A Survey of the Price-Setting Behaviour of Canadian Companies

David Amirault, Carolyn Kwan, and Gordon Wilkinson,
Bank of Canada Regional Offices

- *From July 2002 to March 2003, the Bank of Canada's regional offices surveyed a representative sample of 170 Canadian firms to better understand price-setting behavior in the Canadian economy.*
- *Results suggest that half of Canadian firms changed prices at least once every three months. The survey also found evidence of increased price flexibility among Canadian firms over the past decade, owing to intensified competition and greater use of information technologies.*
- *The survey tested theories as to why firms allow prices to respond sluggishly to changes in market conditions—a key issue in determining the effects of monetary policy. Many firms indicated that their prices do not change until costs change, and that they often take measures to delay raising prices when costs go up. Firms also recognized that adjusting prices ahead of their competition is risky, which causes them to wait. Fixed nominal price contracts create rigidities, and the most commonly cited duration is 12 months. Finally, firms keep prices unchanged out of fear of antagonizing customers with frequent price changes.*
- *If prices are relatively flexible and have become more flexible over time, inflation may be more responsive to interest rate changes; thus, inflation targets may be achieved with shorter lags and fewer real side effects. Moreover, greater price flexibility may reduce the need for countercyclical policy.*

Setting prices correctly plays a critical role in determining the success of a product or service to a firm. The process of choosing and setting the "right" price is, however, costly in many ways. The time and effort expended by senior staff to set prices, and the cost of communicating the price changes to clients, are not trivial. As well, if customers are unhappy with the new price, the firm may incur negotiation costs, or may lose customers.[1]

Firms' attempts to minimize these costs by allowing their market prices to respond slowly to market conditions influence how monetary policy affects the economy. The extent to which prices are unchanged is referred to as price stickiness, rigidity, or inflexibility.

In this article, we summarize the results of a survey of pricing behaviour of Canadian companies. We begin by examining the motivation for surveying firms. The methodology used to set up the questionnaire and conduct the interviews is then described, followed by a presentation of the survey results. The first part of this section focuses on how often firms adjust prices and what motivates them to do so. The second part examines the reasons for price rigidity. The concluding section of the article highlights the main findings of the survey and discusses some potential implications for monetary policy.

1. The costs of printing new menus, catalogues, and price lists and of changing price tags are traditionally referred to as menu costs in the economic literature. Zbaracki et al. (2003) estimate that the managerial costs of adjusting prices, which include the costs of gathering information, making decisions, and communicating information internally, are more than six times larger than traditional menu costs for a typical firm in an industrial setting. They also estimate that customer costs, which include the costs of communicating and negotiating new prices with customers, are more than twenty times larger than menu costs.

Why the Issue Is Important

Why study how prices are determined?

The way firms set prices is of major importance to the design and implementation of monetary policy. Whether prices are sticky—that is, whether they respond slowly to changes in the economic environment—or whether they respond asymmetrically to excess demand and excess supply are key questions for central banks. The answers to these two questions have implications for the conduct of monetary policy, such as the speed with which the monetary authorities attempt to bring inflation back to the target after a shock. They also shape the process by which changes in monetary policy are transmitted to real activity (output and employment) and to inflation.

The way firms set prices is of major importance to the design and implementation of monetary policy.

Views on the importance of price stickiness as a central question in macroeconomics have varied over the years. In the 1960s and 1970s, economists generally accepted the presence of sticky prices and their ability to generate real-side disturbances in the face of monetary policy shocks. In the late 1970s and the 1980s, much of the academic research focused on the real side of the economy. Two economic paradigms at the time, the early rational-expectations and real-business-cycle models, dismissed the presence of sticky prices and therefore argued against a role for monetary policy in stimulating growth during periods of slack demand. This may have reflected, at least in part, the lack of conclusive evidence on the extent and importance of sticky prices.

In contrast, the macroeconomic literature of the 1990s and 2000s has shown a general acceptance of price stickiness and the important role that monetary policy can play in an economy running below potential. Consequently, economists have been devoting substantial resources to assessing the degree of price stickiness.[2] An approach that has become increasingly popular in trying to shed light on these issues is to survey firms directly on how they set prices. This article reports on the results of the first such survey for Canada.

Why do a survey?

There are several reasons why surveys of the price-setting behaviour of firms have been growing in popularity among researchers. Most important is the recognition of the central role played by the relative stickiness of prices in influencing how changes in monetary policy affect real economic variables such as output and employment. As well, conventional approaches to investigating price stickiness, based on econometric analysis of aggregate time-series data, have failed to resolve many of the outstanding issues. Moreover, new theories for sluggish price adjustment have appeared before older explanations have been satisfactorily rejected.[3] There is also a growing recognition that price stickiness can best be understood by examining pricing behaviours at the micro level, where pricing decisions are actually made. However, until the release of firm-based survey studies in recent years, the scope of earlier micro-level studies, which tended to focus on either a single firm or a single market, was too narrow to permit implications to be drawn for price stickiness in the broader economy.

An economy-wide survey of the price-setting process at firms has not previously been conducted in Canada, although surveys have been carried out by central banks in other countries.[4] It was thought that a similar firm-based survey for Canada would be beneficial, given the differences in economic structure between Canada and these other countries in terms of export exposure, industrial mix, and institutional and market arrangements.

In addition to assessing the relative flexibility of prices in Canada, a firm-based survey can be used to examine the various explanations for slow price adjustment and the prevalence of these explanations across firms. This information may be important for the conduct of monetary policy because different explanations of price rigidity may have different effects on the responsive-

2. Several studies have shown that certain wholesale and retail prices often remain unchanged for many months. For instance, price rigidity was found in industrial commodity prices (Carlton 1986), magazine prices (Cecchetti 1986), and mail-order catalogue prices (Kashyap 1995). Bils and Klenow (2002), using disaggregated Bureau of Labor Statistics price data for the United States, found price adjustment more flexible than was the case in these earlier studies.

3. For a fuller discussion, see Blinder et al. (1998, 8–12).

4. The use of surveys to analyze the price-setting behaviour of firms was pioneered in the United States by Blinder (1991, 1994) and Blinder et al. (1998). Subsequent price-setting surveys were conducted by researchers at the Bank of England (Hall, Walsh, and Yates 1997), the Bank of Japan (Nakagawa, Hattori, and Takagawa 2000), the Bank of Sweden (Apel, Friberg, and Hallsten 2001), and, more recently, the Bank of Italy (Fabiani, Gattulli, and Sabbatini 2004). Currently, eight other euro-area central banks are conducting price-setting surveys (Belgium, Germany, France, Spain, the Netherlands, Luxembourg, Portugal, and Austria), and the results are expected to be published in 2005.

ness of prices to changing demand conditions. Macroeconomic modelling may also benefit from more detailed information on firms' price-setting behaviour.

The Approach

How was the survey conducted?

The design and implementation of the survey for Canada drew upon the results and lessons learned from previous price-setting studies conducted in other countries. Structured interviews were conducted with 170 firms across Canada. The firms selected for the survey had to be free to set their prices autonomously in response to market conditions. Thus, the sample was designed to be representative of the private, for-profit, unregulated, and non-commodity-producing segment of the Canadian economy in terms of industry sector, firm size, and, to some extent, regional distribution (Table 1).

Table 1

Representativeness of the Survey Sample

	Industry sector[a]		Firm size[b]		Region[c]	
	Target	Actual	Target	Actual	Target	Actual
Construction	10	10	–	–	–	–
Manufacturing	25	26	–	–	–	–
Retail and wholesale trade	17	14	–	–	–	–
Transportation, information, and cultural industries	11	13	–	–	–	–
Finance, insurance, and real estate	19	16	–	–	–	–
Other commercial services[d]	18	20	–	–	–	–
Small	–	–	29	32	–	–
Medium	–	–	23	28	–	–
Large	–	–	48	40	–	–
Atlantic Canada	–	–	–	–	6	13
Quebec	–	–	–	–	21	22
Ontario	–	–	–	–	42	31
Prairies	–	–	–	–	18	18
British Columbia	–	–	–	–	13	16

a. The target is the percentage of real gross domestic product (GDP) in the private, non-regulated, and non-primary sector of the Canadian economy. It constituted 68 per cent of total real GDP in 2002. The real estate sector was adjusted down by about one-half to account for the effects of imputed rent in published GDP figures. "Actual" represents the percentage of firms in the survey sample. The classification by industry sector is based upon the North American Industry Classification System (NAICS).

b. The target is the percentage of employment in a particular firm-size category in 2002, based on Bank estimates generated from Statistics Canada's *Survey of Employment, Payroll and Hours*. "Actual" represents the percentage of firms in the price-survey sample. Small firms are defined as those with less than 101 employees; medium firms as those with 101–499 employees; and large firms as those with more than 499 employees.

c. The target is the percentage of real GDP in 2002. "Actual" represents the percentage of firms in the price-survey sample.

d. Includes professional, scientific, and technical services; management of companies and enterprises; administrative and support services; waste management and remediation services; arts, entertainment, and recreation services; and accommodation and food services.

Drawing upon the experience of the Bank of Canada's regional offices in conducting firm-based surveys, a non-random form of sampling, widely employed in business surveys and known as "quota sampling,"[5] was used to generate a representative sample of firms. All surveys were completed using face-to-face interviews rather than by telephone, mail, fax, or the Internet, in the belief that survey responses would be more reliable.[6] All interviewers were Bank of Canada staff economists who had training in clarifying concepts, ensuring that all questions were answered, and identifying and resolving any inconsistencies in responses. Company representatives who participated in the survey held senior positions, suggesting that they would know how their firm's products or services were priced.[7] Survey interviews were conducted from July 2002 to March 2003. However, about two-thirds of the surveys were completed between January and March 2003, a period when the Canadian dollar appreciated by about 7 per cent, and the rate of inflation, as measured by the 12-month rate of increase in the consumer price index (CPI), rose to an average of 4.4 per cent, from less than 3 per cent when surveying commenced in July 2002.[8]

What were firms asked?

The price-setting survey was based on a structured questionnaire rather than a free-form interview to allow for standard statistical analysis. The number, type, and phrasing of the questions, as well as the layout of the survey, were finalized in consultation with Bank of Canada senior management and Research Department staff. Consideration was given to striking

5. See Martin (2004) for a description of the Bank of Canada's regional offices' survey experience. The non-random sampling used in the regional offices and in the price survey is called quota sampling because, for each subgroup in a target universe, a quota of respondents is selected which, when aggregated, is intended to produce a sample that is representative of the target universe. Thus, in instances where an initial company contact chooses not to participate in the survey, another firm of similar size with comparable industry characteristics is selected from commercial business directories to achieve sample targets (see also OECD 2003).

6. Blinder et al. (1998) believed that personal interviews conducted by knowledgeable economic professionals would improve the quality of the survey results. Our experience with missing responses and errors with questionnaires sent in by fax suggests that their preference for personal interviews is well founded.

7. The percentage distribution of company contacts was as follows: president, CEO, or owner–22 per cent; vice-president, vice-president of finance, or CFO–41 per cent; manager or director–22 per cent; controller–9 per cent.

8. The rise in total CPI inflation resulted mainly from price increases for energy and auto insurance. Excluding these components, the year-over-year increase in consumer prices averaged 2.3 per cent from January to March 2003.

a reasonable balance between gathering pertinent information and not overburdening the respondents. Given that most firms sell a variety of products, firms were asked to refer to their main product when responding to the survey questions. If product offerings were too diverse to easily identify one main product (e.g., department store) respondents were asked to answer the questions with reference to some broad product category where items are priced similarly (e.g., electronic equipment).

The survey questionnaire consisted of three sections.[9] The first section contained questions on firm characteristics such as cost structure, industry, sales distribution by customer type and region, share of sales under contract, customer concentration, and the number of direct competitors. These questions were posed to allow for the analysis of differences in price-setting behaviour across firms. The second section included questions designed to improve the understanding of the price-setting process at firms. To examine the degree of price flexibility, companies were asked about the frequency of their price reviews and price changes. To better understand the motivation behind a firm's decision to alter prices, the survey probed into the reasons why a company would change prices. The third section asked questions about the relevance of various theories of, or explanations for, price stickiness. In the main part of this section, companies were asked to evaluate the importance of six theories of price rigidity. These theories had been considered important in other price-survey studies or in other empirical or theoretical research. Each theory was presented using a one-line statement capturing its essential features in non-technical language. If respondents recognized this one-line statement as an explanation for slow price adjustment at their firm, follow-up questions were asked on issues specific to that theory before moving on to the next theory. This section also included a single question on the relevance of five other explanations for delayed price adjustment, but was not followed by any supplementary questions, given the smaller role played by these explanations in the economic literature. At the end of the survey, firms were asked whether their responses applied to a broad range of their other products or services, and this was generally found to be the case.[10]

9. See Appendix A of Amirault, Kwan, and Wilkinson (forthcoming) for a copy of the survey.

10. More than three-quarters of firms indicated that the responses were applicable to other products or services or that the question was irrelevant because they offered only one product or service.

The Results

How, and how often, do firms adjust prices?

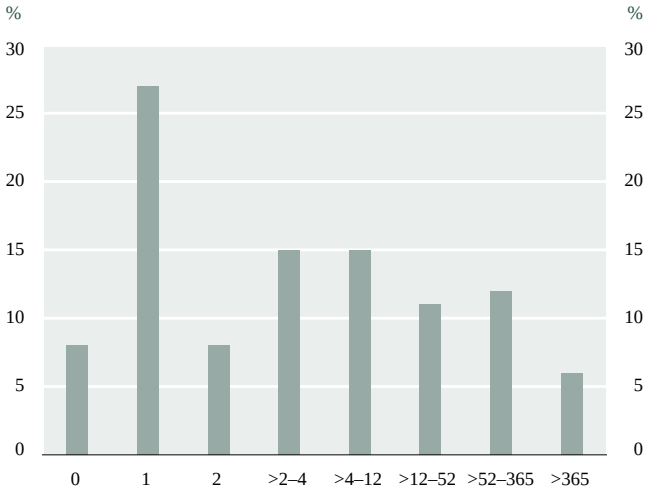
In order to generate estimates of price-setting frequencies among Canadian firms,[11] the respondents were asked, "In the past 12 months, how many times have you actually adjusted transactions prices?" The distribution of answers to this question was surprisingly wide. The most commonly cited answer, given by 27 per cent of the sample, was that prices are adjusted once a year and often at the same time every year.

Another 8 per cent cited no price changes at all in the past year (Chart 1). Taking these two results together, prices for about one-third of the measured Canadian economy are quite sticky. For these firms, the costs of changing prices[12] are burdensome relative to the benefits.

For 38 per cent of the sample, prices change 2 to 12 times per year. At the other end of the distribution, 29 per cent reported adjusting prices more than 12 times in the past year. At the extreme end, 6 per cent reported changing prices more than 365 times in the past year.

Chart 1

In the Past 12 Months How Many Times Have You Actually Adjusted Transactions Prices?



11. It should be noted that the number of price adjustments alone does not indicate price rigidity. Infrequent price adjustment at some firms may simply reflect stability in their demand and cost conditions over the 12-month period covered by the question.

12. Costs of price changes are defined broadly to include both explicit costs, such as the costs of posting new prices, and implicit costs, such as lost or antagonized customers, price wars, and loss of reputation and credibility.

This suggests that the classical paradigm of continuously clearing auction markets (continuous costless repricing) applies to only a very small segment of Canadian product markets. This high price flexibility is largely the result of many of these firms changing prices on a customer-by-customer basis.

Our estimates show that one-half of firms in Canada change their prices at least once every three months, the equivalent of a price change four or more times a year. This result suggests that prices in Canada are reasonably flexible, particularly when compared with the results of similar studies recently conducted in other countries[13] (Box 1).

Are prices more flexible than they used to be?

The Canadian economy has undergone considerable change over the past decade and a half. In addition to lower, more stable, and predictable inflation, which, on the surface, may have reduced the need for frequent price changes, firms have faced a steady stream of technological innovation, new trade arrangements, improvements in public sector finances, and other developments that may have altered their price-setting behaviour. To better understand the impact of these influences, firms were asked, "To the best of your knowledge, has the frequency of price adjustment changed in the past decade?" The evidence suggests that prices in Canada have become more flexible over the past decade. While slightly more than half of the sample had not changed the frequency with which they adjusted prices over the past decade, 45 per cent had adjusted it. Three-quarters of firms in this latter group now change prices more often than they did a decade ago.

The evidence suggests that prices in Canada have become more flexible over the past decade.

13. Survey results on price flexibility are consistent with the findings reported in Bils and Klenow (2002).

Box 1
A Comparison of Selected Price-Setting Surveys

Comparing the Bank of Canada Survey with Three Previous Surveys

Survey features	United States	United Kingdom	Sweden	Canada
Timing	April 1990–March 1992	September 1995	March–May 2000	July 2002–March 2003
Sample size	200	654	626	170
Representative by industry?	Yes	No, mainly manufacturing firms (68%)	No, manufacturing and service sectors only	Yes
Representative by firm size?	No, firms with <$10 million in sales excluded	No, dominated by large firms	Yes	Yes
Regional distribution?	16 states in U.S. Northeast	All regions	All regions	All regions
Random sample?	Yes	No	Yes	No

Key results	United States	United Kingdom	Sweden	Canada
Median frequency of price changes per year	1.4	2	1	4
Most frequently cited price-change frequency per year (i.e., mode)	1	1	1	1
Results: Highest ranked theories of price stickiness[b]	Coordination failure Non-price adjustment Cost-based pricing Implicit contracts Explicit contracts	Cost-based pricing Implicit contracts Explicit contracts Procyclical elasticity[a] Pricing thresholds[a]	Implicit contracts Explicit contracts Cost-based pricing Coordination failure Counter-cyclical cost of finance[a]	Cost-based pricing Customer relationships Explicit contracts Non-price adjustment Coordination failure

a. Not surveyed in the Bank of Canada study

b. Rankings for the United States, the United Kingdom, and Canadian studies are based upon the percentage of firms that recognized a particular theory, whereas rankings for the Swedish study are based on mean scores. Mean scores take into consideration the subjective responses of the firms to a particular theory. In the Canadian study, mean scores could only be calculated for the six main theories, and the rankings are identical to those based on percentage recognition.

Firms with increased price flexibility were asked why they had adjusted their pricing behaviour. Three factors were noted (in order of importance): increased competition, increased use of information technology, and increased volatility of input costs.

As many firms explained, more competition means that their price in the market is wrong or "offside" more often, and the costs of being offside increase dramatically as competition increases. Information technology, for its part, acts as a tool to facilitate price reviews and adjustments, in that it enhances the information flow, thereby reducing costs and lags associated with the price-setting process. The third factor, increased volatility in input costs, was related to volatility in foreign exchange rates and raw material and energy prices.

Why does pricing behaviour vary among firms?

Several firm characteristics were found to be statistically significant factors influencing firm-level price-setting behaviour (Table 2).[14]

Sectors: Price changes are most infrequent at firms in the "other commercial services" sector, where they are generally reviewed and set annually. Many of these service firms described the annual price change as synchronized to the annual wage settlement with staff.[15] Firms in retail and wholesale trade are at the other end of the distribution, with a median of seven price changes per year. Other sectors are clustered near the centre, with three to five price changes per year.[16]

Firm size: Large firms change prices about twice as often as medium firms and five times more frequently than small firms.[17] Many respondents explained that senior staff at small firms have numerous tasks in addition to reviewing and adjusting prices. The administrative and management costs associated with the price-setting process are therefore particularly onerous for small firms.

Number of competitors: A firm's market circumstances play a role in determining its price-setting behaviour.

Table 2

Characteristics That Influence Variations in the Frequency of a Firm's Price Adjustments

Factors leading to variations in the frequency of price adjustments[a]	Number of respondents (*n*)	Median number of price adjustments	Per cent of firms reporting:	
			< 1 price change per year	> 52 price changes per year
Total sample	170	4	34	18
Sectors**				
Construction	18	5	22	6
Manufacturing	44	4	36	16
Retail and wholesale trade	25	7	4	28
Transportation, information, and cultural industries	22	3	45	27
Finance, insurance, and real estate	27	4	30	15
Other commercial services[b]	34	1	50	15
Firm size (using # of employees)***				
Small (less than 101)	54	2	39	9
Medium (101– 499)	48	4	42	15
Large (more than 499)	68	10	25	26
Geographic distribution of sales*				
Export sales less than 50% of total sales	137	3	36	16
Export sales at or more than 50% of total sales	33	9	27	24
Number of competitors**				
0-5	68	2	49	16
greater than 5	102	4	25	19
Price-review type ***				
State-dependent	57	10	14	30
Time-dependent	113	2	44	12

a. A Kruskal-Wallis rank sum test of the equality of populations was conducted. For more information about the Kruskal-Wallis rank sum test, see Kvanli, Guynes, and Pavur (1992).
* indicates the rejection of the null hypothesis at the 80 per cent confidence level
** indicates 90 per cent confidence level
*** indicates 99 per cent confidence level
b. See footnote d in Table 1.

For example, firms with fewer competitors tend to be better able to resist more frequent price changes. As previously mentioned, firms themselves reported

14. To the extent that characteristics such as the breakdown of firms by sector and size are found to be significant, they highlight the importance of having a representative sample when drawing conclusions about economy-wide behaviour.
15. These firms conform to standard staggered contract models such as those proposed by Taylor (1979).
16. These results are similar to those found in Hall, Walsh, and Yates (1997). They show that construction and retail firms have the highest frequency of price adjustment, while firms in other service industries have the lowest frequency.
17. Buckle and Carlson (2000) also find that small firms change prices less frequently.

increased competition as a major source of increased price flexibility.

Sales distribution:[18] Firms with a significant export sales base have a higher number of median price changes. This suggests that exposure to international customers will tend to make firm-level pricing more flexible. Firms focused on sales in their home region have fewer price changes. This may help to explain why the Canadian economy, an economy very much open to trade, has flexible prices.

Price reviews: Firms generally review prices in one of two ways: time-dependent, using a fixed frequency (e.g., quarterly, weekly, annually) or state-dependent, when they perceive a change in the "state" of the market. The majority (about two-thirds)[19] of firms surveyed exhibit time-dependent price-reviewing behaviour.

Firms with time-dependent price reviews have far stickier prices than do state-dependent price reviewers. Many firms reporting state-dependent price reviews offer different prices to different customers for the same, or similar, products.

What causes firms to change prices?

Another important issue for the conduct of monetary policy is what causes firms to change prices. Whatever triggers a price change is the theoretical first step in a microeconomic process that will ultimately lead to a change in the rate of inflation.

Respondents ranked "price changes by competitors" as the most important factor leading firms to change prices.

Table 3 illustrates the dominant role competitive forces play in driving price changes. Respondents ranked "price changes by competitors" as the most important factor leading firms to change prices. Following competitor actions, "changes in domestic input costs" and "changes in demand" were cited as equally important factors, suggesting both supply-side and demand-side factors are at play.[20] Wage changes were next in the rankings, followed by several other factors of similar importance.

Depending on the industry, however, rankings do differ. For example, goods-producing industries consistently ranked domestic non-labour input costs higher in

Table 3

Rankings and Mean Score of Reasons for Price Adjustments

Triggers / Causes[a]	Total sample		CONS	MFG	R&WT	TIC	FIRE	OCS
	Mean score[b]	Rank[c]	Rankings based on mean score					
Price changes by competitors	3.16[d]	1	4	1	1	2	1	1
Change in domestic input costs (non-labour)	2.90	2	1	2	2	5	3	5
Change in demand for product/ service	2.89[d]	3	2	3	3	1	2	3
Change in wage costs	2.53[d]	4	3	5	7	3	6	2
Firm routinely changes prices	2.18	5	7	7	4	4	8	4
Change in taxes, fees, and other charges	2.09	6	6	6	8	8	5	6
Change in economic/ inflation forecast	2.01	7	5	9	9	6	4	7
Change in exchange rates	1.87	8	9	4	5	9	9	8
Sales campaigns	1.84	9	8	8	6	7	7	9

* CONS = Construction, MFG = Manufacturing, R&WT = Retail and Wholesale Trade, TIC = Transportation, Information, and Culture, FIRE = Finance, Insurance, and Real Estate, OCS = Other Commercial Services.

a Firms were also asked about directives from parent companies. The response was insignificant, scoring last in all industries, and so is excluded from this table.

b The mean score in column 2 is the weighted average of the firms' response to the importance of each trigger, where 4 is "very important," and 1 is "not important." The numbers in columns 3 to 9 are rankings for the importance of each trigger for a given industry.

c Ranking based on the total sample

d Mean score is statistically different at the 5 per cent level of significance from the mean score below it

18. Firms were asked to respond to the question using the currency of their main business activity. This implies that daily exchange rate fluctuations were not considered a source of price flexibility.

19. Results contained in Hall, Walsh, and Yates (1997) are similar.

20. These findings match results reported in Apel, Friberg, and Hallsten (2001).

importance than did firms in service-producing industries, where changes in demand ranked higher.

Wages were most important in the "other commercial services" sector—a point previously identified as leading to annual price-setting behaviour. Economic and inflation forecasts were of some importance to the finance, insurance, and real estate and construction sectors. Exchange rates were most important to manufacturers, wholesalers, and retailers.

Why might prices be rigid?

The study assessed 11 explanations for holding prices steady even though there are pressures for a change. These theories were proposed to firms as a series of short, plain-language statements and are listed in Table 4, along with the percentage of firms that recognized these various theories as reasons why prices may change infrequently.

The results indicate that cost-based pricing, customer relations, explicit contracts, and non-price adjustment were the theories most recognized by respondents.

Each theory attributes sticky price behaviour to specific causes. For example, sticky information describes firms as making the best decision with the information available at the time. However, that information is subject to lags and is updated infrequently. Other theories give institutional arrangements, such as contracts, both written and unwritten, an important role in price rigidities. These agreements between parties, whether they are explicit or implicit, often fix prices as a means of protecting one or both parties, but also reduce the opportunities to adjust prices. Cost-based pricing suggests that prices of final goods adjust to costs with a lag. This lag depends on how quickly individual firms revise prices to reflect changes in costs and the length of the multi-stage production process for a final good. Given the firm-specific focus of the survey, questions on cost centred on the firm-level responses to costs, not the chain-of-production process among firms. Coordination failure attributes price stickiness to the preferences of firms to hold back on a price change and wait for other firms to change their prices first. If all firms behave this way, a required price change may not go ahead for some time.

Menu and customer relations costs suggest that there are fixed costs associated with adjusting prices, and that these costs force firms to reduce the number of adjustments they undertake. Non-price adjustment proposes that firms change the characteristics of their product or service instead of changing prices. Low inflation may also make it difficult for firms to adjust prices because price changes are immediately viewed as real price changes as opposed to nominal price changes. Finally, we included a category based on results from pretesting that suggest that factors influencing prices do not change often enough to warrant changing prices more often.

The results indicate that cost-based pricing, customer relations, explicit contracts, and non-price adjustment were the theories most recognized by respondents. Sticky information and menu costs were the least recognized (Table 4). It should also be noted that theory recognition by firms is not mutually exclusive. For example, firms might indicate that they hold back on a price increase (i.e., coordination failure) because they fear antagonizing customers (i.e., customer relations).

Do costs matter?

As we noted in the section on what causes companies to change prices, input costs play an important role in the price-setting process. These results are confirmed here. Cost-based pricing was the most widely recognized theory among respondents, with 67 per cent of the sample accepting it as a reason for price inertia (Table 4). This theory suggests that there are lags between cost and price changes at firms and at different stages of production across firms.

Even though the lags between cost and price changes may be short, some researchers have suggested that, when multiplied by the various levels in the chain of production across firms, they may cause considerable price inertia in final consumer prices (Gordon 1981; Blanchard 1983). However, firms were asked questions about their own behaviour, so the survey provides information only on the lags in cost and price changes at the firm, not across firms.

The results of this survey indicate that a lag does indeed exist between changes in costs and changes in prices at the firm level. Even when these firms expect an increase in input costs, fully 61 per cent of the firms that accepted cost-based pricing indicated that they would delay price changes. In fact, many firms actively try to hold back price increases. For example, if they foresee a cost increase, 38 per cent report buying in advance and storing inventory, and 26 per cent report hedging against cost increases. Measures of this type

Table 4

Percentage of Firms That Recognized Each Theory as a Reason for Infrequent Price Changes

Theories	Description given to respondents	Percentage recognition
Cost-based pricing	Prices depend mainly on the costs of labour and raw materials used in producing goods and services. Therefore, prices don't change until costs change.	67.1
Customer relations	Prices could not change more often without disturbing customer relations.	55.3
Explicit contracts	Firms would like to adjust prices more often to reflect market conditions, but fixed-price contracts make it difficult to pass on price increases when a contract is active.	45.3
Non-price adjustment	Firms are more likely to amend product characteristics (e.g., warranty, delivery lag) than prices.	44.1
Coordination failure (rising prices)	Firms delay price increases because they do not want to be the first in the industry to raise prices.	41.2
Low inflation	Low inflation makes large price changes more noticeable.	33.5
Implicit contracts	Firms delay price increases because they have an implied understanding with customers that they will not raise prices in tight markets.	31.8
Coordination failure (falling prices)	Firms delay price cuts because they do not want to be the first in the industry to cut prices.	31.2
Factors do not change	Factors influencing prices do not change often enough to warrant changes.	31.2
Menu costs	It would be too costly to change prices more often (e.g., time, effort, out-of-pocket costs).	21.2
Sticky information	The information used to review (and ultimately change) prices is available infrequently. Therefore, prices may be slow to adjust to new conditions.	13.5

are more typical in goods-producing sectors, which can more effectively hedge or store their inputs. Beyond these sources of inertia, some firms report having to give customers advance notice—as much as six months—of a price increase. This creates another wedge between cost shocks and price responses.

Do contracts matter?

Explicit contracts fix prices over a specified period of time and have long been recognized as a source of price stickiness. Survey results show that 75 per cent of Canadian firms use contracts. Because some contracts include price escalator or de-escalator clauses or may not fix prices, only 45 per cent of the sample recognized explicit contracts as inhibiting price increases.[21] About 29 per cent of these firms reported that contracts did not prevent prices from decreasing when demand or costs fell. This result suggests that explicit contracts introduce somewhat more price inertia when prices are rising than when they are falling.

How long are prices fixed under explicit contracts? The most frequently cited contract length was 12 months, but owing to the existence of long-lived contracts, the average contract length was 23 months. Contract lengths have generally remained unchanged over the past 10 years, despite low rates of inflation over this period.

Implicit contracts, which are a verbal commitment not to raise prices in strong markets, were acknowledged as an explanation for price rigidity by about 32 per cent of firms. However, about two-thirds of these firms indicated that this commitment is not reciprocated by customers, who demand price concessions in weak markets. This suggests that implicit contracts also constrain prices more when market conditions strengthen than when they weaken. This asymmetric effect on price adjustment is more pronounced with implicit than with explicit contracts.

Does competition matter?

Coordination failure (not moving prices before one's competitors) on a price increase was recognized by 41 per cent of the sample. However, only 31 per cent recognized this as an explanation for price rigidity when prices are declining. This result suggests more price inertia when prices are rising than when they are falling. When firms were asked why prices were not increased until their competitors moved, the main response was a fear of losing or antagonizing customers.

Asymmetrical effects are present in another interesting way. Firms that identify themselves as price leaders in an industry should be the ones who identify least with this theory, since a price leader, by definition, would move prices without regard for its competitors. However, results show that even firms that identify themselves as the price leader in their industry have an asymmetrical reaction to coordination failure. The market leader shows little reluctance in initiating a price decrease. However, on a price increase, the price leader is just as worried as other firms about the negative consequences. This is a particularly interesting result because it shows that competitive forces are important.

21. The price rigidity implied by firms recognizing fixed-price contracts is lessened to the extent that slightly more than 10 per cent of these firms use contracts for fewer than 50 per cent of total sales.

Do customer relationships matter?

The fear of antagonizing customers is a key issue and underscored much of the firms' commentary about what makes changing prices difficult. Firms were explicitly asked if the costs of maintaining customer relations were a source of price inertia. This theory was ranked second highest as an explanation for price stickiness. Respondents felt that customers disliked frequent changes and "expected" stability.[22] Firms were concerned about being perceived as unprofessional if they changed their prices too often.

The fear of antagonizing customers is a key issue and underscored much of the firms' commentary about what makes changing prices difficult.

Perhaps the most compelling evidence on customer relations costs comes from Table 5, which shows the entire sample of firms divided into four groups based on the frequency with which the firms adjust prices. Here, the importance of customer relations truly stands out. Fully 76 per cent of firms with fewer than two adjustments recognized this factor as a source of price rigidity, compared with 37 per cent who adjust prices more than 52 times a year. Customer relations costs have played only a peripheral role in mainstream theoretical work. Recently, however, theorists (Rotemberg 2002, 2004) have begun to model price rigidity on the basis of customer relations costs.

Table 5 also points to other interesting patterns. For example, the firms with the most rigid prices have recognition rates for all theories that are similar to or higher than those of their counterparts with flexible prices. Furthermore, some theories with low recognition overall have significantly higher acceptance among the lowest frequency price setters. Menu costs were acknowledged by only 21 per cent of the respondents overall, but by 38 per cent of firms with fewer than 2 changes. Only 3 per cent of firms with more than 52 price changes per year accepted this explanation. Firms for which menu costs matter clearly set prices less frequently. On the question of whether low inflation makes large price changes more noticeable, firms with sticky prices were, again, significantly more sensitive to the possibility that price changes above the rate of inflation would attract negative attention from customers.

22. Okun (1981) suggested that firms limit price changes because frequent changes would increase customers' search and shopping costs and would therefore antagonize them.

Table 5

Percentage Recognition of Pricing Theory by Frequency of Price Adjustment

Theory	Whole sample	Frequency of price adjustment per year				F-test values[a]	Probability of no variation	Statistically significant differences between the column numbers[b]
		0–1 n = 58	2–4 n = 39	5–52 n = 43	>52 n = 30			
		Col. 1	Col. 2	Col. 3	Col. 4			
Cost-based pricing	67.1	69.0	74.4	62.8	60.0	0.7	0.565	none
Customer relations	55.3	75.9	59.0	37.2	36.7	7.4**	0.000	1&3,** 1&4**
Explicit contracts	45.3	34.5	43.6	53.5	50.0	0.9	0.438	none
Non-price adjustments	44.1	46.6	46.2	41.9	40.0	0.2	0.921	none
Coordination failure (rising prices)	41.2	48.3	41.0	39.5	30.0	0.9	0.429	none
Low inflation	33.5	48.3	25.6	25.6	26.7	2.9**	0.034	1&2,* 1&3*
Implicit contracts	31.8	37.9	33.3	27.9	23.3	0.8	0.511	none
Coordination failure (falling prices)	31.2	29.3	30.8	37.2	26.7	0.4	0.779	none
Factor stability	31.2	48.3	30.8	20.9	13.3	5.1**	0.002	1&3,** 1&4**
Menu costs	21.2	37.9	20.5	11.6	3.3	6.5**	0.000	1&3,* 1&4,** 2&4*
Sticky information	13.5	17.2	15.4	11.6	6.7	0.7	0.550	none

a. *indicates rejection of null hypothesis of equal means at the 10 per cent level
** indicates rejection of null hypothesis of equal means at the 5 per cent level

b. Two-sample t-test assuming unequal variances. Critical values of tests were corrected using a Bonferroni normalization, which corrects for the possibility of falsely accepting significant results.

Conclusions

This survey of the pricing behaviour of a representative sample of Canadian firms has several interesting findings. Firms show wide variation in the frequency with which they adjust prices, with half of Canadian firms changing prices at least once every three months. The survey also found evidence of increased price flexibility among Canadian firms over the past decade, owing to intensified competition and greater use of information technologies.

Several characteristics of firms influence price-setting behaviour. Small firms, service sector firms, and firms with a large proportion of domestic sales adjust prices relatively infrequently. As for what leads firms to adjust prices, price changes by a competitor were the most important trigger. In aggregate, firms ranked supply and demand factors as equally important triggers of a price change.

Beyond understanding how firms set prices, this study was equally concerned with understanding the reasons for price inertia. In particular, firms reacted favourably to the idea that prices do not change until a firm has seen its costs change. Firms were also concerned about adjusting prices ahead of their competition. In addition, some firms using sales contracts hold nominal prices fixed, regardless of market conditions that would otherwise call for a change in price.

These theories as to why profit-maximizing firms may keep prices unchanged, despite pressures to adjust them, seem to have a common genesis: firms' fears of antagonizing customers or disturbing the goodwill or reputation developed with them. The theory of customer relations was the second most popular choice overall and was accepted by three-quarters of firms with the stickiest prices.

Given that customers are more likely to be antagonized by a price hike than by a price cut, we would expect fewer rigidities in cutting prices than raising prices. Firms were queried about these possible asymmetries. Evidence suggests that firms may face more price inertia when experiencing upward price pressures than when experiencing downward price pressures.

Some implications of these results are worth considering despite the caveats that may be attached to this analysis. If, as we have found in this survey, prices in Canada are relatively flexible and have become more flexible over time, inflation may be more responsive to interest rate changes. Thus, inflation targets could be achieved with shorter lags and with less impact on activity in the real economy. Moreover, greater flexibility not only reduces the effects of monetary policy on the real economy, but also reduces the need for countercyclical policy.

The asymmetrical response of prices to changes in economic conditions (i.e., more flexibility downward than upward) also has implications for the conduct of monetary policy. For one, this result runs counter to recent concerns that prices are more sticky downwards than upwards. Similar asymmetries and implications were found by Blinder et al. (1998). While these results are compelling, they require further validation. They say nothing, for example, about wages, the area where downward rigidities are thought to be more important. While the survey offered some insights into price-setting asymmetries, more extensive questioning and further research would be invaluable in refining these results.

Literature Cited

Amirault, D., C. Kwan, and G. Wilkinson (forthcoming). Bank of Canada Working Paper.

Apel, M., R. Friberg, and K. Hallsten. 2001. "Micro Foundations of Macroeconomic Price Adjustment: Survey Evidence from Swedish Firms." Sveriges Riksbank Working Paper No. 128.

Bils, M. and P. Klenow. 2002. "Some Evidence on the Importance of Sticky Prices." NBER Working Paper No. 9069.

Blanchard, O. 1983. "Price Asynchronization and Price Level Inertia." In *Inflation, Debt, and Indexation*, edited by R. Dornbusch and M. Simonsen. Cambridge, MA.: Massachusetts Institute of Technology Press.

Blanchard, O. 1994. Comment on "On Sticky Prices: Academic Theories Meet the Real World," by A. Blinder. In *Monetary Policy*, 150–54. Edited by N.G. Mankiw. Vol. 29 in NBER Studies in Business Cycles. Chicago: University of Chicago Press.

Blinder, A. 1991. "Why Are Prices Sticky? Preliminary Results from an Interview Study."*American Economic Review* 81: 89–96.

———. 1994. "On Sticky Prices: Academic Theories Meet the Real World." In *Monetary Policy*, 117–50. Edited by N.G. Mankiw. Vol. 29 in NBER Studies in Business Cycles. Chicago: University of Chicago Press.

Literature Cited (cont'd)

Blinder, A., E. Canetti, D. Lebow, and J. Rudd. 1998. *Asking About Prices: A New Approach to Understanding Price Stickiness*. New York: Russell Sage Foundation.

Buckle, R. and J. Carlson. 2000. "Menu Costs, Firm Size and Price Rigidity." *Economics Letters* 66: 59–63.

Carlton, D. 1986. "The Rigidity of Prices." *American Economic Review* 76: 637–58.

Cecchetti, S. 1986. "The Frequency of Price Adjustment: A Study of the Newsstand Prices of Magazines." *Journal of Econometrics* 31: 255–74.

Fabiani, S., A. Gattulli, and R. Sabbatini. 2004. "The Pricing Behaviour of Italian Firms: New Survey Evidence on Price Stickiness." European Central Bank Working Paper No. 333.

Gordon, R. 1981. "Output Fluctuations and Gradual Price Adjustment." *Journal of Economic Literature* 19: 493–530.

Hall, S., M. Walsh, and A. Yates. 1997. "How Do UK Companies Set Prices?" Bank of England Working Paper No. 62.

Kashyap, A. 1995. "Sticky Prices: New Evidence from Retail Catalogs." *Quarterly Journal of Economics* 110: 245–74.

Kvanli, A., S. Guynes, and R. Pavur. 1992. *Introduction to Business Statistics: Computer Integrated Approach*. St. Paul: West Publishing Co., 892–94.

Martin, M. 2004. "The Bank of Canada's Business Outlook Survey." *Bank of Canada Review* (Spring): 3–18

Nakagawa, S., R. Hattori, and I. Takagawa. 2000. "Price-Setting Behavior of Japanese Companies." Bank of Japan Working Paper.

Okun, A. 1981. *Prices and Quantities: A Macroeconomic Analysis*. Washington, D.C.: The Brookings Institution.

Organisation for Economic Co-operation and Development (OECD). 2003. *Business Tendency Surveys: A Handbook*, pp. 21–23.

Rotemberg, J. 2002. "Customer Anger at Price Increases, Time Variation in the Frequency of Price Changes and Monetary Policy." NBER Working Paper No. 9320.

———. 2004. "Fair Pricing." NBER Working Paper No. 10915.

Taylor, J. 1979. "Staggered Wage Setting in a Macro Model." *American Economic Review* 69: 108–13.

Zbaracki, M., M. Ritson, D. Levy, S. Dutta, and M. Bergen. 2003. " Managerial and Customer Costs of Price Adjustment: Direct Evidence from Industrial Markets." Bar-Ilan University Economics Working Paper No. 2003.