	26	39	20	11	10
Very large	32	34	24	10	9
<b>Sector</b>					
Industry	18	44	33	10	2
Trade	53	20	22	5	5
Private services	55	29	9	12	3
Government services	56	16	5	7	25
<b>Overall</b>	<b>44</b>	<b>31</b>	<b>16</b>	<b>10</b>	<b>7</b>

(a) Rows sum to greater than 100 percent since firms could choose more than one category.

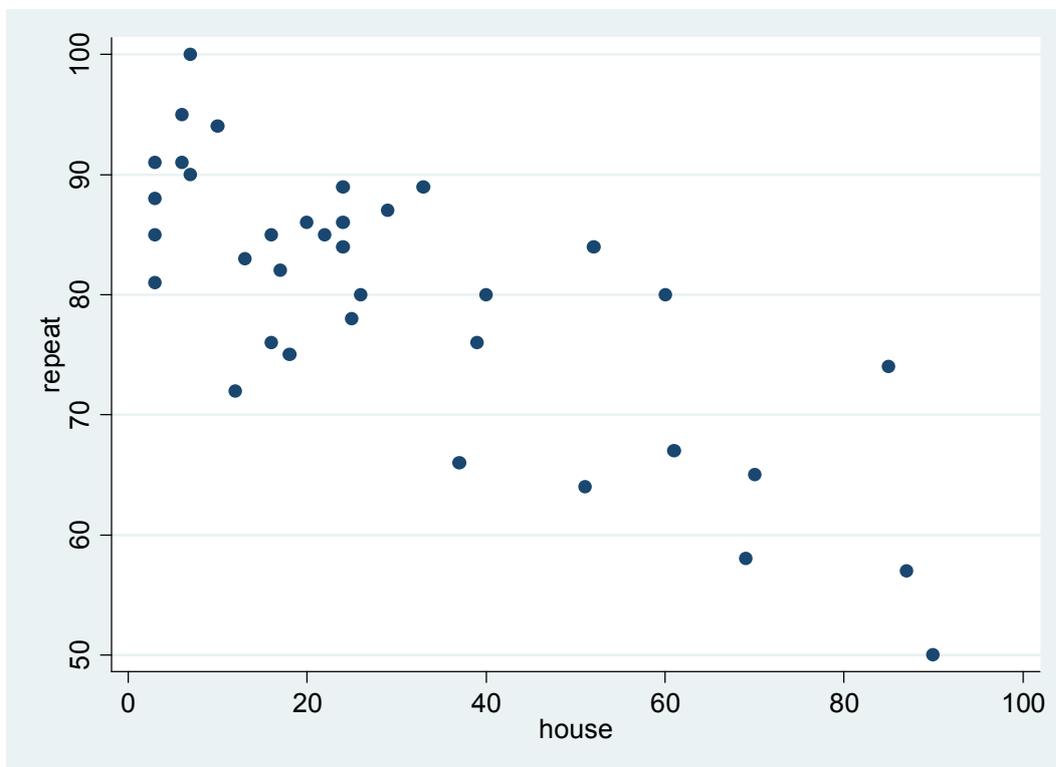
Three quarters of firms had at least half of their customers return for repeat business (Table 5). There was a small amount of variation between industries, with 69 percent of companies in private services having at least half of their customers returning, but 85 percent of firms in industry reporting that proportion.

**Table 5: Customers who return for repeat business**

	0	25% or less	50% or less	51% or more	Don't know
<b>Firm size</b>					
Small	1	9	10	72	7
Medium	2	6	9	79	4
Large	3	6	6	79	5
Very large	1	5	6	81	7
<b>Sector</b>					
Industry	0	4	9	85	2
Trade	0	6	8	82	4
Private services	0	10	14	69	7
<b>Overall</b>	<b>1</b>	<b>8</b>	<b>10</b>	<b>74</b>	<b>6</b>

There is a marked negative correlation between the proportion of repeat customers and the share of households and individuals in the customer base. Looking at the 36-sector level, those sectors where a high proportion of firms reported that more than half of their customers returned for repeat business were also those sectors which had a low share of households as customers (figure 1).

**Figure 1: proportion of firms with more than half of customers returning and proportion of customers that are households and individuals**



$$\text{REPEAT} = 90.5 - 0.346 * \text{HOUSE}$$

(47.8) (7.30)

$$R^2=0.61$$

It appears, therefore, that households are comparatively fickle customers, whereas firms tend to prefer a more continuous, longer-lasting relationship. One potential explanation for this is that households will in general consume final goods, so can choose between competing providers of that final good. Conversely, firms purchase intermediate goods and changing between suppliers may require costly re-tooling of production processes. Certainly these results are in line with the real-world observation of supply chains and preferred suppliers.

Given this potential reliance on particular suppliers, it may be optimal to for firms to contract prices over a long time period. Yet around half of firms had no customers on long-term price contracts (table 6). Conversely, a fifth of firms had more than half of their customers on long-term contracts. There were differences across industries – retail and wholesale firms were less likely to have customers on long-term contracts, whereas those in private services were more likely. Firms in the health and education sectors were far more likely to have long-term contracts, with 46 percent of these firms having more than half of their customers on such contracts. Large companies were more likely to have customers on long-term contracts.

**Table 6: Proportion of customers with long-term price contracts<sup>(a)</sup>**

	0	25% or less	50% or less	51% or more	Don't know
<b>Firm size</b>					
Small	49	17	5	21	9
Medium	44	20	5	26	5
Large	35	24	7	31	3
Very large	33	27	7	29	4
<b>Sector</b>					
Industry	50	24	4	16	4
Trade	60	19	4	10	5
Private services	44	19	6	22	9
Government services	36	11	2	46	6
<b>Overall</b>	<b>47</b>	<b>18</b>	<b>5</b>	<b>22</b>	<b>8</b>

(a) Long term is at least one year.

#### 4. Price reviews

There are two stages to the process for setting prices. In the first stage, covered in this section, the firm gathers information as to what the optimal price (or potentially pricing strategy) may be. In the second stage, covered in section 5 below, the firm decides on whether it should change its current price to, or at least towards, this optimal price.

##### 4.1 Are prices time or state dependent?

There are some costs associated with reviewing and changing prices, which are discussed in greater detail below. As a result of these costs, most firms do not continuously adjust prices (as shown below, 5 percent of firms do review their prices daily which could be viewed as effectively continuous).

The literature differentiates between two forms of price setting: *time-dependent* and *state-dependent* pricing. Time-dependent pricing is where price resets happen as a function of time. In some models the time between price reset is fixed, eg Taylor (1980), in others the opportunity to reset prices is random, e.g. Calvo (1983). In state-dependent models, the price is changed in reaction to shocks. Such models typically assume a cost of changing prices, e.g. Sheshinski and Weiss (1977), Caballero and Engel (1993) and Dotsey, King and Wolman (1999). The consequence of these costs is that firms do not change prices until a shock occurs that is large enough to create sufficient divergence between the current and optimal price for it to be worthwhile to change price.

One implication of costs to changing prices is that firms are likely to review prices more frequently than changing them. Firms will review the optimal price for their product, then ascertain whether the gains from changing outweigh the costs incurred in doing so. A high proportion of firms using state-dependent pricing in the economy should therefore be accompanied by price reviews being more frequent. Conversely, where the costs lie in the review process, a time dependent pricing approach would appear optimal, and price changes should be more closely aligned with reviews.

The survey asked firms whether they reviewed prices at regular intervals, in response to specific events, or a combination of the two strategies. A quarter of firms reviewed prices at regular intervals only, 15 percent did so in response to events, and the majority (61 percent) used the combined strategy (table 7). These response rates were similar across industries and firms sizes.

**Table 7: Timing of price reviews**

	Generally at regular intervals, but also in response to specific events	At regular intervals only	In response to specific events only
<b>Firm size</b>			
Small	60	24	16
Medium	65	22	13
Large	65	24	11
Very large	64	26	10
<b>Sector</b>			
Industry	66	20	15
Trade	59	25	16
Private services	57	29	14
<b>Overall</b>	<b>61</b>	<b>24</b>	<b>15</b>

The proportion of firms with strict state-dependent pricing was the same as that found by Greenslade and Parker (2012) for the UK, and similar to the 20 percent found by Fabiani et al. (2006) for the euro area (table 8). Apel, Friberg and Hallsten (2005) found that 28 percent of Swedish firms reviewed in connection to specific events. A third of Canadian firms reported themselves as being state dependent, although the option was not given in that survey to use both strategies.

The use of the mixed strategy appears higher in New Zealand than in other countries. Fabiani *et al.* report that 46 percent of euro-area firms use the combined strategy, and Greenslade and Parker (2012) report a similar proportion of UK firms (44 percent). Even

including firms that reset prices daily would only result in 41 percent of Swedish firms using both strategies, according to Apel, Friberg and Hallsten (2005).

**Table 8: Use of time and state-dependent strategies**

	Time dependent	Both time and state dependent	State dependent
New Zealand	24	61	15
Euro area	34	46	20
Sweden	42 <sup>(a)</sup>	22	28
United Kingdom	42	44	15

Sources: Fabiani *et al.* (2006); Apel, Friberg and Hallsten (2005); Greenslade and Parker (2012).

(a) Includes those firms who review daily.

#### 4.2 Are firms' price reviews forward looking?

In models using the so-called New Keynesian Phillips Curve (NKPC), firms set prices according to beliefs on the path for future inflation, often given a large degree of information on that path. However, such models typically struggle to reproduce the degree of price stickiness found in real-world data. Consequently, some authors have proposed a 'hybrid' NKPC where past inflation also has an effect on price setting. Various methods have been used to implement this backward-looking behaviour in models, including rule of thumb price-setting (Galí and Gertler, 1999; Galí, Gertler and López-Salido 2001), indexation of inflation (Christiano, Eichenbaum and Evans, 2005) or stickiness in gathering information (Mankiw and Reis, 2002).

Given how some of these methods are relatively *ad hoc* modelling assumptions with potentially little microeconomic support, it is useful to know what information firms use when reaching their pricing decisions. Just 6 percent of New Zealand firms were fully forward looking (table 9). More than 40 percent of firms used current information, with a similar number also incorporating some view of the future. There was little difference between industries, but larger firms were more forward looking than smaller firms. This suggests some costs involved in carrying out assessment of the future, which are relatively higher for small firms. These findings give sound evidence in support of the use of a 'hybrid' NKPC, given that very few firms are truly forward looking.

**Table 9: Pricing decisions' reliance on economic conditions**

	Current economic conditions	Current and expected future economic conditions	Expected future economic conditions	Don't know
<b>Firm size</b>				
Small	44	38	6	12
Medium	41	45	7	6
Large	34	51	10	5
Very large	26	59	11	4
<b>Sector</b>				
Industry	41	43	7	9
Trade	42	38	7	13
Private services	43	42	5	9
<b>Overall</b>	<b>43</b>	<b>41</b>	<b>6</b>	<b>10</b>

### 4.3 How frequent are price reviews?

Firms that claimed some form of time dependence in their price reviewing process were asked to give the frequency at which prices were reviewed. The responses displayed a wide disparity; 10 percent of firms review prices at least weekly, whereas a third of firms review prices either yearly or less frequently (table 10). There was also large divergence in the responses by firm size and sector. Larger firms were more likely to review prices at frequently intervals. Firms in retail and wholesale reviewed prices more frequently – a quarter of these firms reviewed prices at least weekly, compared with 6 percent of private services firms and 9 percent of firms in industry.

**Table 10: Frequency of price reviews**

	Firm size				Sector			Overall
	S	M	L	VL	Industry	Trade	Private Services	
Daily	5	5	6	9	5	12	3	5
Weekly	6	4	5	10	4	14	3	5
Monthly	13	15	14	13	13	17	10	13
Quarterly	13	15	14	13	17	15	16	15
Half-yearly	13	15	12	11	15	13	15	13
Annually	28	30	31	30	26	12	35	29
Less frequently than annual	5	4	5	3	5	2	5	5
In response to specific events only	16	13	11	10	15	16	14	15

Firms were asked to explain why reviews were not carried out more frequently, and given a range of options. The most frequently cited reason was that factors affecting pricing decisions do not change more frequently (table 11). The second most-cited reason was that the firm would not change prices more frequently. Given that firms were able to select more than one option, it is possible that there may be some crossover between respondents for these questions.

The actual cost of the review process, in terms of managerial time, non-managerial time or other costs were not widely recognised as an impediment to holding reviews more frequently. That said, the cost of managerial time was more likely to be an impediment for smaller firms. This is in line with the reasoning of Buckle and Carlson (2000), who propose that the managerial costs of reviewing prices are proportionately higher for smaller firms. The availability of data required for the review process was also not seen as a problem.

**Table 11: Reasons for not reviewing prices more frequently<sup>(a)</sup>**

	Firm size				Sector			Overall
	S	M	L	VL	Industry	Trade	Private Services	
Factors affecting pricing decisions do not change more frequently	39	51	53	57	52	45	46	44
Would not change prices more frequently	24	21	28	22	28	23	28	24
Other reason	26	23	12	13	20	14	21	18
Cost of managerial time	16	7	11	10	11	8	9	8
The information used to inform pricing decisions is not available more frequently	5	7	10	2	6	6	5	5
Other costs of the review process	5	5	5	5	6	3	7	5
Cost of non-managerial time	3	2	3	4	3	4	4	3

(a) More than one response was possible.

Firms were asked whether extra time were spent on larger price reviews. Two thirds of firms agreed, with extra time required principally of managers (57 percent) with some non-managerial time also required for 7 percent of firms (table 12). Around a quarter of firms did not spend extra time. Larger firms were more likely to spend extra time on larger reviews, which supports Buckle and Carlson's theory that price reviews are more onerous for managers of smaller firms.

**Table 12: Extra time spent on larger price reviews**

	Yes, extra managerial time	Yes, extra non-managerial time	No extra time is spent	Don't know
<b>Firm size</b>				
Small	54	6	25	15
Medium	64	9	20	7
Large	68	13	13	7
Very large	66	18	8	8
<b>Sector</b>				
Industry	64	9	17	10
Trade	57	10	24	10
Private services	51	7	27	15
<b>Overall</b>	<b>57</b>	<b>7</b>	<b>23</b>	<b>13</b>

## 5. Price changes

The previous section analysed the factors affecting the review by firms of the optimal price. This section analyses the second stage of the price-setting process - how firms set their price, and the decision on whether to change price if the optimal price diverges from the current price.

### 5.1 How do firms set prices?

The survey asked firms to identify the principal method used for setting the price of their product or service. Economic theory suggests that in imperfectly competitive markets firms will choose to set prices as a mark-up over marginal costs. Under perfect competition prices should be set equal to marginal costs.

In practice, previous work has shown that firms struggle to precisely determine what their marginal cost is, so the question asked refers simply to margin over costs. This potential departure from theory aside, most firms recognised costs plus profit margin as the best description of their pricing method (table 13). Just under a third of firms instead mentioned the influence of competitors' prices. A tenth of firms set prices according to a rule of thumb, such as a change by a fixed amount, or in line with inflation.

There is no significant difference between the pricing methods used by small and large firms. However, there is a significant difference between the price setting methods used by different sectors. Firms in the industrial and trade sectors were more likely to use a cost plus

mark-up approach. Conversely, firms in the health and education sectors were three times more likely to use a rule of thumb than firms in industry or trade.

**Table 13: Methods for setting prices**

	Costs plus profit margin	Influence of competitors' prices	Rule of thumb <sup>(a)</sup>	Other
<b>Firm size</b>				
Small	54	28	9	8
Medium	55	30	8	7
Large	49	33	9	9
Very large	49	33	6	11
<b>Sector***</b>				
Industry	62	27	6	4
Trade	65	26	6	4
Private services	49	30	11	10
Gov't services	33	29	19	20
<b>Overall</b>	<b>54</b>	<b>29</b>	<b>10</b>	<b>8</b>

(a) A change by a fixed amount, or in line with inflation.

A Kruskal-Wallis rank sum test was carried out to test for the equality of populations. \*\*\* indicates that the null hypothesis of equality was rejected at the 99 percent confidence level.

Firms were asked whether customers were charged the same price. Around a third of firms charged the same price to all customers, a further third had fixed price schedules for different types of customers and the final third charged prices on a case by case basis (table 14). In the most recent UK survey, 22 percent of respondents charged the same to all customers, but 57 percent of respondents decided prices on a case by case basis. Less than 20 percent of euro-area firms charged the same price to all customers, with only 8 percent of firms in Germany doing so.<sup>3</sup>

**Table 14: Price discrimination: are all customers are charged the same price?**

	Yes	No, but fixed prices schedules are used for specific types of customers	No prices are set on a case-by-case basis
<b>Firm size</b>			
Small	38	29	33
Medium	33	34	34
Large	26	37	37
Very large	28	39	33
<b>Sector</b>			
Industry	19	39	43
Trade	37	38	25
Private services	43	26	30
<b>Overall</b>	<b>36</b>	<b>31</b>	<b>33</b>

<sup>3</sup> Greenslade and Parker (2010) p17, Fabiani et al. (2006) pp19-20.

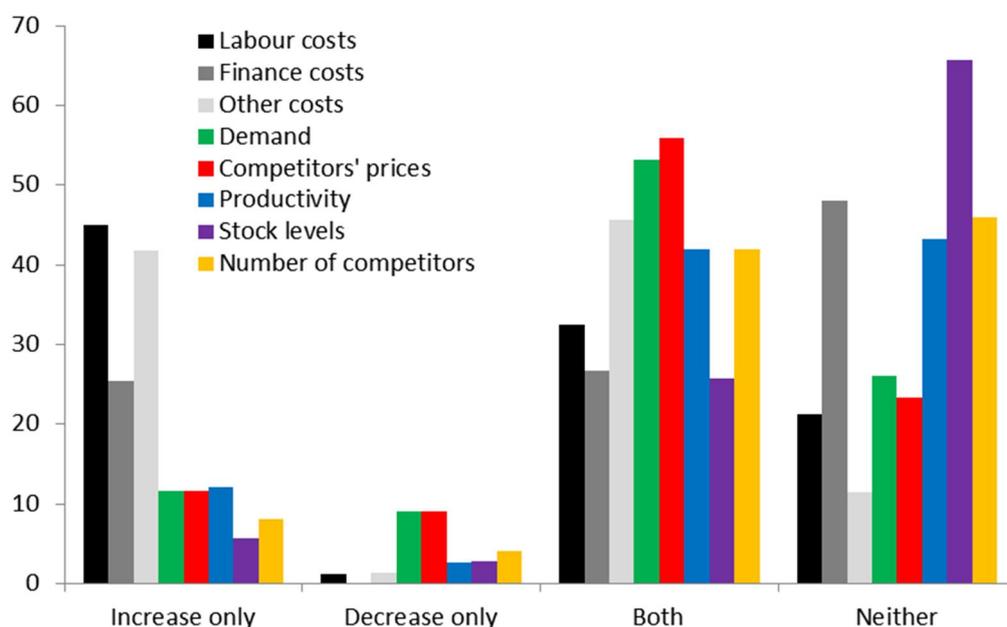
## 5.2 What factors influence prices?

Firms were asked which factors were important for price setting, indicating whether these factors were always important, or whether there was an asymmetry between increases and falls in these factors. 'Other costs' were viewed as the most important factor affecting prices, followed by labour costs, competitors' prices and demand (Figure 2). Productivity, finance costs and the number of competitors were seen as important factors by a little more than half of firms. However, the majority of firms did not view inventories as an important factor affecting prices.

There were some notable asymmetries, with costs in particular being more important for price rises than price falls. However, the number of firms citing costs as being important for price increases is noticeably larger than the proportion of firms citing these reasons as being important for only price falls. Conversely, the number of firms citing demand as being important for only price increases was approximately the same as those who said it only affected price decreases. The response that demand was important for both price increased and decreases was much bigger than either of the previous one-sided responses.

These results for the importance of demand contrast a little with the findings of Coleman and Silverstone (2007), who found that demand changes were far more important for price decreases than increases. Conversely, the asymmetry of responses for the importance of costs is more in keeping with the earlier study.

**Figure 2: Factors that affect price changes**

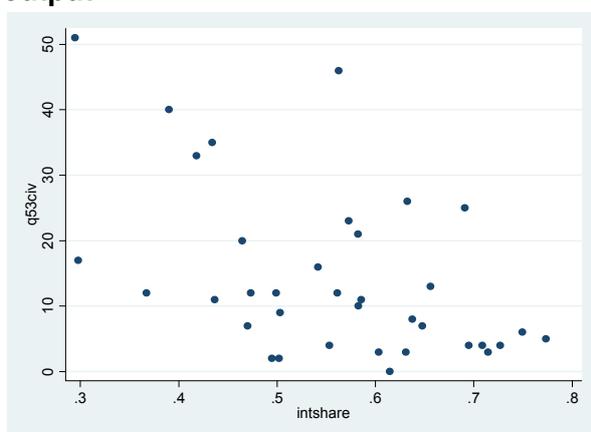


Other costs will presumably include raw materials and other intermediate inputs. Sectors where a high percentage of firms reported 'other costs' as not affecting price changes tended to be those with a low share of intermediates in gross output (figure 3).<sup>4</sup>

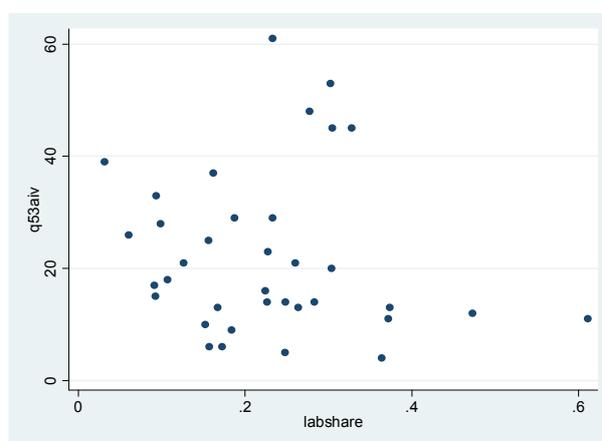
<sup>4</sup> According to the recently published 2007 input-output tables.

The relationship between firms citing labour costs as not affecting price changes and the labour share of gross output is less clear cut. The relationship is not significant across all sectors, but once the wholesale, retail and financial sectors are excluded, there is a clear positive relationship between the labour share of output and its importance for price changes (figure 4). However, while labour costs may be important for the price level of a firm, it does not necessarily translate into more frequent price resets. Only 7 percent of firms in the sample reset wages more frequently than once per year, with 30 percent doing so less frequently than annually.

**Figure 3: Relationship between importance of ‘other costs’ for price setting and intermediates share of gross output**



**Figure 4: Relationship between importance of ‘labour costs’ for price setting and labour share of gross output**



Previous studies have hypothesised that customers may find an increase in prices more palatable if the increase is seen as ‘fair’ (e.g. Hall and Hitch 1939, Rotemberg 2005). In particular price rises that are a result of increased costs to the firm are viewed as being ‘fairer’ than those resulting from higher demand. Blinder *et al.* (1998) had several comments to this effect in their interviews with firms, although did not

Indeed, 49 percent of firms responded that their customers viewed an increase in price resulting from increased costs as being more acceptable than an increase arising from higher demand. This compared with 11 percent of firms who said customers viewed both price increases the same, and 7 percent who believed customers found price increases from higher demand more acceptable. This asymmetric response to shocks contrasts markedly with the models frequently used by monetary policy makers, which typically assume linear and symmetric responses around the estimated steady state.

Given the reluctance to upset customers by making a permanent price change, firms could be reluctant to drop prices if they would need to increase them again in the future. One method for circumventing this problem is to use a temporary price reduction – a sale. When asked whether the use of temporary price reductions was important, 44 percent of respondents said ‘not at all’, and 29 percent said ‘moderately’ or ‘very important’ (table 15). These responses are in line with Coleman and de Veirman, who find that sales occur rarely for 50 percent of the items in the CPI basket, but frequently for 30 percent of the basket.

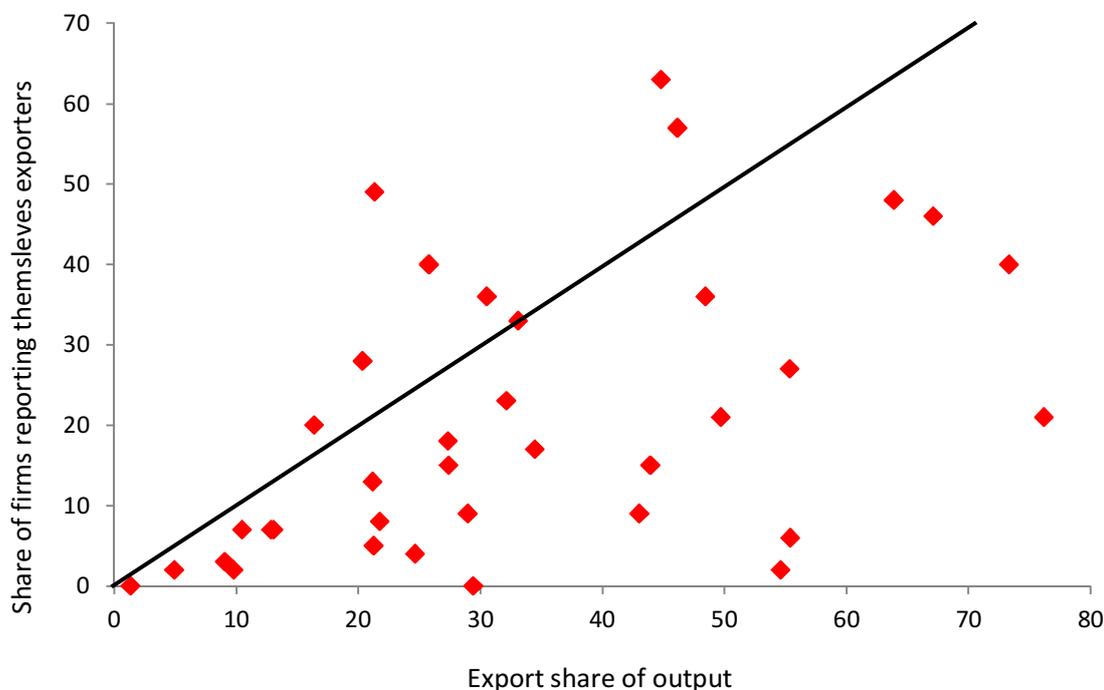
**Table 15: Importance of temporary price reductions (sales)**

	Not at all	A little important	Moderately important	Very important	Don't know
<b>Firm size</b>					
Small	45	17	16	12	11
Medium	46	16	17	13	7
Large	41	15	18	19	6
Very large	34	17	18	25	
<b>Sector</b>					
Industry	41	19	19	13	8
Trade	26	18	28	23	6
Private services	48	19	14	9	11
<b>Overall</b>	<b>44</b>	<b>17</b>	<b>16</b>	<b>13</b>	<b>10</b>

### 5.3 How are export prices determined?

The survey asked a series of questions on the pricing behaviour of exporters. Overall, 15 percent of respondents claimed to be exporters, a share that is lower than the export share of GDP. Looking across industries, this downward bias is consistent: figure 5 shows the relationship between proportion of firms declaring themselves to be exporters, and the export share of sector output. The majority of sectors lie below the 45 degree line.

**Figure 5: Self-reporting by firms of exporting and export share of output**



There are a number of potential reasons for this apparent under-reporting of exports. First, larger firms are more likely to export, and may well have a greater share of sector output. For example, the dominance of Fonterra and Zespri in exporting dairy products and kiwi fruit

respectively would skew the results in the agriculture sector. This difference in firm behaviour according to size is borne out by the survey responses. Whereas only 13 percent of small firms self-reported as exporters, 30 percent of firms with more than 100 employees did.

In addition, survey responses depend on the individual company's view of exporting, which may differ from national accounts definitions which are based on sales to non-residents. For example, none of the companies in the accommodation and food services industry declared itself to be an exporter, yet services provided to non-resident tourists by these companies would be exports in a national accounts sense. Indeed, according to the 2007 Input-Output tables, 29 percent of the output from this industry is exported.

These potential biases in the survey responses have two implications for the results in this section. First, if larger firms are more responsible for a greater share of exports, then more weight should be placed on the responses of these firms relative to the responses of smaller firms. Second, those firms who are unable to correctly identify the difference between domestic and non-resident customers will presumably treat both types of customers the same. This implies that the proportion of firms using local-currency pricing may well be higher than reported in the survey responses.

Approximately half of enterprises indicated that the New Zealand dollar price differs between export markets (table 16). This is markedly less than the recent UK survey, where three quarters of firms differentiated prices between foreign markets, but in line with the euro area, where approximately 50 percent of firms price differently across markets.<sup>5</sup> Bigger firms were more likely to differentiate across markets. In terms of sectors, manufacturers were split evenly, but private services were more likely to have the same New Zealand dollar price across countries, and three quarters of retailers and wholesalers kept the same price. Conversely, three quarters of exporters in the primary sector had differentiated prices in international markets, which contradicts the assumption made in previous studies that these prices are set by the balance of international supply and demand, and that these firms are price takers in international markets.

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<sup>5</sup> Greenslade and Parker (2010) p26, Fabiani et al. (2006) p21.

**Table 16: Is the price of exports the same across countries?**

	Exporter share (%)	Of which, New Zealand dollar price is the same across countries	
		Yes (%)	No (%)
<b>Firm size</b>			
Small	13	54	46
Medium	19	50	50
Large	27	44	56
Very large	30	40	60
<b>Sector</b>			
Primary	28	26	74
Industry	35	50	50
Trade	20	73	27
Private services	8	63	37
<b>Overall</b>	<b>15</b>	<b>53</b>	<b>47</b>

Those businesses that had differentiated pricing across markets were asked what were the main factors in determining the price within market. Exchange rate movements, and the level of competition in the market were the main factors, across firm size and sectors (table 17). These factors were in common with those found in the UK. Conversely, the UK survey also found a role for the destination country's tax system, which was not ranked high by the New Zealand survey. Customer characteristics play an important role for primary sector exporters, although not for other sectors.

**Table 17: What determines prices across countries – ranked by share citing factor 'very important'?**

	Sector				Overall
	Primary	Industry	Trade	Private Services	
Exchange rate movement	1	1	1	1	1
Level of competition in market	2	2	2	2	2
Transport costs	7	3	4	3	3
Regulations	6	4	5	5	4
Tariff	5	5	3	4	5
Customer characteristics	3	6	8	8	6
Cyclical fluctuation in demand	4	7	6	6	7
Tax system of destination market	8	8	7	7	8

Overall, 44 percent of exporters stated that there was no scope for increasing export prices when the New Zealand dollar appreciated (table 18). Retailers and wholesalers appear better able to pass on the appreciation to customers, whereas three quarters of primary exporters are unable to do so.

**Table 18: Effect of New Zealand dollar appreciation on export prices**

	Appreciations are passed on in full and New Zealand dollar price is held fixed	Percentage of appreciation needed to raise export prices		No scope for the business to raise export prices
		10 percent or less	10 percent or more	
<b>Firm size</b>				
Small	31	15	8	46
Medium	35	20	5	40
Large	32	18	7	43
Very large	29	23	3	45
<b>Sector</b>				
Primary	10	10	3	75
Industry	31	23	5	40
Trade	36	34	2	29
Private services	35	15	3	46
<b>Overall</b>	<b>31</b>	<b>19</b>	<b>6</b>	<b>44</b>

The overall figure is higher than the equivalent responses in the UK and Canadian surveys. The UK survey asked exporters for the response in the near term (first six months) and in the longer term to an exchange rate appreciation. Around half of respondents to the UK survey indicated that they would not change prices in the near term, but only 24 percent would leave prices unchanged in the longer term.<sup>6</sup> Similarly, 72 percent of Canadian importers indicated that their suppliers would make no allowance in their prices for depreciation by the Canadian dollar.<sup>7</sup>

Around a third of firms would pass on the appreciation in full. The remaining quarter of firms stated that the exchange rate would need to move by an amount before prices would change in the foreign market. Of those businesses, approximately half would increase prices in line with the appreciation. Almost all the remainder would raise prices by less than the appreciation. Very few would raise prices by more than the appreciation.

#### *5.4 How frequent are price changes?*

Firms were asked how many times they changed prices in the most recent financial year. The picture is one of notable price stickiness. Around a quarter of firms did not change prices, and a further 36 percent changed prices only once (table 19). Only 12 percent of firms changed prices more than six times over the previous year. Larger firms changed prices more frequently.

Split by sector, prices are notably stickier among service-sector firms. Only 13 percent of firms in the health and education sectors changed prices more than once, and 34 percent of other service-sector firms changed prices. This contrasts with the wholesale and retail sectors, where 61 percent of firms changed prices more than once.

<sup>6</sup> Greenslade and Parker (2010) p26.

<sup>7</sup> Amirault *et al.* (2006) p18.

**Table 19: Frequency of price changes, last financial year<sup>(a)</sup>**

	Firm size				Sector				Overall
	S	M	L	VL	Industry	Trade	Private Services	Gov't services	
Zero	25	20	19	16	21	16	27	31	24
Once	36	37	35	35	39	24	39	56	36
Twice	17	18	13	12	18	18	18	7	16
Six times	12	12	15	16	12	20	10	4	12
26 times	5	6	10	8	5	10	3	2	6
182 times	4	4	4	8	2	9	2	0	4
More than 182 times	2	2	4	6	2	4	1	0	2

(a) Percentage of firms that set their own prices.

This large diversity in the frequency of price changes is a feature of previous price-setting surveys (table 20). The median number of price changes in one year by a New Zealand firm is once, which is similar to the majority of countries. But there appears to be a greater level of price stickiness, with only 40 percent resetting prices more than once, compared with 48 percent in the United Kingdom, 51 percent in the United States and 67 percent in Canada. Similarly, 24 percent of firms did not reset prices in the previous year, compared with 13 percent in the United Kingdom, 10 percent in the United States and 8 percent in Canada. Price stickiness in New Zealand appears similar to that in the euro area.

**Table 20: International comparison of frequency of price changes per year**

	New Zealand	Australia	Canada	Euro area	United Kingdom <sup>(a)</sup>	United States
≥ 4	24	33 <sup>(b)</sup>	59	14	30	35
2-3	16	12 <sup>(b)</sup>	8	20	18	16
1	36	40	27	39	39	39
< 1	24	15	8	27	13	10
Median	1	1	4	1	1	1.4

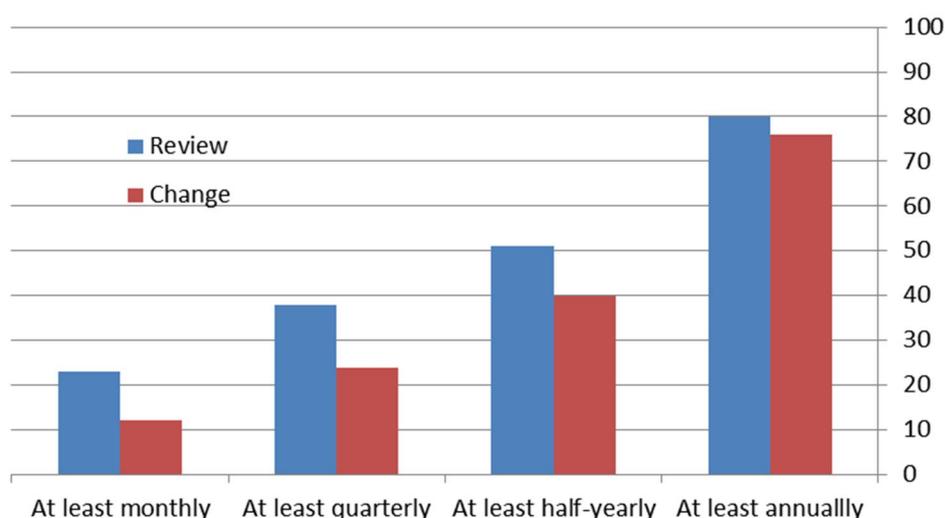
Sources: Park, Rayner and D'Arcy (2010); Amirault, Kwan and Wilkinson (2006); Fabiani *et al.* (2006); Greenslade and Parker (2010); Blinder *et al.* (1998).

(a) The responses for the United Kingdom have been adjusted for the actual number of price changes made by firms that responded 'irregularly' or 'other' to the frequency of price changes.

(b) Estimate, based on Park, Rayner and D'Arcy (2010) Graph 1, p11

Price reviews are notably more frequent than price changes. Twice as many firms review prices at least every month than change them with the same frequency (Figure 6). 51 percent of firms review prices at least every six months, but only 40 percent of firms change prices that frequently. Overall, the median firm reviews prices twice per year, but changes it just once. The divergence between the number of reviews carried out by firms and the number of price changes reinforces the view that there are some costs involved in changing prices, and why it may not always be optimal for a firm to change prices.

**Figure 6: frequency of price reviews and changes**



### *5.5 Causes of price stickiness*

Despite, or perhaps because of, the difficulty in estimating the causes of price stickiness, there have been a large number of potential reasons put forward. A few of the major theories are summarised below.

**Menu costs:** As discussed earlier, changing prices may be costly for firms, which could prevent firms from changing price if these costs outweigh the potential benefits of moving to the optimal price. Mankiw (1985) and Akerlof and Yellen (1985) showed how even small such costs could potentially cause sufficient nominal rigidity to generate macroeconomic effects. Since there are many potential sources for these costs of changing prices, menu costs are narrowly defined in this survey as the physical costs of changing prices (such as reprinting price lists and distributing these to customers).

**Explicit contracts:** This theory suggests that firms contract with customers to provide goods or services at a fixed price for a period of time. These contracts are binding and prevent firms from changing price for the duration of the contract. Since these contracts could potentially lead to sub-optimal prices this theory also requires some justification of why firms and customers would be prepared to enter into such agreements. For firms, the explanation may be that they wish to encourage a long-run relationship with clients to give more certainty over future sales. For customers, such contracts provide certainty over future costs, and reduce potential costs from gathering information on other prices. Fixed contracts resulting in nominal rigidities were originally used in the literature in terms of the labour market, e.g. Fischer (1977), and have since entered the pricing literature.

**Implicit contracts:** similar to explicit contracts, this theory supposes that firms wish to build long-run relationships with customers. However, in this case, firms voluntarily choose to not change prices, rather than being contractually bound to maintain the same price. This theory originates from Okun (1981), who assumes that there are some search costs involved for customers to switch suppliers, so customers will have some inertia in their choice of supplier. Firms encourage this inertia by avoiding actions which would trigger a search by customers

for a new supplier. To this assumption is added a further one, that customers see price increases originating from higher costs as 'fair', but those resulting from higher demand as 'unfair', which is supported by the survey evidence of Kahneman *et al.* (1986). This theory suggests prices will be stickier after a demand shock than after a cost shock.

**Co-ordination failure:** in this theory, firms are concerned about being the first mover following a shock. In particular, if they raise prices they are concerned that competing firms will not follow, resulting in a loss of customers. Conversely, in the case of price cuts, the risk is that the competition matches the price reduction, so no market share is gained. Hence, in the absence of a co-ordinating mechanism between firms (which would almost certainly be illegal under New Zealand competition law), prices are likely to be stickier. The kinked demand curve for oligopolists proposed by Hall and Hitch (1939) is close to this line of reasoning.

**Temporary factors:** Firms may be reluctant to change their price if they believe that the current shock is only temporary in nature. In this case, the optimal price would also be temporary and any price change would need to be reversed in the near future. Firms may choose to avoid both price changes, resulting in price stickiness.

**Pricing thresholds:** firms may choose to price their products at certain psychologically significance pricing points, e.g. \$9.99. Consequently, when faced with shocks, firms may be reluctant to change prices until the shock is sufficiently large to drive the optimal price to another significant pricing point.

**Non-price factors:** this theory suggests that firms are able to vary certain facets of the good or service, without directly changing the price. Examples include changing its quality (perhaps using cheaper, inferior parts), size, delivery time or level of service provided with the product.

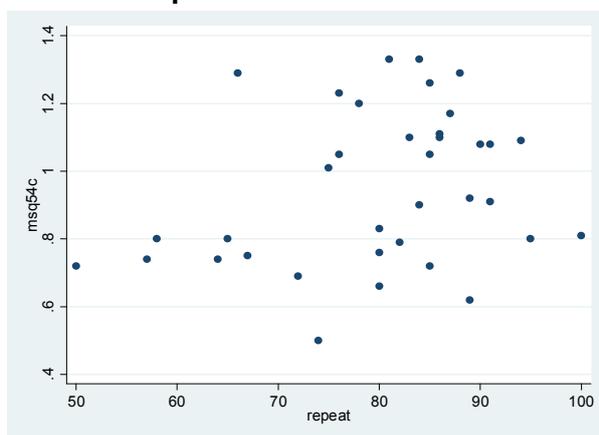
Firms were asked to rate these factors in terms of their importance in preventing price increases. Explicit and implicit contracts were most widely recognised as being 'very important' for causing price stickiness, with co-ordination failure the third most important (table 21). Physical menu costs were not widely perceived as being a factor preventing price increases.

**Table 21: Factors that prevent price increases (share of firms citing factor as very important)**

	Firm size				Sector			Overall
	S	M	L	VL	Industry	Trade	Private Services	
Risk that competitors will not follow suit	20	25	24	32	23	28	19	22
Factors causing pressure to raise prices may only be temporary	17	17	19	20	18	20	15	17
Have formal contracts specifying a fixed price	33	33	45	50	38	21	33	34
Have implicit contracts (customers expect prices to remain stable)	30	31	31	32	34	24	32	30
Prefer to maintain prices at certain thresholds	16	14	12	17	13	25	15	15
Price changes entail physical costs	8	7	6	7	8	8	9	7
Ability to adjust non-price elements	10	6	5	8	8	11	8	9

There was some variance in responses for these factors dependent on the characteristics of the sectors. While there is some positive relationship between the importance of long-term contracts and the proportion of customers who return for repeat business (figure 6), relationship between the proportion of customers who return for repeat business and the importance of implicit contracts is much more marked (figure 7). Sectors where co-ordination failure was an important factor for not increasing prices were also those which put higher weight on competitors' prices (figure 8). Finally, those sectors which cited factors causing the price change were only temporary were typically those with a higher share of intermediates in gross output (figure 9).

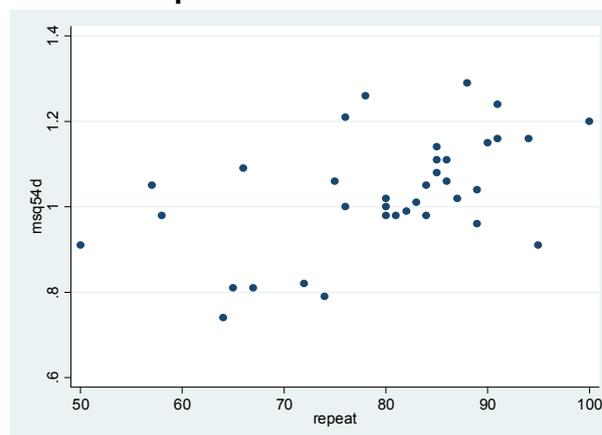
**Figure 6: Importance of explicit contracts against proportion of customers who return for repeat business**



$$\text{Explicit} = 0.499 + 0.006 * \text{REPEAT}$$

(1.88)\*    (1.78)\*

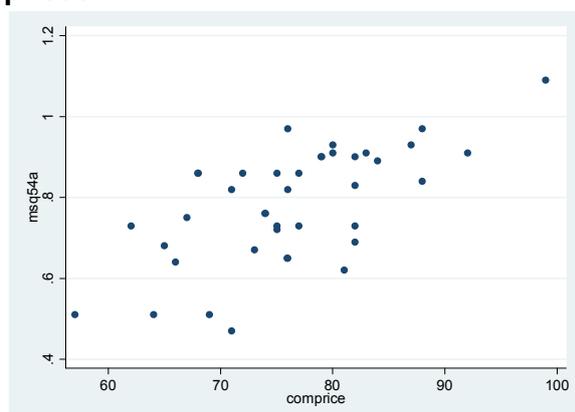
**Figure 7: Importance of implicit contracts against proportion of customers who return for repeat business**



$$\text{Implicit} = 0.550 + 0.006 * \text{REPEAT}$$

(3.46)\*\*\*    (3.91)\*\*\*

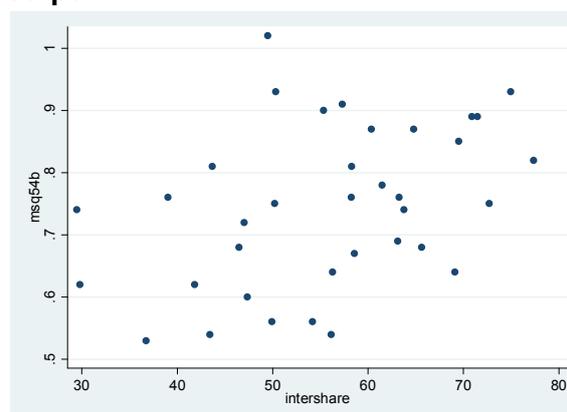
**Figure 8: Importance of coordination failure versus importance of competitors' prices**



$$\text{Coord Fail} = -0.095 + 0.011 * \text{COMPRICE}$$

(0.59) (5.45)\*\*\*

**Figure 9: Importance of temporary factors versus share of intermediates in gross output**



$$\text{Temp factors} = 0.511 + 0.004 * \text{INTSHARE}$$

(5.40)\*\*\* (2.53)\*\*

Figures in parentheses are t-statistics. \*\*\* denotes a rejection of the null hypothesis that the coefficient is zero at the 99 percent confidence level, \* denotes rejection of the null at the 90 percent confidence level.

The top three explanations for price stickiness in New Zealand have typically been highly ranked in other countries (table 22). Implicit and explicit contracts were in the top 4 reasons for price stickiness in Canada, the euro area, Sweden and the United Kingdom. Menu costs, at least in terms of the physical costs of changing prices, were among the theories of price stickiness least recognised by firms, ranking tenth in Canada, eighth in the euro area, eleventh in Sweden and eighth in the United Kingdom.

**Table 22: International comparison of factors leading to price-stickiness**

Factor	New Zealand	Canada	Euro area	Sweden	United Kingdom	United States
Explicit contracts	1	3	2	3	3	5
Implicit contracts	2	2 / 7	1	1	4	4
Co-ordination failure	3	5 / 8	4	4	1	1
Temporary factors	4	n.a.	6	n.a.	5	n.a.
Pricing thresholds	5	n.a.	10	7	7	8
Non-price factors	6	4	7	n.a.	n.a.	3
Menu costs	7	10	8	11	8	6

Sources: Amirault, Kwan and Wilkinson (2006); Fabiani *et al.* (2006); Apel, Friberg and Hallsten (2005); Greenslade and Parker (2012); Blinder *et al.* (1998).

## 6. Explaining sectoral diversity in price stickiness

As noted above, there is considerable diversity across sectors in the frequency of price resets. Only 5 percent of firms in education and training reset their prices more than once a year, compared with the two thirds of firms in retail that do. This diversity in price-setting behaviour is a common finding in price-setting surveys.

The respondents noted a number of reasons why prices may not change, as discussed in section 5.5 above. How successful are these reasons for price stickiness in explaining the

observed differences? In other words, can the differences in firm structure, customer type and market dynamics explain the varying frequencies at which firms reset prices?

Ideally, with the micro data for firms available, it would be possible to carry out a cross-sectional analysis using a Poisson model, or some similar model for interpreting count data. However, with responses aggregated by sector to protect the anonymity of firms, there are two complications with this analysis. The first is that 36 industries do not give many degrees of freedom. The second is finding a suitably continuous dependent variable.

For the first problem, we test residuals for normality using the Shapiro-Wilk test to ensure the validity of hypothesis testing. For the second, we use the proportion of firms that reset prices either once or not at all in the previous financial year. Given that the median firm reviews its prices at twice a year, these firms have some reason for resetting prices less frequently – which is to say exhibit some form of price stickiness. This proportion is labelled STICKY in the following regressions.

The top three reasons among firms for price stickiness are explicit contracts, implicit contracts and co-ordination failure. For the first two reasons, the proportion of customers that are long term, or repeat customers will presumably have some bearing on a firm's use of explicit or implicit contracts. Hereafter, the proportion of firms within each sector stating that the majority of customers are on long-term price contracts is given by LONGTERM, and the proportion of firms who have a majority of repeat customers is given by REPEAT.

Co-ordination failure is where the firm is reluctant to increase its price if its competitors will not follow and thus lose market share. It is likely that firms who state that a change in competitors' prices have an effect on its own price are more likely to face greater competition. The share of firms within each sector who cite competitors' prices as being important for their own price changes is given by the variable COMPRICE.

Similarly, other costs, assumed principally to be the costs of intermediate inputs, were viewed as important by a large number of firms as important for price setting. The variable INTSHARE gives the share of intermediate goods in gross output for each sector, as given by the most up-to-date input-output tables for New Zealand. Finally, we take the proportion of firms within each industry that state that temporary sales are very important, given by TEMPSALE.

Table 23 shows the results of a number of ordinary least squares regressions using these variables to explain differences in price stickiness between sectors. Column (1) reports the results of first equation. Having a high proportion of customers on long-term price contracts unsurprisingly increases the rate of price stickiness to a significant extent. Having a high proportion of customers who return for repeat business also increases price stickiness, although the coefficient is not significant. Higher competition in the sector, as represented by the importance of competitors' prices, results in more frequent price resets. The share of intermediates in output does not have an effect on price stickiness in this equation.

Column (2) reports the same equation, but weighted by the number of firms in each sector. This reduces the influence of certain small sectors, such as insurance, which operate in markedly different ways to the standard firm in economic theory. As before, a higher degree

of long-term and repeat customers results in a greater degree of price stickiness, whereas greater competition results in more frequent price resets. All three variables are now significant. A higher share of intermediate goods is now significantly associated with more frequent price resets. There does not appear to be a significant relationship between the labour share of gross output and price stickiness (results unreported).

The regression in column (3) replaces the share of repeat customers with the proportion of customers who are households (HOUSE) or the government (GOV). The other coefficients are little changed and are significant at the 1 percent confidence level. The coefficient on HOUSE is negative and significant, implying that firms dealing with households reset their prices more frequently than those with predominantly firms as customers. Conversely, the coefficient on GOV is positive and significant, suggesting that firms selling to the government have stickier prices.

Finally, column (4) shows the results of the addition of TEMPSALE, the proportion of firms in each industry that cite temporary sales as being very important. The coefficient on TEMPSALE is negative – this is not particularly surprising given that firms who make use of temporary sales are less likely to leave prices unchanged. However, the residuals from this regression fail the Shapiro-Wilk normality test, so it is not possible to carry out the standard hypothesis tests.

**Table 23: Estimation results for factors causing price stickiness<sup>(a)</sup>**

Dependent	(1)	(2)	(3)	(4)
Weighted by size of sector	STICKY	STICKY	STICKY	STICKY
	No	Yes	Yes	Yes
LONGTERM	0.570 (4.30)***	0.582 (5.12)***	0.331 (2.36)**	0.381 (3.64)
REPEAT	0.119 (0.58)	0.276 (2.37)**		0.279 (2.94)
HOUSE			-0.169 (-3.30)***	
GOV			0.423 (2.02)*	
COMPRICE	-0.652 (-2.63)**	-1.34 (-6.17)***	-1.31 (-6.70)***	-0.832 (-3.87)
INTSHARE	0.028 (0.15)	-0.244 (-1.93)*	-0.328 (-2.45)**	-0.265 (-2.57)
TEMPSALE				-0.465 (-4.11)
F-Stat	5.9***	26.52***	26.15***	35.47
Adj. R-squared	0.36	0.74	0.78	0.83
Shapiro-Wilk test for normality	0.16	0.22	0.33	0.028**

(a) T-stats in parentheses. \* denotes a rejection of the null at the 10 percent confidence interval, \*\* a rejection at the 5 percent confidence level and \*\*\* at the 1 percent confidence level.

## 7. Conclusions

How firms set prices determines inflation dynamics within the economy, and is important knowledge for monetary policy makers, and macroeconomic modellers seeking accurate microfoundations for their models. This paper brings new insights into price-setting behaviour, using data collected from a comprehensive survey of New Zealand firms. This is the first such survey for New Zealand, and the first to cover all private sector industries.

New Zealand firms are rarely strictly state-dependent price setters, although the use of the mixed state and time-dependent is higher than seen elsewhere. The most common way of setting prices appears to be a mark-up over cost, but a significant minority of firms also based their prices on those set by competitors. Very few firms are purely forward looking when setting prices,

Price stickiness occurs at both stages of the price-setting process. The median firm reviews its price twice per year, but changes it only once. The most recognised reasons for price stickiness are explicit and implicit contracts and co-ordination failure. Pure menu costs – treated as the physical cost of changing prices – are not widely recognised as an impediment to changing prices.

Higher competition within the sector and a higher share of intermediates in output are associated with a greater rate of price resetting. Conversely, sectors where there are a larger number of repeat customers exhibit greater price rigidity. Overall, price stickiness appears to be more a factor in intermediate goods, with those selling direct to households more flexible. This suggests that a focus on the flexibility of goods in the Consumer Price Index will underestimate the degree of price stickiness in the economy.

The asymmetric response of prices to shocks, notably cost shocks, and the diversity of price-setting behaviour both between and within sectors suggest caution when interpreting the results from linearised models based on representative agents.

## References

- Amirault, D., Kwan, C. and Wilkinson, G. (2006). 'Survey of price setting behaviour of Canadian companies', Bank of Canada Working Paper No. 2006-35
- Apel, M, Friberg, R and Hallsten, K (2005). 'Microfoundations of macroeconomic adjustment: survey evidence from Swedish firms', *Journal of Money, Credit and Banking* Vol 37 (2, April) pp. 313-338
- Buckle, R, and Carlson, J (2000) 'Menu costs, firm size and price rigidity' *Economics Letters* Vol 66 (1) p. p59-63
- Bunn, P. and Ellis, C., (2012a). 'How do individual UK producer prices behave?', *The Economic Journal* (February) 122 F16-F34.
- Bunn, P. and Ellis, C., 2012b. 'Examining the behaviour of individual UK consumer prices', *The Economic Journal* 122 (February) F35-F55.
- Bils and Klenow (2004) 'Some evidence on the importance of sticky prices' *Journal of Political Economy* 112 (5) pp 947-985
- Calvo, G (1983) 'Staggered prices in a utility-maximising framework' *Journal of Monetary Economics* 12 (September) pp383-398
- Christiano, L, Eichenbaum, M and Evans, C (2005) 'Nominal rigidities and the dynamic effects of a shock to monetary policy' *Journal of Political Economy* 113 (1) pp1-45
- Coleman, A and de Veirman, E (2011) 'Retail Discounting in New Zealand' Paper presented to the 2011 Annual Conference of the New Zealand Association of Economists
- Coleman, A. and Silverstone, B. (2007) 'Price changes by firms in New Zealand – some evidence from the Quarterly Survey of Business Opinion', *Reserve Bank of New Zealand Bulletin* Vol 70 (3) pp18-30.
- Dhyne, E, Alvarez, L, Le Bihan, H, Veronese, G, Dias, D, Hoffman, J, Jonker, N, Lünne-man, P, Ruml, F and Vilmunen, J (2006) 'Price changes in the euro area and the United States: some facts from individual consumer price data' *Journal of Economic Perspectives* 20(2) pp171-192
- Fischer, S (1977) 'Long-term contracts, rational expectations, and the optimal money supply rule' *Journal of Political Economy* 85(1) pp191-222
- Galí, J and Gertler, M (1999) 'Inflation dynamics: a structural economic analysis' *Journal of Monetary Economics* 44 (2) pp195-222
- Galí, J, Gertler, M, and López-Salido, D, (2001) 'European inflation dynamics' *European Economic Review* 45 (7) pp 1237-70
- Greenslade and Parker (2010) 'New insights into price-setting behaviour in the United Kingdom' *Bank of England Working Paper* No 395
- Greenslade and Parker (2012) 'New insights into price-setting behaviour in the UK: introduction and survey results' *The Economic Journal* 122 (February) F1-F15.
- Hall, R and Hitch, C (1939) 'Price theory and business behaviour' *Oxford Economic Papers* (May) 12-45
- Kahneman, D, Knetsch, J and Thaler, R (1986) 'Fairness as a constraint on profit: seeking entitlements in the market' *American Economic Review* 76 (September), 728-41
- Klenow, P and Kryvtsov, O (2008) 'State-dependent or time-dependent pricing: does it matter for recent US inflation?' *Quarterly Journal of Economics* 123(3) pp 863-904
- Klenow, P and Malin, B (2010) 'Microeconomic evidence on price-setting' *NBER Working Paper* No. 15826

- Mankiw, N and Reis, R (2002) 'Sticky information versus sticky prices: a proposal to replace the New Keynesian Phillips Curve' *The Quarterly Journal of Economics* 117(4) pp1295-1328
- Nakamura, E., and Steinsson, J., 2008. 'Five facts about prices: a re-evaluation of menu cost models', *Quarterly Journal of Economics* 123(4), 1415-64
- Park, A., Rayner, V. and D'Arcy, P. (2010) 'Price-setting behaviour – insights from Australian firms' *Reserve Bank of Australia Bulletin*, June pp7-14
- Smets, F and Wouters, R (2003) 'An estimated dynamic stochastic general equilibrium model of the euro area' *Journal of the European Economic Association* 1 (5) pp1123-1175
- Taylor, J (1980) 'Aggregate dynamics and staggered contracts' *Journal of Political Economy* 88(1) pp1-23
- Vermeulen, P, Dias, D, Dossche, M, Gautier, E, Hernando, I, Sabbatini, R and Stahl, H (2007) 'Price setting in the euro area: some stylised facts from individual producer price data' *European Central Bank Working Paper No. 727*

## Appendix – variable definitions

Variable	Definition
STICKY	Proportion of firms within the sector resetting prices once or less per year
LONGTERM	The proportion of firms within the sector where more than half of customers are on long-term price contracts
REPEAT	The proportion of firms within the sector where more than half of customers are repeat customers
COMPRICE	The share of firms within the sector where the change in competitors' price is important for pricing
INTSHARE	The share of intermediate goods in gross output
TEMPSALE	The share of firms within the sector for whom temporary price reductions (sales) are very important
HOUSE	The share of firms' customers that are households