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## **1. INTRODUCTION**

This paper reports the results of a survey asking Colombian businesses about the way in which they set the prices of their main products. The questionnaire's design was based on the works of Blinder (1991, 1994), Blinder et al. (1998) and those they carried out under the framework of the Eurosystem Inflation Persistence Network (IPN) (Fabiani et al., 2005).<sup>1</sup>

This work also supplements other studies on price setting in Colombia which employ different types of approaches. Among the most important of these is research based on the use of quantitative databases originally constructed for creating Colombia's producer price index (Julio and Zárate, 2008).

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<sup>&</sup>lt;sup>1</sup>This is the first attempt in our country to carry out a survey following strict technical and conceptual guidelines. Nonetheless, it is important to recognize a previous work which, with all the technical and financial limitations of a pregraduate economics thesis, attempted to sound out Colombian businesses on the same topic (Arosemena, 2001).

Interest in clarifying how firms set their prices began to grow during the eighties when a group of authors started to notice an important stylized fact: firms' price setting behavior apparently determines the way in which monetary policy decisions –interest rates, money and inflation– affect the economy as a whole. This goes against one of the main precepts of neoclassical macroeconomic theory, according to which the behavior of monetary variables does not affect real variables. Such theory is based on the fact that changes in prices do not generate costs and therefore take effect immediately.<sup>2</sup> One explanation for this stylized fact emerged from contributions made by New Keynesian economists. According to them, an explanation for such behavior can be found in the fact that price changes are delayed, i.e., they are rigid. The first models in which they specifically collected that idea suggested that strategic interactions among firms, cost conditions, the relationship between firms and their customers, and costs of reviewing price lists, were reasons why prices might not change so frequently.

Nowadays it is accepted that the way monetary policy is implemented can affect economic activity. The essential assumption to obtain real and nominal effects from monetary policy is the stickiness of prices, i.e., that they remain fixed for at least short periods of time. If price adjustment is incomplete after a monetary shock, monetary policy will have real effects in the short-term at least. Thus, the impact of changes in interest rates on inflation and GDP is affected by the degree and type of rigidities prices exhibit. In this context, better understanding of price rigidities is fundamental for analyzing macroeconomic phenomena such as the impact of monetary policy on output and employment, and the size of economic fluctuations.

Microeconomic evidence on price adjustment has grown substantially during the last few years, making it possible to use this in complete macroeconomic models. Such knowledge is essential for constructing inflation models with the macroeconomic fundamentals appropriate to allow improved monetary policy design and performance.<sup>3</sup> These models usually include different types of nominal rigidities through which monetary policy affects real economic activity over the short and medium term. In this regard, the well-known formulas of Calvo (1983) and Taylor (1980) on

<sup>&</sup>lt;sup>2</sup> This point of view was questioned by Friedman and Schwartz (1963) as well as other authors who found evidence that changes in money and prices (nominal variables) could affect unemployment and output (real variables).

<sup>&</sup>lt;sup>3</sup> Máckowiak and Smets (2008) warn that results of microeconomic studies cannot be automatically applied to macroeconomic models.

price rigidities have been employed to construct a significant amount of monetary models in which monetary policy has real effects.

Recent studies on the topic have stopped focusing on the price setting of a single company or individual market<sup>4</sup> in order to have a wider reach. Such studies include two types of analysis. The first approach stems from the liberation by statistics bureaus of large databases collected as a base for calculating consumer and/or producer price indexes. Pioneering works in this line of study were those of Bils and Klenow (2004) for the USA and Baharad and Eden (2004) for Israel. Other efforts in this line of research were made later by the European Central Bank's IPN. The second proposal was based on designing direct surveys with straightforward questions on the reasons and procedures businesses followed when fixing the prices of their products. The first of this type of surveys were developed by Blinder (1991, 1994) and Blinder et al. (1998) for the United States (USA), Hall et al. (2000) for the United Kingdom (UK), Apel et al. (2005) for Sweden, Amirault et al. (2006) for Canada and also by the European Union's Inflation Persistence Network (Fabiani et al., 2005).

Studies made with direct surveys have certain advantages over those using consumer or producer price index databases. Although the latter achieve a very complete quantitative characterization of the periodicity and size of changes in prices, they do not provide sufficient understanding of the main determinants guiding the actions of those setting prices. There are certain aspects of firms' pricing policies that can only be researched from qualitative information; such is the case, for instance, of the group of information businesses consider when reviewing their prices. In any case, survey results are useful for verifying and extending evidence obtained with quantitative micro data (Álvarez and Hernando, 2005).

The results reported in this paper come from a direct survey carried out by Banco de la República in two stages.<sup>5</sup> The first was a pilot survey which tested the technical solidity of the questionnaire designed for sounding out businesses. This took place between August and October 2007, questioning 142 business managers. The second stage used the refined questionnaire to survey a final sample of 787 business managers and was carried out between November 2007 and May 2008. Design of the questions on the form was based on the experiences of other countries

<sup>&</sup>lt;sup>4</sup> Such as, for example, the pioneering works on magazine prices by Cecchetti (1986), sales catalogue prices by Kashyap (1995), gasoline distributer retail prices by Asplund et al. (2000), or supermarket prices by Levy et al. (1997).

<sup>&</sup>lt;sup>5</sup> Banco de la República encharged field work to Centro Nacional de Consultoría.

which have made similar surveys, including some studies carried out in developing economies.  $^{6}$ 

Under this context, one of the survey's objectives is to deepen knowledge on price setting by Colombian firms. In particular, it explores the degree of autonomy firms have for changing their prices and the existence of periodic pricing review policies (time dependent) or policies dependent on the state of the economy (state dependent). It also investigates the set of information employed in making decisions on price changes, the frequency of pricing reviews and changes, and the use of some type of discrimination for determining prices. Its second objective is to analyze the main factors leading to price changes as well as the speed at which firms react to different shocks. It studies underlying factors (cost structure, degree of competition, among others) explaining sectorial differences observed in the frequency of price changes and the speed of response to different shocks. The final objective is to provide empirical evidence for the different theories set forth by literature for explaining the price adjustment lags.

This introduction is the first of seven sections contained in this paper. The second section presents a review of pertinent literature, while the third explains the methodology employed for carrying out and processing the survey. The characteristics of the firms surveyed are presented in the fourth section and an analysis of the determinants of pricing review is made in the fifth section. Meanwhile, the sixth section shows the way in which changes are made. The factors associated to price changes, such as asymmetries in adjustments and response times after a shock are topics of the next section. Finally, the last section gives the conclusions.

## 2. A REVIEW OF THE LITERATURE

Since the pioneering studies of Blinder (1991, 1994), the survey approach has become more and more powerful for providing information on the way firms set their prices. Box 1 summarizes the most important studies carried out since then. After Blinder efforts were made at the Bank of England (Hall et al., 1997), the Bank of Japan (Nakagawa et al., 2000) and the Swedish central bank (Apel et al., 2001). Later, in 2003 and 2004 nine euro zone central banks (Italy, Belgium, Germany, France, Spain, the

<sup>&</sup>lt;sup>6</sup> Section 2 presents a summary of the literature examined in this paper.

Netherlands, Luxembourg, Portugal and Austria) surveyed firms on their price setting behavior. This effort was part of a collaboration project called the Eurosystem Inflation Persistence Network (IPN). Surveys have been carried out more recently in Canada (Amirault et al., 2006), Rumania (Sahinöz and Saraçoglu, 2008) and Mexico (Castañon et al., 2008).

Despite the high costs that collecting information on prices through a direct survey can have, its advantages make it increasingly popular. Among the latter is the possibility to research in depth: *i*) the group of information businesses employ when reviewing prices and *ii*) the relative importance businesses give to different price rigidity theories. In fact, many of the new theories have emerged before previous ones have even been rejected, posing questions that can only be answered through surveys. In addition, the use of direct surveys allows the two stages of the price setting process (review and change) to be studied separately. These also provide a basis for empirically evaluating the response of prices, both their direction and size, to different shocks the economy might experience. Thus, the diverse information that can be extracted from direct surveys surpasses the limits of conventional approaches employing econometric study of aggregate time series data, with which it is not possible to answer many of the relevant questions posed by the topic.

Box 1 shows the date of the surveys,<sup>7</sup> the size of the samples, the response rate of firms surveyed, the sectorial coverage of the survey, the type of sampling used and the price rigidity theories business managers identified as the most important for explaining their behavior.

Although the first surveys were not carried out by central banks, one characteristic of this type of study is that it is mostly made at central banks or with the participation of researchers linked to such institutions. In the majority of cases surveys were carried out directly by the central bank, although some of these institutions used external research centers to collect information using questionnaires they had designed. Such was the case, for instance, of surveys carried out in Germany, Spain, the Netherlands and Austria. In other cases, questionnaires were sent by post after previous telephone contact. Responses could be sent directly to the bank by fax or post, or the questionnaire was received. Only a few banks used internet as an alternative for collecting survey information (Spain, Portugal, Italy and the Netherlands). The Bank of Canada made direct surveys in

<sup>&</sup>lt;sup>7</sup> This date does not coincide with the publication of the research's results.

which all the pollsters were officials from the bank. Blinder's (1991) seminal work also included direct surveys. Differences in the procedures used explain the dispersal in the response rate observed in the third column of Box 1.

		Firms in the sam	-	Sampling	
Country	Date	ple/response rate	e Sectors	technique	Theories
Austria	2004	2,500 / 36%	M, S	Random stratified	Contracts (explicit and implicit)
Belgium	2004	5,600 / 35%	M,Rc, S, Cons	Random stratified	Implicit contracts
Canada	2002 – 2003	170 / 100%	M, Rc, S, Cons	By quota	Idle costs
France	2003 – 2004	4,300 / 38%	М	Random stratified	Coordination failures
Germany	2004	2,740 / 46%	Μ	Purposive	Explicit contracts
Italy	2003	729 / 46%	M, Rc, S, Cons	Random stratified	Explicit contracts / coordination failures
Japan	2000	1,202 / 56%	M, Rc, S, Cons, Trans	N.A.	Coordination failures
Luxembourg	2004	1,100 / 30%	M, Rc, S, Cons	Random stratified	Explicit contracts
Mexico	2005	745 / 53%	М	Random stratified	Idle costs
Portugal	2004	2,494 / 55%	M, S	Random stratified	Implicit contracts
Rumania	2006	1,901 / 19.8%	The whole eco- nomy	Random stratified	Implicit contracts
Spain	2004	3,000 / 69%	M, Rc, S	Random stratified	Implicit contracts
Sweden	2000	1,300 / 48.7%	M, S	Random	Implicit contracts
The Netherlands	2004	1,870 / 67%	M, Rc, S	Random stratified	Implicit contracts
Turkey	2005	999 / 27.7%	M, Ener	Random	Mark-up
United Kingdom	1995	1,100 / 59%	M, Rc, S, Cons	No	Idle costs
United States	1990 – 1991	400 / 50%	M, Rc, S, Cons, Min	Random	Delivery times

#### **BOX 1.** THE LITERATURE REVIEWED

SOURCE: Own elaboration

NOTES: A: agriculture; M: manufacturing industry; Rc: retail commerce; S: services; Cons: construction; Ener: energy; Trans: transport; Min: mining; N.A.: not available.

Sectorial coverage of the surveys varies from country to country. In some cases the survey covers the whole economy (Rumania), while in others it focuses on manufacturing industry (Germany, Mexico). Some countries take commerce into account and others do not. Moreover, some countries include services and construction in their samples. The surveys carried out in Turkey and Rumania are different in that they include energy companies in their samples.

The sampling method employed is fundamental for reaching a correct inference on population characteristics. Most European countries employed previously prepared samples used in opinion polls and balance sheets or for other purposes. The most commonly used was random sampling stratified by sector or level of employment. Quota sampling (Canada) and purposive sampling (Germany) were seldom used. The latter type of sampling implies the compulsory inclusion of certain firms which need to be surveyed given their relative importance in the German economy (Stahl, 1995).

The last column of the box shows the theory chosen by those surveyed as the most important for explaining price rigidities. This column is referred to below in the explanation of each theory. At this moment it is used to show the importance of contracts (explicit or implicit) as a theory for explaining price rigidities. This theory explains price rigidities in ten out of the 17 works reviewed.

#### **3. METHODOLOGY**

The survey was carried out in two stages. The first of these was a pilot survey which took place in August and October 2007 and questioned 142 business managers. The second stage used an improved questionnaire based on the experience of the pilot survey for questioning a final sample of 787 business managers during November 2007 to May 2008. The survey was carried out by a private company (Centro Nacional de Consultoría) using a questionnaire designed by Banco de la República and constructed taking into account other countries' experiences in the area. The questionnaires were applied in person to those in charge of establishing pricing policies in the companies, such as, for instance, general managers, finance managers, marketing managers or production managers. This took place after a letter signed by the General Manager of Banco de la República had been sent requesting their collaboration and guaranteeing the complete confidentiality of the answers given by those taking part in the survey.

The polling company was given the sample of firms together with a list of replacement firms just in case any of the former was not able to take part in the survey.

## 3.1 Sample Design

The relevant population for the study comprises all firms who are obliged to report their financial statements to the Superintendencia de Sociedades or the Superintendencia Financiera in 2005. In accordance with 590 Act from the year 2000 they also had to have total assets of above 501 current legal minimum wages (salarios mínimos legales vigentes, SMLV) from the same year in order for them to be classified as non-large (small and medium) and large companies.<sup>8</sup> The population does not, therefore, include microenterprises given that we believe their pricing decisions do not significantly affect the behavior of aggregate prices in the economy. Likewise, the population studied does not include firms producing and/or providing services due to the fact that in such cases it is difficult to identify the main product they supply to the market. Thus, the population only includes firms which according to the International Standard Industrial Classification (ISIC) belong to sectors such as agriculture, hunting and forestry (section A), fishing (section B) and manufacturing (section D). Firms within the aforementioned sections were then separated according to their three digit classification number. From these, only subsectors which, in line with our criteria and research objectives, were relevant to price setting in Colombia were considered. Retail and wholesale firms in the commerce sector were not included in the study due to the difficulty of selecting a representative product which would allow them to correctly answer the questionnaire. A detailed description of the population with its three digit ISIC code can be found in Appendix A.

After employing the two categorizations mentioned above (size and economic sector), a population of 4,626 firms classified into 28 homogeneous strata was reached. Once the strata were identified, stratified random sampling with proportional representation was carried out, resulting in a representative sample of 743 firms at a 95% confidence level. However, in order to obtain greater variability in strata which ended up with a very small sample size, the sample was increased to 787 firms. Table 1 gives a summary of the composition of the final sample, showing both the

<sup>&</sup>lt;sup>8</sup> According to the Ministerio de la Protección Social, the SMLV for 2005 was \$381.500. Thus, in 2005, a firm was considered large if it reported total assets of over \$5.722.500 thousand million; medium if it reported total assets of between \$1.907.882 and \$5.722.500 thousand million and small if it reported total assets of between \$191.132 and \$1.907.882 thousand million.

sectorial division as well as that between large and non-large firms for each sector and the simple as a whole.

A pilot survey was carried out during the second half of 2007 (August and October) to ensure stratified random sampling was developed correctly. This survey was distributed to 142 randomly selected firms, a number taken from information obtained by Arosemena (2001), who following Blinder (1991, 1994) studied the presence of coordination failures among Colombian firms. The pilot survey had two main objectives. First, it allowed identification of the questionnaire's weaknesses and strengths. In fact, after it was analyzed a number of questions were reworded or eliminated in order to make the questionnaire as short and straightforward as possible. Second, results obtained from the pilot survey were used to construct a group of variance estimators within each stratum which allowed stratified random sampling to be carried out later. A description of the sampling method applied in this exercise can be found in Appendix B.

	1	Size		
ISIC	Large	Non Large	Total	Total (%)
Agriculture	28	57	85	10.8
Fishing	2	6	8	1.0
Food products	48	63	111	14.1
Textiles	18	24	42	5.3
Apparel	17	48	65	8.3
Leather	5	16	21	2.7
Wood and paper; Publishing and printing	25	57	82	10.4
Petroleum refining; Chemicals	33	39	72	9.1
Rubber and plastic	26	39	65	8.3
Minerals and metals	18	24	42	5.3
Metal products	16	43	59	7.5
Machinery and equipment	6	18	24	3.0
Electrical appliances <sup>a</sup>	5	14	19	2.4
Vehicles and remaining industry	29	63	92	11.7
Total	276	511	787	
Total (%)	35.1	64.9		100

TABLE 1. SAMPLE DISTRIBUTION

SOURCE: Own elaboration

<sup>a</sup> Includes communication equipment, medical instruments and other electronic devices

Regarding the response rate of survey participants, it is important to mention that, unlike in other exercises carried out in this field, 100% of the questionnaires were answered. This is due to the fact that a random

replacement process was carried out each time a firm in a strata did not respond to the pollster's first contact. Replacement was made by simple random sampling within each stratum following the ideas of Martínez (2002). This therefore allows us to have the representativity necessary to be able to make statistical inferences on the population studied.

### 3.2 Questionnaire Design and Implementation

The questionnaire employed was based on those developed by Blinder (1991, 1994), Hall et al. (1997), Apel et al. (2001), the members of the European Union's Inflation Persistence Network and others described in the preceding section. The final form has 32 questions grouped into five sections. It was constructed using non-technical language which could be understood by non-economists. The full questionnaire can be found in Appendix 3.

The first part of the questionnaire (questions 1 to 15) collect information on the main product sold by the firm, destination of sales, the existence of discriminatory policies among competitors and the type of relationship it has with its customers.

The second section (questions 16 to 24) investigates the firm's pricing policies. In particular, it asks about the firm's ability to set prices, i.e., if it is a price taker or setter, and about the determining factors it takes into account when setting the price of its main product. It also attempts to analyze the type of pricing review rule followed by Colombian firms: state dependent or time dependent; as well as the frequency of price adjustments and their evolution over the last five years.

The third part of the form (questions 25 to 27) analyzes the reasons explaining changes in prices as well as the period of time between the moment firms experience a shock and adjust their prices. It also studies the phenomenon of asymmetrical responses to economic shocks.

The fourth section (questions 28 to 30) asks about the type and relevance of information used by firms when reviewing prices. Special emphasis is placed on the effect Banco de la República's inflation target and the setting of the minimum wage have on pricing decisions.

Finally, section five (question 31) asks firms to rate the importance of different economic theories on price rigidities. For this reason a group of easily understood statements were prepared which attempt to identify the main idea behind each of such theories.

Once the questionnaire was completed and the sample was designed,

each of the firms was contacted by telephone in order to make an appointment between a representative from the polling company and the relevant person from the firm being interviewed, thereby allowing the survey to be carried out in person. Firms contacted by telephone were also asked if their target market was domestic or external. Those which answered that 100% of their production was exported were removed because the research is focused on the process of setting prices inside the country.

The questionnaire contains three types of questions. The first group of questions attempts to determine the importance the person taking part in the survey places on a given statement. The possible answers are "1=not important", "2=not very important", "3=important", "4=very important" and "9=do not know / no answer". Analysis of the results gives the average weighted population of all the alternatives. Likewise, for the questions that merit it, a hypothesis test of equality of means is carried out in order to be able to compare the fact that a pair of options are not statistically equal. This allows option ordering.

The second group of questions consists of the firm choosing an option from a list of posibilities. To analyze these results population shares are estimated in such a way as to be able to present relative frequencies for each question. Finally, the last type of question corresponds to those requiring an exact quantitative answer, for which weighted population means are calculated.

Calculation of stratified and weighted population means is based on developments presented by Hansen et al. (1953a and 1953b) and detailed in Appendix 5.<sup>9</sup> Estimates of each population mean are accompanied by the corresponding estimate of population variance. The latter allows hypothesis testing of equality of means. The weighter used corresponds to the operational revenues reported by each firm to the Superintendencia de Sociedades and the Superintendencia Financiera during the 2005 fiscal year. The chosen weighting scheme gives greater importance to the answers of firms with high operational revenues within each stratum because, presumably, their decisions are more relevant to the general level of prices in the economy.

<sup>&</sup>lt;sup>9</sup> In order to carry out a correct process of statistical inference, and in light of the existence of omitted values in some survey participant's answers, a multiple imputation procedure is employed in such way as to balance the database with all the answers to each question. More specifically, a Markov Chain Monte Carlo (MCMC) method is used, details of which are shown in Appendix 4.

### **3.3 Economic Conditions**

Economic conditions can affect agents' perceptions and the way they respond to a survey such as the one designed in this work. In the period when Colombian business managers answered the questionnaire (November 2007 to May 2008), Colombia's economy had lost the strength it had been exhibiting around that time. In fact, average growth during the preceding three years had been 7%, figure not observed since the years following the World War II. In particular, an increase in GDP such as the one registered in 2007 (8.2%) can only be compared with those observed in 1978 (8.2%) and 1949 (8.7%). Despite the strength of recent growth, in 2008 the Colombian economy had begun to slow considerably and by the first quarter of the year the figure for annual growth was 4.1%, half the size of that recorded in 2007.

Economic slowdown stemmed from a decline in external demand, rising internal tensions associated to reductions in local government spending, increases in the prices of imported raw materials and higher inflationary pressures affecting household consumption. In response to rising inflation Banco de la República changed its monetary policy stance in April 2006. This fact also contributed to reducing the strength of domestic demand and, as a consequence, to slowing economic growth (Banco de la República, 2008).

#### 4. CHARACTERIZATION OF THE MARKET WHERE FIRMS OPERATE

The characteristics of the markets where firms operate are important determinants of price setting policies. The first section of the questionnaire therefore asks about some of these including, for instance, the destination of sales, the level of competition they face, the type of relationship they have with their customers and the type of product they produce.

Firms from the population studied are mainly oriented towards the domestic market. The results in Table 2 indicate that 81.9% of Colombian firms channel their sales to the domestic market, while the remaining 18.1% do so to the external market. In the external market firms sell mostly to countries other than Venezuela and the USA. At sectorial level, local markets are very important for agriculture and food products, while vehicles are largely dependent on the Venezuelan market. In addition, most firms (71.6%) consider they have a long term relationship with customers for their main product. Evidence on the type of customer firms have is

relevant -it has traditionally been argued that long term customer relationships can cause firms to delay price adjustments in response to shocks. At the sectorial level, answers to the questionnaire show that this type of relationship is fundamental for sectors such as that of vehicles and petroleum refining (plus chemicals) and much less important for firms producing food and agricultural products.

СШ	Domestic sales (%)	USA sales (%)	Venezuela sales (%)	Other sales (%)	Sales percentage sales with long term customers
Agriculture	97.2	0.6	0.0	2.2	77.1
Fishing	74.1	21.1	0.0	4.9	80.9
Food products	94.9	0.5	0.3	4.3	43.9
Textiles	62.6	19.4	6.2	11.9	86.4
Apparel	73.3	2.8	14.0	10.0	86.3
Leather	77.1	13.3	1.5	8.1	81.0
Wood and paper; Publishing and printing	81.6	1.0	7.4	10.1	86.1
Petroleum refining; Chemicals	68.7	0.8	9.5	21.0	93.6
Rubber and plastic	85.1	2.3	4.6	8.0	84.3
Minerals and metals	87.1	2.1	3.6	7.3	86.1
Metal products	87.8	1.4	3.1	7.7	87.9
Machinery and equipment	81.8	0.9	7.2	10.1	90.7
Electrical appliances	63.5	0.0	12.8	23.7	86.1
Vehicles and remaining industry	48.8	1.9	40.8	8.5	93.2
Total	81.9	2.44	7.64	8.03	71.6

**TABLE 2.** POPULATION CHARACTERISTICS: SALES DISTRIBUTION AND BUSINESS RELATIONSHIPS<sup>a</sup>

SOURCE: Own elaboration.

<sup>a</sup> Characteristics inferred from a representative sample

Most Colombia firms produce consumption goods as their end product (68.4%), followed by intermediate goods (32.4%), while production of capital goods is very small (1.3%). This structure, shown in Table 3, is in line with the system of national accounts information. On the other hand, one very important characteristic obtained from the results of the questionnaire is that Colombian firms face a relatively small number of competitors. In general, Colombian firms have an average of five competitors. Ten out of the fourteen economic sectors into which Colombian firms were divided were characterized by having less than five competitors. According to survey participants' declarations, the four remaining sectors have between five and twenty competitors.

This result concerning the degree of competition faced by firms is more important for understanding the way these adjust their prices. In highly competitive markets firms are more likely to change their prices in response to a shock given that the opportunity cost of not doing so to an optimum level is very high. In contrast, the opportunity cost of not setting an optimum price is reduced for firms with market power. Álvarez and Hernando (2005) cite some relevant literature to illustrate the relationship between price rigidity and the degree of competition. Geroski (1992) finds that the response of prices to supply and demand shocks is faster in industries with greater competition. Hall et al. (2000) and Carlton (1986) also find something similar when they affirm that companies working in highly competitive markets tend to adjust their prices faster than firms facing less elasticity of demand.

ISIC	Finished Good Producer (%) <sup>b</sup>	Intermediate Good Producer (%)	Capital Good Producer (%)	Average number of competitors (%)	Existence of industry leaders (%) <sup>c</sup>	Leaders <sup>d</sup>
Agriculture	95.2	4.6	0.2	5 - 20	16.5	48.2
Fishing	97.6	2.4	0.0	5-20	55.3	100.0
Food products	80.4	22.5	0.0	5-20	75.5	82.2
Textiles	14.7	85.3	0.0	Less than 5	47.8	76.7
Apparel	99.1	0.9	0.0	5-20	22.6	63.0
Leather	4.7	95.3	0.0	Less than 5	1.2	41.8
Wood and paper; Publishing and printing	39.4	60.6	0.2	Less than 5	16.3	46.2
Petroleum refining; Chemicals	61.4	39.5	0.0	Less than 5	52.0	82.4
Rubber and plastic	63.9	47.9	0.2	Less than 5	45.5	84.9
Minerals and metals	62.1	40.9	1.3	Less than 5	49.6	12.5
Metal products	33.0	58.9	8.2	Less than 5	78.6	48.8
Machinery and equipment	86.7	1.0	12.3	Less than 5	65.6	17.3
Electrical appliances	91.8	5.1	3.1	Less than 5	60.3	71.2
Vehicles and remaining industry	89.1	5.4	5.7	Less than 5	15.9	84.8
Total	68.4	32.4	1.3	Less than 5	48.7	72.4

**TABLE 3.** POPULATION CHARACTERISTICS: GOOD PRODUCED, PERCEIVED COMPETITION AND EXISTENCE OF LEADERS<sup>a</sup>

SOURCE: Own elaboration.

<sup>a</sup> Characteristics inferred from the representative sample. <sup>b</sup> Percentage of firms in each industry producing each type of good. <sup>c</sup> Percentage of firms in each industry which recognize existence of a leader in their industry. <sup>d</sup> Percentage of firms which recognize the existence of a leader in their industry and consider themselves the price leader.

The questionnaire asks about the existence of leaders in the industry and also if the firm being surveyed considers itself as such. These are obviously very subjective measurements but the results are extremely interesting. In this regard, it is important to research the perception firms have regarding the competitive structure that surrounds them. Firms which recognize the existence of leaders in their industry are indicating the presence of monopolistic structures or monopolistic competition, evidence which is essential for the study of price formation. Out of the total, only 48.7% of firms consider that there is a leader in their industry and 72.4% of these believe that they themselves are the leader. Cases differ among the sectors. There are sectors where a large share of company managers recognizes leaders exist and think that their company is the industry leader (food products and electrical equipment). There are also cases where a small share of firms considers there are industry leaders, answering that they are one of them (apparel, vehicles and remaining industry).

#### **5. PRICING REVIEW**

Literature related to the topic of this paper establishes two stages in the process of setting prices (Fabiani et al., 2005). First is the pricing review process. In this stage firms evaluate the price they eventually want to set, verifying its optimality and comparing it with the cost implied by changing it. Thus, in order to evaluate a new price, the firm takes available information into account and compares it with the price it charges at that moment. This procedure implies the fixed cost of collecting, analyzing and evaluating information. For this reason firms do not carry it out continually but at determined times or in response to relevant events. The second stage is making actual changes in prices. There are costs associated with this also (new pricing tables, labels, etc.). It is worth mentioning that not all pricing reviews necessarily result in price changes. Below are the results of the survey regarding the pricing review process.

## 5.1 Pricing Review Policies: Time Dependent vs. State Dependent

Individual firms employ two types of pricing review policies. Theoretical literature has modeled this fact considering two types of rule: *i*) time dependent price setting rules, and *ii*) state dependent price setting rules.

In the first case, firms review their pricing at specific intervals of time (Fischer, 1977; Taylor, 1979 and 1980; Calvo, 1983). Thus firms review pricing periodically either using a deterministic price adjustment process according to Taylor or a stochastic process according to Calvo. This implies that the pricing review interval is exogenous and does not depend on the state of the economy. In contrast to this, firms following a state dependent rule review their prices according to the economic variables affecting them. As a consequence, a large shock leads them to review their pricing. One standard justification for this type of discontinuous price adjustment is the existence of the fixed costs associated to making such price changes (Sheshinski and Weiss, 1977).

In response to an economic shock, both types of pricing review policies have different implications for the evolution of the real sector. Firms following a state dependent policy review their prices immediately after a shock. This is not the case for firms using a time dependent policy because they must strictly follow their rule and wait until their next pricing review date. Price rigidity is higher in the latter case. It is clear that the impact of monetary policy will be different in each situation and for this reason it is important to discern which type of behavior predominates in the economy.

The questionnaire (question 18 in Appendix 3) allows companies reviewing their prices to be cataloged as time or state dependent. Nonetheless, other possibilities are also considered, such as firms which follow a time dependent rule but review their prices at times of economic turbulence, i.e., firms which follow mixed strategies. The results indicate that 19.1% of firms review the pricing of their main product on daily basis and 27.7% review it at fixed time intervals. Only 9.4% review prices in the event of an economic shock and employ both rules (Table 4). The latter companies usually review their prices at predetermined time intervals, but change to a state dependent policy in response to an important shock.

Review procedure	Frequency	Relative frequency(%)
Daily review	883	19.1
Fixed time intervals	1,283	27.7
Fixed intervals and in response to an event	2,025	43.8
In response to an event	436	9.4

#### TABLE 4. PRICING REVIEW PROCEDURE

SOURCE: Own elaboration.

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Refining the information allows for a more comprehensive view of the problem. As can be seen in Figure 1, in periods when the economy is calm (normal conditions), most Colombian firms (71.5%) review their pricing according to a time dependent rule, while 28.5% only review pricing when they consider the economy is subject to some kind of shock. This indicates that under normal economic conditions state dependent firms exist even though the states are not changing per se, but their decision to review pricing is contingent upon the existence of shocks. On the other hand, when disturbances do occur they affect the pricing review process and some time dependent firms change to a state dependent rule. In this case 72.2% of companies follow a state dependent rule and only 27.7% continue to employ a time dependent rule. This behavioral profile remains the same if firms are divided into large and non-large (Figure 2). However, dividing by sectors reveals some different results. Thus, in nonindustrial, agricultural and fishing sectors the share of firms which continue to follow a time dependent rule does not change considerably even in the event of shocks. Meanwhile, state dependent pricing review rules are widely used under normal conditions, to such an extent that change to state dependent rules during disturbances is less pronounced than in industrial sectors.

Interesting results are obtained if the number of competitors reported by firms participating in the survey is taken into account. Firms which



FIGURE 1. PRICING REVIEW RULE (PERCENTAGE OF FIRMS)



FIGURE 2. PRICING REVIEW RULE ACCORDING TO SIZE OF FIRM (PERCENTAGE OF FIRMS)

perceive a high level of competition in their industry employ state dependent rules (Figure 4). This result is in line with the idea that firms facing a larger number of competitors react faster to changes in economic conditions.

## 5.2 Body of Information Employed in Pricing Review

One important factor in firms' price setting strategies is the body of information they employ when making such decisions. In particular, the

existence of forward looking price setting firms is a central element of New Keynesian models used for monetary policy analysis and which emphasize the rationality of economic agents' expectations. Despite their theoretical success, models with New Keynesian Phillips curves do not manage to replicate the smoothing exhibited in price behavior. This has led to the specification of hybrid Phillips curves containing rules-ofthumb and rules based on the past behavior of prices. In other words, firms can set their prices by not only observing forecasts and current information on relevant variables, but also by taking into account past information regarding the same variables. In such cases, deviations in optimizer behavior generate an additional source of smoothing in the way inflation responds to different shocks.

In order to study this aspect, the questionnaire asks about the information firms employ when reviewing their prices as well as about the importance they give to past, present or future information. Inflation is dealt with individually within the total body of information (question 28).

Figure 5 shows the results regarding the information employed by Colombian firms when reviewing their prices. As can be seen, present and future information is the most important for Colombian firms. Large firms give much more importance to forecasted information on the relevant variables. This is not the case for non-large companies which place greater importance on current information. At the sectorial level, it can be seen that current information is more important for both agriculture and industry. Meanwhile, in the case of fishing, future information competes for hierarchy with current information.

Both current and expected inflation are important for Colombian firms pricing review processes. This is true whether companies are viewed by size or by sector. However, the latter is relatively more important than the former in the case of industry and fishing.

The results place least importance on past information, meaning that arbitrary or indexed linked rules are not the price setting strategies used by Colombian businesses. This evidence suggests that firms' pricing does not deviate substantially from optimum prices set in the event of a shock affecting Colombia's economy.

The questionnaire also investigates the importance given in pricing reviews to the inflation target and the minimum wage. Those taking part in the survey are asked to grade the level of importance of each variable (questions 29 and 30). The results shown in Figure 6 refer to two variables measured simultaneously in the same bar, where zero divides the importance



FIGURE 3. PRICING REVIEW RULE BY ECONOMIC SECTOR (PERCENTAGE OF FIRMS)

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SOURCE: Own elaboration.

placed on each of them. The total shows that both variables are important for firms, although the inflation target has slightly more interest. For large firms the inflation target is more important than the minimum wage, while the minimum wage is more relevant for non-large companies.



The difference between the sectors regarding the value they place on each of these variables is significant. Businesses in the agricultural sector consider both variables to be of similar importance, while the inflation target is more important for those in industry. Firms in the fishing sector place less importance than the other sectors on both the referred variables.

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FIGURE 4. PRICING REVIEW PLAN VS. PERCEIVED COMPETITION (PERCENTAGE OF FIRMS)

## 5.3 How Often Do Firms Review Pricing?

Firms following a time dependent pricing review rule are also asked about the frequency with which they check their prices (question 19). The results reported in Figure 7 show that a large proportion of companies review their prices monthly (around 32%), while many firms do so on a



quarterly basis (approximately 22%). These are followed by six monthly and annual pricing reviews. The amount of firms which check their prices at intervals of more than one year is very small. Although large firms exhibit the same pricing review pattern, within the group of non-large firms the proportion of companies which review their prices weekly is higher than those which do so on a six monthly or annual basis. These results



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FIGURE 6. IMPORTANCE OF THE INFLATION TARGET AND MINIMUM WAGE IN MAKING PRICING DECISIONS (AVERAGE SCORE)

SOURCE: Own elaboration.

contrast with those observed, for instance, in the Eurozone, where in the majority of firms review their prices three times per year at the most (57% for the region as a whole). Moreover, small firms in those countries review prices less frequently, arguing that the cost of reviewing prices in a company with few staff members can be extremely high (Fabiani et al., 2005).

Some significant differences appear when economic sectors are studied separately. Firms in the agriculture sector review their prices more frequently than industrial firms. Weekly and monthly pricing reviews are the most common among the former, while industrial firms tend to review prices more on a monthly and quarterly basis. Fishing firms exhibit the two extremes of annual or weekly review.

The results in Figure 8 show that firms facing greater competition review their prices more frequently. Firms which do not face competition review pricing quarterly and annually. Some important differences also emerge if pricing review frequency is studied from the point of view of economic destination (Figure 8). A very high proportion of pricing reviews in the capital goods sector are carried out on a monthly basis (47%). Although relatively less important, such frequency is also predominant in sectors producing consumption and intermediate goods. It is worth pointing out that the high frequency of pricing review for capital goods is surprising given that this type of good is characterized by high unit costs.



FIGURE 7. PRICING REVIEW FREQUENCY (PERCENTAGE OF FIRMS)

#### **6. PRICE CHANGE**

Pricing reviews do not necessarily lead to changes in prices. It is possible that the spread between the current and optimum price is less than the cost of making the change. This section explores the determinants of price



FIGURE 8. RELATIONSHIP BETWEEN PRICING REVIEW, COMPETITION AND TYPE OF GOOD (PERCETAGE OF FIRMS)

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setting by firms. In particular, it investigates if firms discriminate their prices, especially if they do it in accordance with the market where they are selling their product. Finally, the frequency of pricing changes and the relation between pricing change and review is also studied.

## 6.1 How Do Firms Set Prices?

#### 6.1.1 Price Setting Model

A standard result of models of imperfect competition is that, under certain conditions, firms set a price based on marginal costs plus a margin. Under this scheme, firms keep a space allowing them to maintain their price if costs vary. In the case of perfect competition, on the other hand, all firms belonging to a determined market set their prices at one level which the market takes. In this case there is no margin above costs and the price is equal to the marginal cost.

In order to investigate this aspect further in the case of Colombian firms, the questionnaire asks businesses about the relative importance of competitor based or costs plus mark-up price setting strategies (question 24). The results shown in Figure 9 indicate that for Colombian firms as a whole, the most important price setting strategy is that based on costs plus mark-up. Nevertheless, the difference is not visually very important because the bars representing the importance given to a competitor based pricing strategy and one based on costs plus mark-up are similar in size. In order to clear up this point, a statistical test was carried out to ascertain whether the respective means were different or not. The results of this test for means are shown in Table 5. According to the test, although numerically different, the means reported are not statistically different to





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#### TABLE 5. PRICE SETTING STRATEGY

	Average score <sup>a</sup>	% Importance
Competitor based pricing	3.22	73.03
Pricing based on costs plus mark-up	3.46	93.26

SOURCE: Authors' calculations.

Means are not statistically different to 5%. *p*-value = 0.86.

5%, i.e., in reality both strategies are equally important for Colombian firms.

For large firms the difference is much more pronounced and a price setting strategy based on costs plus mark-up is clearly dominant. This is not the case for non-large companies, for whom both strategies are equally important. In the agricultural sector both strategies are equally important, while in fishing and manufacturing a pricing strategy based on costs plus mark-up dominates.

Finally, the pricing strategy is associated with the level of competition firms perceive (Figure 10). The result shows that in a highly competitive environment, firms are sustantialy price-takers, but in a low level of competition firms use the costs plus mark-up strategy. The negative relationship between the percentage of firms following a costs plus mark-up strategy and the degree of competition has also been found in other countries (see for instance Fabiani et al., 2005).

#### 6.1.2 Price Discrimination

Firms are interested in implementing some kind of price discrimination for different reasons and this phenomenon has been studied in literature on industrial organization. Such literature defines discrimination as the event when two units of the same physical good are sold at different prices either to the same or different consumers. Firms obtain greater benefits from this nonlinear behavior than if they fixed the same price in the different markets (Tirole, 1985).

To investigate price discrimination by Colombian firms, the questionnaire asks businesses about the possibility of having different prices for buyers of the firm's main product (question 11). The results in Figure 11 show that use of a uniform price scheme as a general rule describing Colombian firms' pricing strategies can be rejected outright. As can be seen in the figure, most companies (close to 70%) follow a price discrimination plan.



Some clear relations appear regarding price discrimination if firm size and economic sector are taken into account (Figure 11). This behavior is more pronounced in non-large companies (81% of firms), firms in the agricultural sector (around 89%) and, to a lesser extent, in the industrial sector (78%). On the other hand, there is a relation between price discrimination and the degree of competition (Figure 12). It can be seen that, as competition increases so does price discrimination, although it declines slightly for companies with more than 20 competitors.





FIGURE 11. PRICE DISCRIMINATION (PERCENTAGE OF FIRMS)

Price discrimination can take several forms: the price can be different according to the type of customer, the geographical area where the product is sold and the number of units sold, among others. Thus, business managers were also asked to indicate the importance of the reasons why they discriminate their prices. The results show sales volume is the most important



FIGURE 12. PRICE DISCRIMINATION AND PERCEIVED COMPETITION (PERCENTAGE OF FIRMS)

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reason for price discrimination, followed closely by the fact that it is about local markets (Figure 13).

FIGURE 13. DETERMINANTS OF DISCRIMINATION BETWEEN PURCHASERS (AVERAGE SCORE)



### 6.1.3 Pricing to Market

Fabiani et al. (2005) remind us that the law of one price states that, taking into account exchange rate adjustments, prices of a product should be the same in all markets. Nevertheless, empirical studies reject the value of this hypothesis in the short-term. One explanation of this result is that transaction costs between geographically different markets are so high that they allow price discrimination between countries. This phenomenon is known in literature as pricing to market.

The Colombian economy is not particularly open to international trade. This explains why the latter is not one of the main reasons explaining the price discrimination described in the previous section.<sup>10</sup> Nonetheless, when external market discrimination does occur, businesses do it for two major reasons: competitor prices and exchange rate. Such result was reached by asking businesses about their reasons for discriminating between prices in domestic and external markets (question 13).

<sup>10</sup> It is important to remember that the population studied does not include net exporters, i.e., businesses which sell their products abroad. Caution should therefore be taken when interpreting the results shown in this section.

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**FIGURE 14.** DETERMINANTS OF DISCRIMINATION BETWEEN EXTERNAL AND DOMESTIC MARKETS (AVERAGE SCORE)

## **6.2 Frequency of Price Changes**

One measure of the degree of price rigidity in an economy is provided by the number of times the price of a good changes during one year or, in other words, the period of time between two consecutive changes in prices of that product. An approximation of this measurement is essential for improving the macroeconomic models used to support monetary policy.

The questionnaire asks businesses about the number of times they have changed the price of their main product during the last year (question 20). The questionnaire's answers reveal that, on average, the relative frequency of price changes is low (Figure 15). Most firms change the price once a year (38%) and 75% do so a maximum of two times. This structure remains if the size of company is taken into account, with price changes occurring predominantly once per year. According to the results, nonlarge companies change the price of their main product even less frequently than large firms. Behavior differs between economic sectors. For instance, industrial firms change prices much less frequently than those in the agricultural or fishing sectors. More frequent changes predominate in the latter. This behavior confirms that, in terms of price changes, primary activities are more flexible than those which add more value.

Figure 16 relates the frequency of price changes to the structure of competition in the firm's market. The results lead to the conclusion that, as the number of competitors increases, the proportion of firms making one change per year decreases. Meanwhile, as firms face more competitors, a larger share of those taking part in the survey answer that they must



FIGURE 15. NUMBER OF PRICE CHANGES IN THE LAST YEAR (PERCENTAGE OF FIRMS)





SOURCE: Own elaboration.

SOURCE: Own elaboration.

change the price at least twice a year. A similar situation is seen for firms which change the price of their main product more than 24 times per year.

If firms are classified according to the economic destination of their main product and this result is related to the number of times the firm changes the price of this good (Figure 17), it is found that firms producing consumption goods change their prices less frequently. In this case, one price change per year predominates (42%), while in the other cases two, and between two and five changes per year become more important.



FIGURE 17. PRICE CHANGE BY TYPE OF GOOD (PERCENTAGE OF FIRMS)

SOURCE: Own elaboration.

## 6.2.1 Changes in Price Adjustments During the Last Five Years

The frequency of price adjustment can change according to the phase of the business cycle the economy is in. The existence or not of demand side pressures and the way in which economic authorities address such situations directly affect price adjustment. The implementation of inflation targeting during the current decade has led to lower, more stable and predictable inflation. Nonetheless, as stated previously, at the time the survey was carried out, inflationary pressures had risen, mainly as a consequence of the strength of domestic demand, higher energy prices and increases in the prices of different raw materials, partly offset by the revaluation of the peso.

The decline in inflation during the first half of the decade reduced the need for more frequent price changes. The opposite should therefore happen when inflation increases as it did in the most recent period when the survey was carried out. Recent years have generally been characterized by a very strong global economy with technological innovations and movements of goods, services and capital. This has affected the way businesses set their prices.

Taking into account the importance of measuring if businesses have modified their behavior regarding the number of price changes, survey participants were asked if the frequency of price adjustments had changed during the five years preceding the survey (question 21). Such time period was chosen because various works have calculated it as the average length of the Colombian economy's business cycle (Arango et al., 2007). Survey participants were given the option to indicate the direction of the change.



FIGURE 18. PRICE CHANGE VS. PERCENTAGE OF DOMESTIC SALES (PERCENTAGE OF FIRMS) %

SOURCE: Own elaboration.

The answers suggest that price setting frequency has changed (Figure 19). Most businesses believe the frequency has increased, some that it has declined and others that both of these have happened. If the division of



large and non-large companies is analyzed, a larger proportion of small and medium sized companies consider that the frequency of price adjustment has decreased. The opposite is observed in the case of large firms. Meanwhile, the frequency of price adjustments has risen in the industrial and agricultural sectors.

The main reasons for changing the frequency of price adjustments are, in the order of importance given by survey participants, greater competition from imports, higher inflation and the lower exchange rate (Figure 20). Cost volatility is linked to increases in the prices of energy, transport and raw materials observed throughout the period. The second answer can be understood as the definition that the price can be outside the market regarding the imported product and the costs of being outside increase substantially as competition increases. As an explanation, inflation can be another way of saying the same as the option marked as most important, or it can also be explained by an increase in inflation expectations. Appreciation of the exchange rate is also important during the period and can doubtlessly have affected price setting in some firms.

By sector it is interesting to see that for industry the most important reason for changing the frequency of price adjustments during the last five years was a higher exchange rate. This result suggests that the appreciation of the exchange rate led to an increase in the frequency of price

SOURCE: Own elaboration.



FIGURE 20. REASONS FOR CHANGING FREQUENCY OF PRICE ADJUSTMENT (AVERAGE SCORE)

changes possibly because of greater imports competition for companies which sell their products domestically, or due to a loss of competitiveness abroad for firms which sell a percentage of their products externally. Meanwhile, for agriculture and fishing, the greater volatility of input prices and the higher exchange rate were the reasons behind firms changing the frequency of price adjustments (Figure 21).

When the answers of firms which stated they had increased the frequency of price adjustments are cross referenced with the reasons why they did so, it can be seen that a large proportion of survey participants consider greater volatility of input prices caused the change in frequency. This result remains true for firms which indicate that the frequency has decreased (Figure 22).

## 6.3 Relation between Pricing Review and Change

As mentioned, in the price setting process, reviews do not necessarily imply change. It is possible to compare the frequency of pricing changes and reviews using survey information, which shows that pricing reviews are more frequent than changes (Table 6). The table can be interpreted in





FIGURE 21. REASONS FOR CHANGING FREQUENCY OF PRICE ADJUSTMENT BY ECONOMIC SECTOR (AVERAGE SCORE)

SOURCE: Own elaboration.

the following manner: 67.09% of total companies review their prices more than three times per year, while those that change their prices more than three times per year represent 18.07% of total companies.

TABLE 6. PRICING REVIEW VS. PRICING CHANGE

	Relative frequency ( $\%$ )
Pricing review > 3	67.09
Pricing change > 3	18.07

SOURCE: Authors' calculations.

NOTE: Omitted values are not included.

An explanation for this behavior might be that the companies which review their prices do not change them because there is no reason to do so. On the other hand, if companies incur costs for reviewing prices, there must be compelling reasons not to change them. The problem, therefore, resides in finding out what these reasons are. **FIGURE 22.** REASONS FOR CHANGING FREQUENCY OF ADJUSTMENT: FREQUENCY INCREASE VS. DECREASE (PERCENTAGE OF FIRMS)



Increased Frequency of Adjustment

SOURCE: Own elaboration.

The next section deals with studying the possible motivations behind why companies do not change their prices. Nevertheless, the first idea can be found in relating the flexibility of price changes with the strategy for their review (Figure 23). The more flexible companies are those that use a state-dependent review strategy. The opposite occurs when the companies follow a time-dependent strategy, a strategy which is characterized as highly rigid.

The higher reaction capacity of firms which follow a specific strategy is by itself an interesting result. Flexibility is an important result of an inflation targeting strategy and knowing how to achieve this is a relevant question. However, it is only possible to obtain such information by asking agents about the factors which make them behave the way they do. An explanation of the pricing review strategy is inadequate because it does not indicate the business's reasons and motives for not pursuing it.



FIGURE 23. CHANGE VS. PRICING REVIEW RULE (PERCENTAGE OF FIRMS)

## 6.4 Theories on Price Rigidity

One of the survey's objectives was to investigate the causes of price inflexibility inside companies. With respect to this, theories offering various explanations are tested in this section of the document. To this end, we accept Blinder's suggestion to question businesses as a way of examining the empirical relevance of the different theories (Blinder et al., 1998). The survey explained each of these to those taking part in the survey and asked them to rate each option in order of importance.

The results in Table 7 show the theories in order of importance as ranked by survey participants in response to the different statements presented by the survey. The theories were presented in straightforward language and businesses were asked to rank the theory in one of four ways: 1) not important, 2) not very important, 3) important and 4) very important. The theory we have named "idle costs"<sup>11</sup> is the most important according to the business managers surveyed.

TABLE 7. IMPORTANCE	OF DIFFERENT PRICE	RIGIDITY THEORIES
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	Average Score	Standard Dev.
Idle costs	3.14	0.22
Explicit contracts	2.90	0.18
Implicit contracts	2.90	0.11
Product quality	2.63	0.14
Coordination failures	2.51	0.15
Irregular information	2.45	0.10
Transitory situation	2.41	0.24
Price point	2.24	0.16
Menu costs	1.95	0.15

SOURCE: Authors' calculations.

NOTE: Dotted lines indicate that a two-tailed test rejects that the theory above and below the line has the same measurement with a 95% level of confidence.

The idea that prices are mainly determined as a function of the final product's production inputs is not formally recognized by the international literature as a price rigidity theory. The argument is based on the idea that the lag between a cost shock and a price change is too short. Nonetheless, authors such as Gordon (1981) and Blanchard (1983) show that due to the fact that a product's production is tied to a production chain composed of many processes, a cost shock for one of these takes time to propagate to the other stages of production and, in this way, to the final consumer. For this reason, even short lags in the adjustment process of one single company can lead to long lags when the entire production chain is considered. Additionally, according to this *theory*, prices do not change due to the fact that input costs do not change, i.e., prices are rigid because other prices are also rigid.

<sup>&</sup>lt;sup>11</sup> Also known in the literature as *cost-based pricing* or constant marginal costs.

The second group of explanations corresponds to explicit or implicit contracts. These two theories are extremely interrelated. Both coincide in that agents are looking to avoid price variations. The first of these theories was proposed by Fischer (1977) and Phelps and Taylor (1977) and is based on the existence of contractual relations between companies and consumers in which the former guarantees to sell a product to its customers at a predetermined price. Companies offer this type of contract in order to build long term relationships with their clients. This should prevent customers from buying elsewhere and establish the foundation for the company's future sales. Additionally, the clients are attracted by constant prices as it helps them minimize search time costs.

The theory of implicit contracts (Okun, 1981, and Rotemberg, 2005) is based on the fact that companies look to build long term relationships with their clients in order to make their future sales more predictable. In contrast to explicit contracts, implicit contracts try to create customer loyalty by changing prices as little as possible. According to Okun (1991), price increases should be differentiated between those due to cost shocks or demand shocks. Higher costs are rationally accepted as leading to price increases, while price increases due to an increase in demand are seen as unfair. Therefore, companies do not change their prices due to increases in demand as they do not want to impair their relationship with their customers. These companies only adjust their prices due to cost shocks. Rotemberg's (2005) idea is based on the theory that clients want to buy from companies whose prices are seen as fair.

The theory of product quality, the fourth most important, refers to the fact that companies prefer not to reduce their product prices as the client could perceive this as a drop in product quality. According to this rationale, companies prefer to maintain constant nominal prices.

Coordination failures between companies could lead to price rigidity. The theory with this name started its academic journey with Clower (1965) and Leijonhufvud's (1968) work on labor market analysis. Later, Ball and Romer (1991) applied these ideas in the context of the price setting process. According to this theory, companies do not like to change their prices because this might have severe implications for both consumers and the competition. In fact, a company could decide not to increase their price for fear of losing clients. On the other hand, a company might decide not to reduce its price as this strategy does not guarantee a higher market share if its competition does the same. Therefore, after a shock, the company only changes its price if there is an agreement with the other

companies about the way in which to react. Nominal prices of companies remain rigid without this coordination mechanism.

The irregular information theory is postulated as a deficient flow of information. The business's gathering of required information is slow and wasteful as a consequence of temporary lags in the production of certain variables. Price change decisions could be prolonged as a consequence of the delay in the collection of the required statistical elements.

The company must make the decision of whether or not to change its prices when confronted with a shock. According to the theory of transitory situations or temporary shocks, it is possible that the company will not change prices if it thinks that the shock is transitory. The new optimal price could be temporary and the company would incur new costs if the decision had to be reversed. Companies prefer not to change prices until they are sure that the shock is permanent. Thus, frequent price changes are considered to be detrimental to customer relationships.

The price point theory suggests that companies set their prices at psychologically attractive points, a situation associated with discontinuities in the demand curve. Companies choose price *points* as an increase in price beyond that point would imply a disproportionate decrease in demand. Companies do not immediately react to the presence of small shocks which would suggest correspondingly small price changes. On the contrary, price changes are postponed until new events justify a larger price change and bring them to the next price point.

Menu cost theory, the last on the list, is derived from the work of Barro (1972), Sheshinski and Weiss (1977), Akerlof and Yellen (1985) and Mankiw (1985). It is based on the idea that the act of changing prices has costs in itself, such as printing and distributing new price lists or changing price labels. A company confronted with these costs might change its prices less that a company which does not.

Some differences can be detected if companies are divided by size and economic activity (Figure 24). In the first case, the importance given by large firms to implicit contracts and product quality as theories to explain price rigidity can easily be seen. For non-large companies, product quality theory is much less important than for large firms and for companies as a whole. By sector, the differences are much more apparent. In fact, the ordering of theories changes substantially. The most important theories for agriculture, in descending order, are idle costs, price point and irregular information. For industry, transitory situations, implicit contracts and coordination failures are the main reasons for keeping their prices stable.

FIGURE 24. IMPORTANCE OF DIFFERENT PRICE RIGIDITY THEORIES (AVERAGE SCORE)



SOURCE: Own elaboration.

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And finally, for fishing, idle costs and explicit and implicit contracts are the most important.

## 7. FACTORS ASSOCIATED WITH PRICE CHANGES

## 7.1 Asymmetries

Empirical literature provides evidence of the differences which exist, in terms of conditional probability, of increasing or reducing prices. Dhyne et al. (2005) show that there is evidence of a smaller frequency of price reductions than price increases in the euro zone. The results for the USA are similar (Klenow and Kryvtsov, 2005). Two papers for Columbia also show similar results (Zárate and Julio, 2008 and López, 2008).

The survey asks businesses questions on the importance of several price determination factors in order to perform an analysis of the factors which determine price changes and stipulate if there are asymmetries which depend on the direction of price adjustments. They are asked to rate a list of factors which could influence their decision to increase (question 26) or lower their prices (question 27). Table 8 shows the results of those surveyed in relation to price increase and Table 9 in relation to price decreases.

	Average score	Standard deviation
Change in raw material costs	3.81	0.05
Change in competitor prices	3.25	0.08
Change in energy and fuel prices	2.99	0.08
Change in taxes and contributions	2.97	0.17
Change in demand for their main product	2.89	0.10
Change in the exchange rate	2.83	0.16
Change in financial costs	2.63	0.13
Change in labor costs	2.52	0.15

TABLE 8. ASYMMETRIES IN DECISIONS TO INCREASE PRICES

SOURCE: Own elaboration.

NOTE: Dotted lines correspond to a two-tailed equality of averages test.

Table 8 shows that changes in the cost of raw materials (with an average importance of 3.8) and a change in competitor prices (3.2) are the most important factors for explaining a price increase. The most important elements explaining price decreases are a change in competitor prices (3.4 score) and changes in the cost of raw materials (3.2). It is slightly

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	Average rating	Standard deviation
Change in competitor prices	3.39	0.11
Change in costs of raw materials	3.20	0.08
Change in demand for their main product	2.91	0.10
Change in taxes and contributions	2.77	0.21
Change in the exchange rate	2.72	0.15
Change in energy and fuel prices	2.56	0.13
Change in financial costs	2.27	0.14
Change in labor costs	2.22	0.15

TABLE 9. ASYMMETRIES IN DECISIONS TO DECREASE PRICES

SOURCE: Own elaboration.

NOTE: Dotted lines correspond to a two-tailed equality of averages test.

strange that the same explanatory factors, in a different order, are found. Based on these results, one could come to the conclusion that the company is willing to respond to shocks that affect their bottom line (competitor costs and pricing).<sup>12</sup> On the other hand, changes in financial and labor costs are not important in either of the events contemplated.

If groupings are made by company size and by economic sector the following is found. With regard to decisions to increase prices, large companies and non-large companies agree that the main motivation is changes in the costs of raw materials (Figure 25). Likewise, a change in the costs of fuel and energy is very important for non-large companies. For this last group of companies, importance given to labor costs increase in significance, an aspect that could be interpreted as a reflection of the importance that this factor could have on the technology they use. In contrast, the change in demand for their main product is very important in the decision to increase prices for agriculture and fishing, while changes in raw material costs is extremely important to industrial companies (Figure 26).

With respect to price decreases, the most relevant factors for large companies are prices of the competition and raw material costs (Figure 27). The importance given to the first factor contrasts with that seen in decisions to increase prices. Changes in the demand for its principle product is the determining factor in the decision to reduce prices for agriculture and fishing, while changes in raw material costs are the most important for industrial companies (Figure 28).

<sup>&</sup>lt;sup>12</sup> The dotted lines in Tables 8 and 9 correspond to the results of an equality of averages test. Their reading is similar to that presented in Section 6.4.



#### FIGURE 25. ASYMMETRIES IN DECISIONS TO INCREASE PRICES (AVERAGE RATING)

SOURCE: Own elaboration.

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FIGURE 26. ASYMMETRIES IN DECISIONS TO DECREASE PRICES (AVERAGE SCORE)

SOURCE: Own elaboration.

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FIGURE 27. ASYMMETRIES IN FACTORS DETERMINING PRICES<sup>a</sup>

SOURCE: Own elaboration.

NOTE: <sup>a</sup> Corresponds to the difference between the average when they decide to increase and the average when they decide to decrease. A positive score indicates that a factor is more important when increasing than when decreasing.

One way of understanding the asymmetries is to combine the degree of importance that each factor confers on the increase and decrease in prices into one statistic. Using the information gathered by the survey, a balance is constructed that corresponds to the difference between the average score given by businesses to each factor used when they decide to increase or decrease prices. A positive number indicates that a specific factor is more important in the decision to increase than to decrease. A negative number signifies the exact opposite. The magnitude is also important because a larger number means that the difference between the importance given to a factor for price increases or decreases is greater than in the case of a smaller number. The results of this exercise are shown in Figure 27. In general, a regular pattern of positive asymmetries exists for costs and a negative one for market conditions. The importance of changes in raw material costs is evident as an explanation for price increases in comparison to price decreases. Fuel and energy costs display similar behavior. The opposite is seen for changes in competitor prices. This factor is extremely relevant in the decision to reduce prices.

## 7.2 Adjustment of Prices after Shocks

The response of prices after different types of shocks that could affect the economy will be analyzed next. In this regard, survey participants are first asked if they change the price of their main product when an unanticipated event occurs. If so, they are then asked to rate the importance of a series of events (question 25).

Around 90% of firms modify the price of their main product when a production cost increase occurs, while 67% do so when a decrease occurs. Around 60% react to a decrease in demand. Only 28% change the price when demand increases (Figure 28). Meanwhile, when a cost change occurs, the percentage of large companies and non-large companies which change prices is similar. On the contrary, if decreases as well as increases in demand occur, the vast majority of firms which change their prices are large ones.



FIGURE 28. RESPONSE OF PRICES TO SHOCKS (PERCENTAGE OF FIRMS)

SOURCE: Own elaboration.

On the other hand, if input costs increase, agricultural and industrial companies change their prices in similar percentages. A decrease in costs affects a higher percentage of agricultural than industrial firms. Fishing companies react more than any other type of firm when demand moves either up or down (Figure 29).

Finally, the time taken for a firm to change the price of its main products once a shock occurs is investigated (Figure 30). Companies change



FIGURE 29. PERCENTAGE OF FIRMS WHICH CHANGE THEIR PRICES

prices relatively quickly whatever the type of shock. In almost all cases, the most important changes take place in less than one month; their relative importance is always over 40%. It should be pointed out that in the case of a decrease in the exchange rate, the reaction time could expand to between one and three months. If the shock that occurs is related to demand, whether positive or negative, firms react with even greater alacrity than in other cases. It rarely takes between six months and a year to see a price change after the shock.

SOURCE: Own elaboration.

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SOURCE: Own elaboration.

## 8. CONCLUSIONS

This document presents the results of a survey given by the Banco de la República to 787 Colombian companies from November 2007 to May 2008. This survey sought to analyses how companies set their prices. The sample was constructed using a stratified probabilistic test. The study examines the topics of determination, adjustment, rigidity and asymmetry of company prices. The approach used allowed equal distinction between the different existing price rigidity hypotheses in the literature.

The most important conclusions that can be drawn are:

- With respect to the markets in which firms participating in the survey operate, it can be concluded that the majority of sales by Colombian companies are to the domestic market and to long term clients. Furthermore, the markets where Colombian companies operate are not very competitive. Companies face, on average, less than five competitors.
- In relation to the pricing review stage, the evidence suggests that the majority of Colombian companies use time-dependent rules when the

economy is stable. This is true for companies with few competitors. Meanwhile, in times of economic turbulence, companies follow statedependent rules. This type of rule is seen more frequently in companies which face a high level of competition.

• When reviewing prices, Colombian companies consider actual and expected inflation equally important, as well as other relevant variables within the productive process. In this way, companies are forward-looking in their pricing decisions.

• The inflation target set each year by Banco de la República and minimum wage are considered to be important factors when reviewing prices. Large companies attribute higher importance to the inflation target, while small and medium size companies consider the minimum wage more important.

• Firms which review their prices at set time intervals do so mostly on a monthly or quarterly basis. Large firms review their prices more frequently than the rest. Meanwhile, in the industrial sector, agricultural firms are the ones that review their prices with more frequence.

• Companies which have little competition review their prices every three months, while firms with a high level of competition review their prices monthly.

• In general, Colombian firms follow costs plus mark-up and competitor based pricing strategies. Large companies, on the whole, operate in non-competitive markets, while small and medium sized companies are price takers.

• As for the second stage of the price setting process, findings show that 38% of Colombian firms change their prices once a year, while 75% of companies change their prices a maximum of two times a year. In sectorial terms, primary sector industries are more flexible than those in the secondary sector. Along the same lines, evidence is found that companies whose production is destined for the domestic market are more flexible than those whose production is mostly exported. Likewise, consumption goods producers are less flexible than firms producing intermediate and capital goods.

• Previous studies suggest that prices respond asymmetrically to different types of shocks. The survey results allow for the conclusion that cost shocks (exchange rate, raw material prices, fuel and energy prices, financial and labor costs) are more important for explaining price increases than for explaining decreases, while demand shocks are more important for explaining price reductions.

• Price adjustment practices changed over the five years previous to when the survey was carried out. The main reason for these changes was higher input price variability.

• Price changes were found to be less frequent than pricing reviews when comparing the results obtained for the two stages of price setting. On the other hand, under normal economic conditions, more flexible companies followed state-dependent rules while less flexible companies followed time-dependent rules.

• The hypothesis of cost based prices is the principle explanation for why companies did not change their prices more frequently. Even so, theories associated with customer preferences for stable nominal prices, such as explicit and implicit contracts, are also very important for explaining price rigidity.

## Appendix 1

Three digit ISIC Code		
Section	Category	Description
А	011	Growing of crops
Α	012	Farming of animals
В	050	Fishing, aquaculture and service activities incidental to fishing
D	151	Production, processing and preservation of meat and fish
D	152	Manufacture of fruit, legumes, vegetables, oils and fats
D	153	Manufacture of dairy products
D	154	Manufacture of grain mill products, starches and starch products, and prepared animal feeds
D	155	Manufacture of macaroni, noodles, couscous and similar farinaceous products
D	156	Manufacture of coffee products
D	157	Sugar refineries and mills

## **Detailed Population by Three Digit ISIC Code**

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D	158	Manufacture of other food products
D	159	Manufacture of beverages
D	171	Preparation and spinning of textile fibers
D	172	Weaving of textiles
D	173	Textile product finishing of textiles not produced at the same produc-
		tion unit
D	174	Manufacture of other textile products
D	175	Manufacture of knitted and crocheted fabrics and articles
D	181	Manufacture of wearing apparel, except fur apparel
D	191	Tanning and dressing of leather
D	192	Manufacture of footwear
D	193	Manufacture of luggage, handbags and the like, saddlery and harness
D	201	Sawmilling and planing of wood
D	202	Manufacture of veneer sheets; manufacture of plywood, laminboard,
		particle board and other panels and boards
D	203	Manufacture of builders' carpentry and joinery
D	204	Manufacture of wooden containers
D	209	Manufacture of other products of wood; manufacture of articles of
		cork, straw and plaiting materials
D	210	Manufacture of pulp, paper and paperboard
D	221	Publishing
D	222	Printing
D	223	Service activities related to printing
D	224	Reproduction of recorded media
D	232	Manufacture of refined petroleum products
D	241	Manufacture of basic chemicals
D	242	Manufacture of other chemical products
D	243	Manufacture of man-made fibers
D	251	Manufacture of rubber products
D	252	Manufacture of plastic products
D	261	Manufacture of glass and glass products
D	269	Manufacture of non-metallic mineral products
D	271	Manufacture of basic iron and steel
D	281	Manufacture of structural metal products, tanks, reservoirs and steam
		generators
D	289	Manufacture of other fabricated metal products; metalworking service
		activities
D	291	Manufacture general-purpose machinery
D	292	Manufacture of special-use machinery
D	293	Manufacture of domestic appliances
D	311	Manufacture of electric motors, generators and transformers
D	312	Manufacture of electricity distribution and control apparatus
D	313	Manufacture of insulated wire and cable
D	314	Manufacture of accumulators, primary cells and primary batteries
D	315	Manufacture of electric lamps and lighting equipment
D	319	Manufacture of other electrical equipment
D	321	Manufacture of electronic valves and tubes and other electronic com- ponents
D	322	Manufacture of television and radio transmitters and apparatus for line
-	~	telephony and line telegraphy

Three digit ISIC Code		
Section	Category	Description
D	323	Manufacture of television and radio receivers, sound or video record- ing or reproducing apparatus, and associated goods
D	331	Manufacture of medical appliances and instruments and appliances for measuring, checking, testing, navigating and other purposes, except optical instruments
D	332	Manufacture of optical instruments and photographic equipment
D	341	Manufacture of motor vehicles and their engines
D	342	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
D	343	Manufacture of parts and accessories for motor vehicles and their en- gines
D	359	Manufacture of other transport equipment
D	361	Manufacture of furniture
D	369	Manufacturing

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SOURCE: DANE.

## Appendix 2

## **Stratified Random Sampling**

The group of firms taking part in the research is selected through random stratified sampling. This type of procedure requires that the population of size N be subdivided into subpopulations of sizes  $N_1, N_2, ..., N_L$  in such a way that  $\sum_{h=1}^{L} N_h = N$ . These subpopulations are defined as strata and their sizes refer to the number of individuals that each of them comprise. In order to achieve an optimal population subdivision or stratification, the stratification factors are defined as those which are closely related to the characteristics under investigation, and in such a way that the individual only belongs to one subpopulation or stratum.

Once stratification has taken place, a process of random sampling without replacement of each of the strata is performed. Samples of  $n_1, n_2, \dots, n_L$  sizes are thus obtained. In this way, the size of the sample is equal to  $n = \sum_{h=1}^{L} n_h$ . In particular, the simple random sampling can be carried out in such a way that the proportions  $\frac{N_h}{N}$  and  $\frac{n_h}{n} \forall h = 1, \dots, L$  are equal, which is known as proportional assignment. That is to say, the

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individuals are distributed in the sample strata in similar proportions to those found in the population strata. This concept allows for the construction of central population tendency measurements within each stratum.

Substitution of those individuals selected through the simple random sampling process who do not want to participate in the investigation takes place in order to maintain proportional assignment. In other words, they do not respond to the survey and therefore do not become part of the sample. In theory there should be no substitution of individuals so as to not contaminate the selection process as per Martínez (2002). However, in practice, the applications of some substitution methods are accepted without debating the results. For instance, some individuals from those not selected are randomly chosen to substitute the non-participating selected individuals.

According to Cochran (1977) there are different reasons why stratified sampling is a widely used technique. It may be that the most important of them centers on the higher precision of the estimation of the population's characteristics based on the relatively homogenous grouping of individuals in each stratum.

It is important to define the following concepts, which will be used to calculate the sampling measurement and variance and its spread to the population, in order to apply the stratified random sampling method.  $N_h$  is the total number of individuals in  $h_{th}$  population stratum,  $n_h$  the number of total individuals in the  $h_{th}$  sampling stratum,  $y_{hi}$  the value of variable y observed for the  $i_{th}$  individual in the  $h_{th}$  stratum. The ensuing variables are defined as follows:

Population measurement of stratum h:

$$\overline{Y}_h = \frac{\sum_{i=1}^{N_h} y_{hi}}{N_h}$$

- Sampling average of stratum *h*:

$$\overline{y}_h = rac{\sum\limits_{i=1}^{n_h} y_{hi}}{n_h}$$

Population variance of stratum h:

$$S_{h}^{2} = \frac{\sum_{i=1}^{N_{h}} (y_{hi} - \overline{Y}_{h})^{2}}{(N_{h} - 1)}.$$

It is possible to construct an estimator of the total population average through the stratified average  $\overline{y}_{est}$  on the basis of the preceding definitions:

$$\overline{y}_{est} = \frac{\sum_{h=1}^{L} N_h \overline{y}_h}{N}$$

The variance of this estimator is given by:

$$VAR\left[\overline{y}_{est}\right] = \frac{1}{N^2} \sum_{h=1}^{L} N_h \left(N_h - n_h\right) \frac{S_h^2}{n_h}.$$

It can be demonstrated that this estimator complies with the unbiasedness property, that is to say,

$$E[\overline{y}_{est}] = \overline{Y}$$

being

$$\overline{Y} = \frac{\sum_{h=1}^{L} \sum_{i=1}^{N_h} \mathcal{Y}_{hi}}{N} \,.$$

Under stratified sampling, the estimation of the population proportion is based on the stratified sampling proportion:

$$\hat{p}_{est} = \sum_{h=1}^{L} \frac{N_h p_h}{N} ,$$

being  $p_h = \frac{\sum_{i=1}^{n_h} a_{hi}}{n_h}$ , with  $a_{hi} = 1$  if company *i* in stratum *h* takes the specific alternative;  $a_{hi} = 0$ , in another case.

# Appendix 3

## Questionnaire

Fecha de Impresión	CO	N F I D E N C I A L*	Fecha de Impresión						
BANCO DE LA REPÚBLICA C. C. 1780-03	Centro Diag.	Nacional de Consultoría 34 N° 5-27 - Santa Fé de Bo Conmutador: (1) 339 4888	Ltda. Encuesta sobre gotá Formación de Precios Banco de la República						
Elaborado por : El Banco de la República	Revisado por :Ma	aria José Roldán	Revisado por : Juan Carlos Parra A.						
Buenos días/tardes/noches, mi nombre es (dar nombre COMPLETO) y soy entrevistador del Centro Nacional de Consultoría, una empresa que hace estudios para mejorar los productos y servicios que reciben las empresas y las personas. En estos momentos estamos realizando por solicitud del Banco de la República, un estudio sobre el proceso de fijación de los precios en Colombia y necesito hablar con la persona responsable del manejo de este tema en su empresa. Me gustaría hablar con el Gerente General, Gerente de Producción. Gerente de Mercadeo o el Gerente Financiero									
ENCUESTADOR: UNA VEZ LO CON	ENCUESTADOR: UNA VEZ LO COMUNIQUEN CON LA PERSONA A ENCUESTAR REPITA LA PRESENTACIÓN ANTERIOR Y PREGUNTE:								
a. Me podría decir de acuerdo con el valor	ovolumen de ventas ¿cuál es el p	rincipal producto de su empresa?							
b. ¿El 100% de las ventas del principal prod	ucto de su empresa se realiza en	el exterior, es decir, fuera de país?.							
ENCU	ESTADOR: SI LA RESPUES	TA ES AFIRMATIVA, TERMINE Y	REEMPLACE						
c. ¿Es usted la persona encargada de fijar l	os precios de comercialización o v	enta de ese producto o participa directar	mente de ese proceso?						
Sí Si	opinión es muy importante. Ve podría dar una cita para respor é día y a qué hora lo puedo visita	nder una encuesta? ¿me puede decir r?	Día y Hora y						
No Jepodria decir por favor el nombre de la persona o personas que fija (n) los precios de comercialización o venta de ese producto principalo participa (n) directamente de ese proceso?									
ENCUE	STADOR: REALIZAR CITA	Y CONTACTAR LA NUEVA PERS	ONA						
Fecha:		Código Entrevistador:							
7. ¿Cuál es el criterio para elegir el principal producto?       8. En el último año contable, ¿qué porcentaje de las ventas totales de su empresa corresponden a ventas de su principal producto <u>en Colombia</u> ?         Volumen de ventas       1       2         Valor de ventas       1       %         Nota: Las preguntas 9 a 13 deben ser contestada teniendo en cuenta su PRINCIPAL PRODUCTO independientemente de donde se venda o distribuya       Nota: Las preguntas 9 a 13 deben ser contestada teniendo en cuenta su PRINCIPAL PRODUCTO independientemente									
9. ¿Cômo clasifica usted su principal producto de asuerdo con los siguientes criterios? ( <i>Multiple respuesta</i> , MOSTRAR TARJETA) 10. ¿Cuál es la distribución de ventas de su principal producto en los siguientes mercatos? ( <i>en porcentaje</i> )									
Bien Final 2 Bien Intermedio 2 Bien de Capital 3	2	1. Interno 2. EE.UU 3. Venezuela 4. Otros destinos internacion	25 35 35 35 36 36						

<ol> <li>¿Existen distintos precios para diferentes compradores de su principal producto? (si su respuesta es negativa pase a nota 1 y léasela al informante)</li> </ol>	12. Para su principal producto, ¿cuál es la importancia de los siguientes factores a la hora de diferenciar sus precios entre diferentes compradores? (Si la respuesta para mercado externo es 3 o 4 continúe, de lo contrario pase a la nota 1) (1 = No importante, 2 = Poco importante, 3 = Importante, 4 = Muy Importante 9 = No sabe / No responde) MOSTRAR TARJETA					
Si Contraction	Mercado externo Tiempo de relación co Formas de Pago Plazo de Entrega Volumen demandado Mercados locales Costos de Transporte	on el Cliente	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	9 9 9 9 9 9 9 9 9		
13. ¿Cuál es la importancia de los siguientes factores p Importante, 9 = No sabe / No responde) MOSTRAR TA Tipo de cambio Sistema impositivo del país Condiciones socioculturales particul Fiuctuaciones en la demanda del pa Precios de competidores Costos de transporte	ra diferenciar sus precios e RJETA ares a cada país is	ntre el mercado interno y el exte	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	nportante, 4 = Muy 9 9 9 9 9 9 9		
NOTA 1 para leerle al informante: Respon	da las preguntas re que es vendida únic	stantes para su princip camente en el mercado	al producto teniendo en mente la prop doméstico	oorción de éste		
14. De las ventas totales de su principal producto, que porcentaje se realiza con clientes con los cuales la relac comercial es:         De largo plazo (más de 1 año)         De corto plazo (menos de 1 año)         10%	15. ¿Cuántos com principal producto e Ninguno Menos de 5 Entre 5 y 20 Más de 20	etidores existen para su en el mercado doméstico?	16. ¿Existe una empresa líder en establecer los mercado de su principal producto? (Si la respu sabe / No Responde pase a la pregunta 18) Si No No Sabe / No Responde	precios en el esta es No o No 1 2 9		
17. Para su principal producto, ¿es su empresa la líder	en precios?	18. ¿Con que frecuencia chequea usted el precio de su principal producto?				
Si [ No [ No Sabe / No Responde [	1 2 9	<ul> <li>Se revisa diariamente (o m</li> <li>Se revisa únicamente en in</li> <li>Se revisa principalmente e en respuesta a eventos es precios de los insumos)</li> <li>Se revisa únicamente en m específicos</li> </ul>	hás frecuentemente) (Pase a la pregunta 20) ntervalos fijos de tiempo in intervalos fijos de tiempo, pero también pedifoso (e). Cambios radicales en los espuesta a eventos (Pase a la pregunta 20)	1 2 3		
19. Si usted chequea el precio de su principal producto tiempo, ¿con qué frecuencia lo hace?	en intervalos fijos de	20. En los últimos doce meses, ¿cuántas veces ha cambiado el precio de su principal producto?				
Semanal 4 Mensual 2 Trimestral 3 Semestral 4 Anual 5 Más de un año 6						
21. De acuerdo con su experiencia, ¿cree usted que ho frente a cinco años atrás, ha cambiado la frecuencia de ajuste de precios de su principal producto? (Si su respuesta es No o No sabe / No responde pase a la pregunta 23.) (Marque sólo una opción)	22. Pensando en lo ha cambiado la frei Importante, 9=No S	os últimos cinco años, señale la i suencia de ajuste de los precios Sabe / No Responde)	mportancia de cada una de las siguientes razones p (1 = No importante, 2 = Poco importante, 3 = Importa	ara explicar porqué ante, 4 = Muy		
Si, ha aumentado TTO Si, ha disminuido Za No ha cambiado Tago No Sabe / No Responde T	Mayor competer Mayor competer Mayor competer Cambios tecnol Mayor volatilida Mayor volatilida Mayor inflación Menor inflación Mayor tasa de c Menor tasa de c	cia interna ncia interna icia por importaciones legales/ile icia por importaciones legales/ile igicos le n los precios de los insumos d en los precios de los insumos d en los precios de los insumos ambio	gales 1 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	4     9       4     9		

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23. En el mercado interno a la hora de fijar el precio de su principal producto enfrenta usted algún tipo de limitación diferente a la competencia u otras fuerzas del mercado: (Múltiples opciones, MOSTRAR TARJETA)			24. ¿Señale la importancia de las siguientes estrategias en la fijación de precios de su principal producto en el último año? (1 = No importante, 2 = Poco importante, 3 = Importante, 4 = Muy Importante, 9=No Sabe / No Responde ) MOSTRAR TARJETA					
Legales / Regulatorias 1 Precios internacionales Comunes 2			Fijar precios basados en los precios de los competidores					
Directrices Casa Matriz Solution frente a sus compradores Solution Ninguna de las anteriores Solutions Solutions			Fijar precios basados en costos más un margén de ganancia					
25. Ante cada uno de los siguientes eventos no previstos ¿modifica usted los precios de su principal producto? 25a. Si los modifica, ¿cúanto tiempo se demora en hacerlo?								
Evento	Si se modifican	No se modifican	Menos de 1 mes	Entre 1 y 3 meses	Entre 3 y 6 meses	Entre 6 y 12 meses	Más de 12 meses	
Un incremento significativo e inesperado de la tasa de cambio.	8 <b>1</b> 88	2	2362	2	3	4	5	
Un descenso significativo e inesperado de la tasa de cambio.	8968	2	2363	2	3	4	5	
Un incremento significativo e inesperado en la demanda por su principal producto.	848	2	53 <b>1</b> 53	2	3	4	5	
Un descenso significativo e inesperado en la demanda por su principal producto.		2	8368	2	3	4	5	
Un incremento significativo e inesperado en los costos de producción distintos a la tasa de cambio.		2		2	3	4	5	
Un descenso significativo e inesperado en los costos de producción distintos a la tasa de cambio.	8.to	2		2	3	4	5	
26. En la decisión de <b>aumentar</b> el precio de su	u principal product	to, califique la importan	cia de cada uno de los	s siguientes factore	s: (1 = No importante,	2 = Poco importante	3 = Importante, 4 =	
Factores			8884888	200	3 4 4	9		
2. Un cambio en los costos financieros	1	2	3 4	9				
<ol> <li>Un cambio en los costos de las mateir</li> <li>Un cambio en los precios de la energi</li> </ol>	ias primas ía y el combustible	e	000010000	2	3 4	9		
5. Un cambio en los precios de los com	oetidores		0001000	2	3 4	9		
<ol> <li>Un cambio en los impuestos y otras cargas tributarias</li> <li>Un cambio en la demanda por su producto.</li> </ol>			0000000	2	3 4	9		
8. Un cambio en la tasa de cambio	1	2	3 4	9				
27. En la decisión de <b>disminuir</b> el precio de su	u principal product	to, califique la importane	cia de cada uno de los	s siguientes factore	s: (1 = No importante,	2 = Poco importante	, 3 = Importante, 4 =	
Factores			009000	2	300 00400 6	900		
2. Un cambio en los costos financieros			1	2	3 4	9		
<ol> <li>Un cambio en los costos de las mater</li> <li>Un cambio en los precios de la energi</li> </ol>	ias primas ía v el combustible	e	1	2	3 4	9		
5. Un cambio en los precios de los com	oetidores		000	2	3 4	9		
<ol> <li>Un cambio en los impuestos y otras o</li> <li>La cambio en la demanda por su pro-</li> </ol>	argas tributarias		8884888	2	3 4	9		
8. Un cambio en el tipo de cambio			0001000	2	3000 0004000	<u> </u>		
28. Califique la importancia de la siguiente información al momento de calcular el precio de su principal producto: (1 = No importante, 2 = Poco importante, 3 = Importante, 4 = Muy Importante, 9= No Sabe / No Responde) MOSTRAR TARJETA								
<ul> <li>Información sobre el comportamiento par costos, precio de los competidores</li> </ul>	sado de variables	a tales como: demanda,	0001000	2	3 4	9		
<ul> <li>Información sobre el comportamiento ac precio de los competidores</li> </ul>	tual de variables	tales como: demanda, o	costos, 1	2	300 00400	9		
<ul> <li>Información sobre pronósticos de todas de sus ganancias.</li> </ul>	s las variables rele	evantes en la maximizad	ción	200	3 4	9		
- Inflación pasada			0009000	2	3 4	9		
- Inflación actual			2003000	002000	3 4	9		
- Inflación esperada			0001000	200	3 4	<b>9</b>		

29. Evalue la importancia de la meta de inflación fijada por el Banco de la República para las decisiones de precios que toma su empresa ( <i>1 = No im</i> <i>2 = Poco importante, 3 = Importante, 4 = Muy Importante )</i> MOSTRAR TAR	portante, JETA							
30. Evalue la importancia de la fijación del salario mínimo legal por parte de gobierno para las decisiones de precios que toma su empresa (1 = No impo 2 = Poco importante, 3 = importante, 4 = Muy Importante ) MOSTRAR TAR	el ortante, E JETA							
31. Si existen razones para cambiar los precios de su principal producto, ¿qué importancia tiene cada uno de los siguientes factores para NO hacerlo? (1 = No importante, 2 = Poco importante, 3 = Importante, 4 = Muy Importante) MOSTRAR TARJETA								
		No importante	Poco importante	Importante	Muy importante	No sabe		
* La existencia de contratos escritos especificando que los pre- pueden ser cambiados cuando el contrato sea renegociado.	cios sólo	2262	2	3	4	9		
* A pesar de la ausencia de un contrato escrito, existe un acuerdo con sus clientes, según el cual ellos esperan que no aumenten los cuando las condiciones económicas así lo ameriten.	implícito s precios		2	3	4	9		
* La existencia de unos costos asociados con los cambios en los pre ejemplo, la impresión de nuevas listas de precios, los costos de anu cambios, etc.	cios. Por Inciar los		2	3	4	9		
* El riesgo de que los competidores no cambien los precios, es empresa no quiere ser la primera en cambiar los precios.	decir, la	88888	2	3	4	9		
* La frecuencia de la información usada para revisar (y finalmente los precios de su principal producto es irregular. Por lo tanto, los responden lentamente a nuevas condiciones	cambiar) s precios	88 <b>1</b> 88	2	3		9		
<ul> <li>La situación que generaría el cambio de precio es considerada con transitoria</li> </ul>	10		2	3	4	9		
* Las características del producto podrían ser modificadas o alterada	5		2	3	4	9		
* Los costos laborales y de materias primas empleados en la produce su principal producto no cambiaron	sión de	8368	2	3	4	9		
* Existen umbrales de precios que pueden ser más atractivos clientes. Por ejemplo se puede pensar que su producto se vende m \$4.999 que a \$5.000.	para los ás fácil a	1	2	3	4	9		
32. ¿Las respuestas entregadas por usted respecto a su producto principal representan de igual manera sus otros productos?								
Si 🔯 No	Si O10 No D2 No Aplica. La compañía tiene un solo producto 80							

## Appendix 4

## **Treatment of Variables Missing Due to No Response**

The existence of missing values, or non-responses to survey questions, could potentially lead to a bias in the estimation of the population's characteristics as pointed out by Lohr (1999), Durrant (2005), SAS/STAT 9.1 User's Guide (Proc MI) and Särndal et al. (2005). Different methods exist to impute plausible values to the missing data to produce a complete collection of information. Thus, the main reason for using the imputation method is to reduce nonresponse bias occurring because the distribution of missing, but supposedly known, values generally differs from the distribution of the actual answers.

The method used in this paper pertains to the category of multiple imputation methods. The basic idea of these methods is centered on the random assignment of different values to the missing response which allows inclusion of uncertainty about the true non-observed value. In practice, one of the most employed methods in the context of multiple imputations is the Bayesian focus parameter of Markov Chain Monte Carlo (MCMC),<sup>13</sup> which assumes a multivariate normal distribution of the collection of variables with missing information (Schafer, 1997).

In those cases where it was not possible to obtain imputation by applying the MCMC, a non-conditional mean method was used belonging to the simple deterministic imputation deduction methods (see Durrant, 2005). This method assigns the simple average of the values observed in its strata to the missing value.

## Appendix 5

#### **Calculation of the Mean and the Stratified Weighted Variance**

The stratified sampling average, Appendix 1, is adjusted by weighting the importance of each of the companies by its importance in the strata with the objective of reaching a better representativeness of the measurement of the central tendency by strata. Declared company operating income for 2005 (to the Superintendencia de Sociedades and the Superintendencia Financiera) is used as the measurement of importance in this paper.

In general, calculation of the stratified weighted average is based on the theoretical development of the estimate of a ratio of random values by stratum and by its weighted average (see Hansen et al., 1953a, and Hansen et al. 1953b). As such, the stratified weighted average, by a measure of the importance of the company, is defined as:

$$\widehat{\overline{y}}_{est} = \frac{\sum_{h=1}^{L} N_h \sum_{i=1}^{n_h} \frac{y_i x_i}{n_h}}{\sum_{h=1}^{L} N_h \sum_{i=1}^{n_h} \frac{x_i}{n_h}} = \frac{\sum_{h=1}^{L} N_h \sum_{i=1}^{n_h} \frac{y_i}{n_h}}{\sum_{h=1}^{L} N_h \sum_{i=1}^{n_h} \frac{x_i}{n_h}},$$

In our case,  $y_i$  is the answer to a particular question by the  $i_{th}$  company in the  $h_{th}$  stratum and  $x_i$  is the value of the net operating income of the corresponding company. Additionally, the variance of this estimator can be defined as follows:

<sup>&</sup>lt;sup>13</sup> The imputation exercise (MCMC) was carried out using the SAS of MI V.9.1 Procedure.

$$\begin{split} & \text{VAR}\left(\hat{\tilde{y}}\right) = \frac{1}{\left(\sum\limits_{h=1}^{L} N_{h} \sum\limits_{i=1}^{n_{h}} \frac{x_{i}}{n_{h}}\right)^{2}} \left[\sum\limits_{h=1}^{L} \left\{N_{h} \left(\frac{N_{h}}{n_{h}}-1\right)\right\} \left(S_{\tilde{y}_{(h)}}^{2} + \hat{C}^{2} S_{x(h)}^{2} - 2\hat{C} S_{\tilde{y}_{x(h)}}\right)\right] \\ & = \frac{1}{\left(\sum\limits_{h=1}^{L} N_{h} \sum\limits_{i=1}^{n_{h}} \frac{x_{i}}{n_{h}}\right)^{2}} \left[\sum\limits_{h=1}^{L} \left\{N_{h} \left(\frac{N_{h}}{n_{h}}-1\right)\right\} \left(S_{\tilde{y}_{(h)}}^{2} + \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{y_{i}x_{i}}{n_{h}}\right)^{2} S_{x(h)}^{2} - 2\left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{y_{i}x_{i}}{n_{h}}\right)^{2} \left[\sum\limits_{h=1}^{L} \left\{N_{h} \left(\frac{N_{h}}{n_{h}}-1\right)\right\} \left(\left\{\sum\limits_{i=1}^{n_{h}} \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{y_{i}x_{i}}{n_{h}}\right)^{2} S_{x(h)}^{2} - 2\left(\sum\limits_{h=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}\right)^{2} \left[\sum\limits_{h=1}^{n_{h}} \left\{N_{h} \left(\frac{N_{h}}{n_{h}}-1\right)\right\} \left(\left\{\sum\limits_{i=1}^{n_{h}} \left(\sum\limits_{j=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{y_{i}x_{i}}{n_{h}}\right)^{2} + \left(\sum\limits_{h=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{y_{i}x_{i}}{n_{h}}\right)^{2} \left[\sum\limits_{i=1}^{n_{h}} \left(\sum\limits_{j=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}\right)\right] \left(\sum\limits_{h=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}\right)^{2} \left[\sum\limits_{i=1}^{n_{h}} \left(\sum\limits_{j=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}\right)\right] \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}\right)\right] \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}\right)^{2} \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}\right)\right] \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}}\right) \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}}\right)\right) \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}}\right) \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}}\right)\right) \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}}\right) \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}}\right) \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{x_{i}}{n_{h}}}\right)\right) \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{X_{i}}{n_{h}} \frac{X_{i}}{n_{h}}}\right) \left(\sum\limits_{i=1}^{n_{h}} \frac{N_{h}}{n_{h}} \frac{X_{i}}{n_{h}}}\right) \left$$

On the other hand, taking the weighted importance of the company in the stratum, the stratified weighted proportion is defined as:

$$\hat{p} = \frac{\sum_{h=1}^{L} \sum_{i=1}^{n_h} \frac{N_h}{n_h} a_{hi} x_i}{\sum_{h=1}^{L} \sum_{i=1}^{n_h} \frac{N_h}{n_h} x_i},$$

where  $a_{hi}$  takes a value of one if the company chooses a specific alternative and zero for the opposite situation.

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