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How Do Firms Set Prices? Survey Evidence from Ireland

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Abstract

Despite the importance of understanding and estimating the “stickiness” of prices of goods and services, empirical assessment of price setting behaviour by firms has remained relatively limited. This is the first paper to provide detailed information on the pressures, manner and frequency with which Irish firms adjust their output prices. Using survey information from almost a thousand Irish firms, we present a number of stylised facts on price setting behaviour. One of the first of these relates to the level of control firms have over their pricing strategy – the most common approach for firms is to set a price based on costs and a self-determined profit margin. However, one-third of firms said that their price was set primarily by following that of their closest competitors. The perceived intensity of competition was found to be one of the most significant factors in determining the price-setting approach and is also a central factor in determining price changes.

¹ The authors are all economists in the Bank’s Economic Analysis and Research department. We would like to acknowledge the work of the head and staff of the ESRI survey unit, who co-ordinated the survey fieldwork and provided valuable feedback on the survey instrument. This work was undertaken as part of a Eurosystem research network, the Wage Dynamics Network, and we would also like to thank all of the participants for their collaboration. The views expressed in the paper are our own and do not necessarily reflect the views of the Central Bank and Financial Services Authority of Ireland or the ESCB. Email: mary.keeney@centralbank.ie; martina.lawless@centralbank.ie; alan.murphy@centralbank.ie

Non-Technical Summary

In theory, firms are assumed to have a pricing strategy which meets a revenue or profit objective. However for various reasons, prices of goods and services may not adjust instantly to changing demand and supply conditions. Empirical assessment of price setting behaviour by firms has remained relatively limited despite the fact that pricing outcomes are crucial parameters in any micro-founded economic model. This is the first paper to provide detailed information on the pressures, manner and frequency with which Irish firms adjust their output prices.

The survey contains information from almost a thousand Irish firms undertaken as part of a coordinated research network of European central banks. Of the stylised facts about price-setting that emerge from this analysis, one of the first relates to the level of control firms have over their pricing strategy – the most common approach for firms is to set a price based on costs and a self-determined profit margin. However, one-third of firms said that their price is set primarily by following that of their closest competitors. The perceived intensity of competition was found to be one of the most significant factors in determining the price-setting approach.

The strength of competition faced by the firm was also a central factor in determining price changes with over half of firms reporting that they were likely or very likely to reduce price if a main competitor did so. Beyond price changes in response to competitor actions, one-third of firms reported that the standard frequency with which they adjusted the price of their main product was once every six months.

External shocks such as higher wage cost or a diminished demand for the product or service presents the firm with a changed trading position. The firm's reaction is found to be determined by the competitive environment and the associated pricing power held by the firm.

1. Introduction

In theory, firms are assumed to have a pricing strategy which meets a revenue or profit objective and ultimately ensures their continued survival. However for various reasons, while prices of goods and services may not adjust instantly to changing demand and supply conditions, in time they should reflect new trade and market conditions. Empirical assessment of price setting behaviour by firms has remained relatively limited despite the fact that pricing outcomes are crucial parameters in any micro-founded economic model. This is the first paper to provide detailed information on the pressures, manner and frequency with which Irish firms adjust their output prices. In particular, it assesses the relationship between wages and prices and the responsiveness or stickiness of output prices when firms are faced with wage and other external shocks. We present results of a survey that directly asked firms about how they went about setting prices, how closely they matched changes in their competitors' prices and how frequently prices were changed.

The survey contains information from almost a thousand Irish firms and was undertaken as part of a coordinated research network of European central banks. This Wage Dynamics Network (WDN) has a broad remit of investigating determinants of wages and labour cost changes across Europe. The survey that was undertaken as part of this project gathers a wealth of qualitative information on firms' approaches to wage and price determination in normal times and when the firm is faced with adverse shocks. The approach of directly asking firms about their policies follows the seminal interview study into price stickiness in the US by Blinder (1991) and earlier work in a European context (Fabiani *et al.*, 2006).

The most common approach to price-setting, reported by 44 percent of firms, was to set a price based on costs and a self-determined profit margin (cost-plus pricing). Another one-third of firms participating in the survey said that their price followed that of their closest competitors (perfect competition pricing). Intensity of competition was found to be one of the most significant factors in determining the price-setting approach. Looking further at the influence of competition, over half of firms said they were likely or very likely to reduce price if a main competitor made such a move.

When asked about the frequency of price changes, the most common response was that prices were adjusted once every six months. Intensity of competition was again a key factor in explaining the pattern of results, with sector differences also important in determining the observed frequencies. Almost two-thirds of firms reported no particular link between price and wage changes within the firm.

The paper is organised as follows: Section 2 describes the survey and some characteristics of the sample. Section 3 presents results on how the firms portray their price setting behaviour. Section 4 examines the relationship between perceived product market competition and price changes and Section 5 discusses the frequency of price changes. Section 6 looks at links between price changes and wage changes. Section 7 looks at the response of prices to a demand shock. Section 8 concludes.

2. Survey Design

2.1 Questionnaire Content and Approach

The survey was undertaken as part of a coordinated network made up of central banks from across Europe. The Survey Unit of the ESRI was commissioned to conduct the fieldwork for the survey. The final questionnaire was sent out in late September 2007. The survey was a mixed modal survey; five rounds of intensive phone interviewer follow-ups followed the initial postal distribution of the questionnaire. The final response was extremely satisfactory at approximately 25 percent. The stratified sampling strategy was based on an equal probability basis, stratified by employment size category, sector (NACE code) and region. The weighting scheme used to gross up the final data was likewise dependent on these variables to ensure our survey data represented the national situation.

The final questionnaire comprised of four sections with 34 questions. The wage setting portion of the survey is described in Keeney and Lawless (2010), while this paper concentrates on the questions related to prices. Section 1 of the survey gathers information about the firm including general firm descriptives including age and size; the composition of the workforce; the labour turnover rate during 2006; the tenure and occupational distribution and the importance of labour costs. Section 2 contains questions on wage-setting practices and the role of any wage-bargaining processes.

The section concludes with a question examining the frequency and timing of wage changes. Section 3 of the questionnaire examines the existence of downward wage rigidity and its causes.

Section 4 of the questionnaire looks at the relationship between price setting and price changes referring to the main product or service of the firm that generated the highest fraction of turnover in the previous year. The price-setting strategy employed by the firm would indicate the degree of external competition faced and the reaction that the firm would take to competitor pricing strategies. The coincidence or otherwise of price and wage changes was asked explicitly as the final question of the survey.

2.2 Description of the Sample

The sample was derived by the ESRI from the ‘Kompass’ database of Irish firms. The sample was composed in such a way that firms of all sizes would be represented according to their distribution nationally. Firms in distribution and other service sectors were heavily represented in terms of the number of employees covered, as shown in Table 1. The average number of employees per firm was 23 in our sample, and almost half of the firms surveyed fell in the “10 to 49 employees” group.

Table 1: Size and Sector classification of firms in our sample

No. of firms	Manufacturing	Construction	Distribution	Oth. Services	All
Micro 5-9	25	12	77	108	222
Small 10-49	74	43	131	220	468
Medium 50-249	55	20	53	66	194
Large 250+	43	5	15	38	101
Total	197	80	276	432	985

A weighting scheme was derived to make the survey results representative of the total population of firms. Individual firm weights were deemed necessary where an over- or under-representation of the national population of firms were observed in the sample aggregates. The weighting scheme chosen is based on employment and is calculated by taking the total workforce of the firm subgroup and dividing it by the number of firms in question. For a given firm, the individual weight assigned to it indicates the number of workers in the total population, taking account of the sector to

which it belongs. The sum of the sample weights of all firms together is equal to total employment of the national population making up the sample.

3. Price Setting

3.1 How do firms set the price for their product or service?

The first stage in understanding the price setting process at the firm level is to gauge the extent to which firms were in control of their own price setting policies. Firms were asked the following question: “How does your firm set its price for its main product or service on its main market? Please tick only one answer.” The following list of options was provided:

- We do not have an autonomous price setting policy because the price is regulated, or it is set by a parent company/group.
- The price is set by our main customer(s).
- We do set our price ourselves but following our main competitor(s).
- We do set our price fully according to our costs and a completely self-determined profit margin.
- Other.

Table 2: How is the Price of Your Main Product Set

	Percentage
No autonomous price setting	11.1
Price set by customer(s)	5.5
Price set following main competitors	33.3
Price based on costs and self-determined profit margin	44.2
Other	5.9

Table 2 presents the results for how firms set their prices. The main options chosen were to set a price based on cost and profit margin determined by the firm itself or to follow the prices set by competitors. Eleven percent of firms report that they have no autonomous price setting policy and slightly over 5 percent had prices set by their main customers.

Table 3: How is the Price of Your Main Product Set
Firm Size and Sector

Firm size	Micro 5-9	Small 10-49	Medium, 50-249	Large 250+
No autonomous price setting	8.6	15.9	14.1	25.9
Price set by customer(s)	6.0	4.2	4.3	9.4
Price set following main competitors	34.0	32.3	30.7	30.9
Price based on costs and self-determined profit margin	45.6	41.3	42.6	30.1
Other	5.8	6.3	8.3	3.7
Sector	Manufacturing	Construction	Trade & Distribution	Other services
No autonomous price setting	9.7	4.5	18.3	7.6
Price set by customer(s)	9.8	7.3	3.9	5.1
Price set following main competitors	22.5	27.9	32.7	37.6
Price based on costs and self-determined profit margin	57.6	56.2	39.9	41.6
Other	0.4	4.1	5.2	8.1

Table 3 shows how the price setting policies vary across firm size groups and sector. The lack of an independent pricing procedure was more common amongst the largest firms (those with more than 250 employees). Although the survey did not contain information on ownership, it could be inferred that these firms are subsidiaries of multinational groups whose pricing structure is determined by a head office elsewhere. The other options did not vary to any great extent across the size groups. Regarding differences across sectors, manufacturing and construction² were the most likely to report that prices were set on the basis of the firm's own costs and margin decisions.

² The survey was undertaken towards the end of the construction boom in Ireland and the responses may reflect firm behaviour during the boom years.

Table 4: How is the Price of Your Main Product Set

	No autonomous price setting	Price set by customer(s)	Price set following main competitors
Strong competition	-0.242 (0.347)	-1.320*** (0.388)	-0.691*** (0.239)
Weak competition	-0.589 (0.567)	-34.350 (72.688)	-1.445*** (0.389)
No competition	0.359 (1.017)	-34.366 (20.050)	-2.019* (1.122)
Export Intensity	0.016*** (0.005)	0.195*** (0.333)	0.002 (0.004)
5-19 workers	-0.198 (0.379)	0.906* (0.544)	0.063 (0.271)
20-49 workers	0.280 (0.397)	0.237 (0.673)	0.176 (0.302)
50-199 workers	0.518 (0.455)	0.133 (0.665)	0.042 (0.386)
Manufacturing	1.053 (0.806)	0.032 (0.678)	0.102 (0.437)
Distribution	1.979*** (0.762)	-0.384 (0.673)	0.610* (0.390)
Non-Manufacturing	0.044 (0.803)	-0.882 (0.668)	0.567* (0.367)

Multinomial Logit: number of observations = 632.
Adjusted R²: 0.07
Benchmark: The price is set fully according to costs and a completely self-determined profit margin.
Standard errors in parentheses.
*** = significant at the 1% level, ** = significant at the 5% level, * = significant at the 10% level.

Table 4 examines the different responses to the question on overall price setting policy using a multinomial logit regression for the four potential categories (dropping the “other” responses). The base category is that firms use their own costs and self-determined profit margin as the basis of their price setting. The explanatory variables are size group, sector, export intensity and a measure of perceived competition. The

competition variable is the firm's response to a question in the survey that asked directly "To what extent do you experience competition for your main product/service?" The firm had four potential options for their competitive environment – severe competition, strong competition, weak competition and no competition. These are entered as a categorical variable with severe competition as the base category.

As expected, where the self-reported market competition is strong or severe, prices are set in the majority of cases by following competitors. When firms have sufficient market power to set their own prices and maintain price stickiness (Taylor, 1999), it would normally be achieved as a mark-up on costs and would lead to a self-determined profit margin. The survey results confirm this: autonomous price setting prevails where competition is considered to be absent. We also find that firms that have regulated prices or prices set by a parent company tend to be in the largest size category. On the other hand, firms who report that they can exclusively set their own prices are concentrated in firms with the smallest employment categories (<50 employees). Export intensity is positive and statistically significant for those firms that report no autonomous price setting abilities or for which prices are set by their customers. This probably reflects the fact that many of these firms are price takers in foreign markets where they have little power to influence the price of their goods or services. The next section looks in more detail at the influence of competition on firm pricing decisions.

4. Prices and Competitive Environment

In the previous section, we saw that a measure of perceived competition was significant in explaining which broad type of price setting policy the firm operated. This section expands the discussion of the role played by the competitive environment, this time focusing on how the firm reacts to price changes by competitors.

Firms were asked to consider how they would respond to the following scenario: "Suppose that your main competitor for your main product/service decreases their prices; how likely is your firm to react by decreasing your price?" The main response options given were: Very likely, likely, not likely and not at all. Table 5 shows the

distribution of answers for all firms in the sample. Slightly over half the firms responded that they would be very likely or likely to reduce their price if a competitor had done so. This is a higher figure compared to that reported in Table 2 where 33 percent of respondents stated that prices were set following their main competitors. One explanation for the difference is that while many firms primarily focus on their own costs and self-determined margins, they still take in to account the general price levels prevailing in their sector. A further third were not likely to decrease price following a competitor’s reduction.

Table 5: If the Main Competitor to Your Firm’s Product Decreases Prices, How Likely is Your Firm to React by Decreasing its own Price

	Percentage
Very likely	13.5
Likely	38.6
Not likely	34.2
Not at all	5.5
Don’t know/no answer	8.2

Looking at a more detailed breakdown of the responses by size and sector in Table 6, we see that the largest size group has the highest percentage of firms reporting that they would be likely to cut price if there was a reduction in their competitor’s price. Across sectors, firms in construction and trade were the most likely to respond to a competitor’s price decrease by following suit. Manufacturing firms had the highest proportion (41.5 percent) responding that they were not likely to make such a move.

Table 6: If the Main Competitor to Your Firm’s Product Decreases Prices, How Likely is Your Firm to React by Decreasing its own Price?

Firm size	Micro	Small	Medium	Large
Very likely	12.6	15.7	15.3	13.0
Likely	38.1	38.4	41.5	47.4
Not likely	35.3	33.9	27.3	31.3
Not at all	6.3	2.9	5.7	0.2
Don’t know	7.8	9.2	10.3	8.1
Sector	Manufacturing	Construction	Trade	Oth. services
Very likely	13.4	11.4	20.1	9.4
Likely	36.4	50.4	41.1	35.7
Not likely	41.5	28.5	28.8	36.7
Not at all	3.9	2.3	6.4	5.7
Don’t know	4.9	7.4	3.6	12.5

Table 7 below again uses a multinomial logit specification to examine more formally the responses of firms to whether or not they would cut their price following a competitor’s price decrease. The base category is a response of likely to reduce price. We find that the perceived level of competition is again a significant factor, with weak competition negatively associated with being very likely to reduce price and positive and significant for a response of not likely or not at all.

Table 7: If the Main Competitor to Your Firm's Product Decreases Prices; How Likely is Your Firm to React by Decreasing its own Price

	Very likely	Not likely	Not at all
Strong competition	-1.356*** (0.227)	0.485** (0.221)	0.321 (0.512)
Weak competition	-1.675** (0.782)	1.982*** (0.375)	2.506*** (0.619)
No competition	-30.246 (45.519)	1.675* (0.305)	-29.186 (76.281)
Export Intensity	0.002 (0.004)	0.004* (0.002)	-0.010 (0.008)
5-19 workers	0.018 (0.302)	0.194 (0.231)	-0.157 (0.433)
20-49 workers	0.286 (0.335)	0.177 (0.260)	-0.697 (0.565)
50-199 workers	-0.012 (0.397)	0.181 (0.308)	-1.510 (1.082)
Manufacturing	0.516 (0.471)	0.673** (0.327)	0.666 (0.882)
Distribution	0.939** (0.416)	0.015 (0.309)	0.857 (0.793)
Non-Manufacturing	0.147 (0.428)	0.488* (0.294)	1.120* (0.772)

Multinomial Logit: number of observations = 906.
Adjusted R²: 0.08.
Benchmark: Likely. Standard errors in parentheses.
*** = significant at the 1% level, ** = significant at the 5% level, * = significant at the 10% level.

5. How often do firms change their prices?

One of the key questions motivating the survey was to examine how frequently prices were adjusted by firms. The literature on price setting behaviour makes a distinction between time-dependent and state-dependent price-setting behaviour. Time-dependent models refer to the fact that the timing of any price adjustment is exogenously given. In other words, it does not depend on the state of the economy and would not react to unanticipated shocks faced by the firm. The most well known time-dependent pricing

rules are those of Calvo (1983) and Taylor (1980). In the first case, the interval between two consecutive price adjustments is random (but exogenous), while in the second case prices are adjusted after fixed intervals.

Under a state-dependent pricing rule, the price will be adjusted when a specific event occurs that causes a deviation from optimal pricing behaviour. Although both strategies imply that prices remain unchanged for periods of time, they have quite different implications for monetary policy. Under time-dependent rules, the higher the level of inflation the shorter should be the time interval between output price revisions. On the contrary, under state-dependent rules, firms would review their prices at a particular frequency and/or do so only in response to particular events e.g. changed cost conditions.

Table 8: How Often is the Price of Your Firm’s Main Product Changed: All Firms

	Percentage
Daily, Weekly or Fortnightly	12.6
Monthly	4.8
Quarterly	7.7
Half-yearly	33.6
Once a year	7.7
Less frequently than once a year	4.5
Never	0.5
There is no defined pattern	28.6

In the survey, firms were asked: “Under normal circumstances, how often does the price of your main product/service change in your firm?” We take the response of “no pattern” to indicate that the firm is more likely to be considered a state-dependent price-setter, whereas the other options all indicate regular time intervals between price changes. Table 8 shows that the modal response, chosen by one-third of firms, is that prices are adjusted once every six months. Approximately one-quarter of firms change prices more frequently than twice a year, with 12.6 per cent adjusting prices on a daily, weekly or fortnightly basis. A further 4.8 per cent change prices monthly

and 7.7 percent reported quarterly price changes. A fairly large percentage of firms (28.6) reported that they did not adjust prices with any particular time frequency.

How do these frequencies compare to firm behaviour in other countries? Druant *et al.* (2009) combine the data from all of the Wage Dynamics Network (WDN) surveys and construct a duration measure for the average number of months prices (and wages) go unchanged.³ The Irish answers translate into an average price duration of 8.5 months. This was the shortest average duration of the Euro area countries surveyed and the second shortest of all countries (Lithuania had an average price duration of 8.4 months). The average price duration across all countries was 9.6 months. This was slightly shorter than earlier survey evidence had suggested – Fabiani *et al.* (2006) had found an average duration across nine Euro area countries of closer to eleven months. The Irish results are most similar to those from a UK survey, which found that the most common occurrence was for firms to change prices twice a year, although price reviews were carried out monthly (Hall, Walsh and Yates, 2000).

Table 9: Are Price Changes Concentrated in a Particular Period

	Percentage
January - March	43.1
April-June	17.6
July-September	18.6
October-December	20.6

The firms that reported a regular time pattern to their price changes were further asked if their price changes tended to occur in particular months. A large concentration of price changes at a particular time may be an alternative indicator of rigidities that restrict firms from making adjustments. Most of the changes in price take place in the first quarter of the year, with 43.1 per cent of firms reporting that price changes occurring at this time, as we see in Table 9. Price changes in the rest of the year are reasonably evenly spread across quarters. A similar pattern was found by Druant *et al.* (2009) across European countries.

³ This is based on the frequency answers as given in Table 8 with additional distributional assumptions made where the frequency cannot be directly related to a fixed interval (e.g. More than 2 years). Appendix 3 of Druant *et al.* (2009) describes the construction of the duration measure in detail.

Table 10: How Often is the Price of your Firm's Main Product Changed?

	Monthly or more	Quarterly	Twice a year	Every 2 years	Less frequently
Strong competition	-0.894*** (0.258)	-0.256 (0.388)	0.625 (0.438)	1.012** (0.551)	-0.421 (0.486)
Weak competition	-2.098*** (0.584)	-1.217* (0.800)	0.625 (0.438)	1.140** (0.639)	0.546 (0.587)
No competition	-35.339 (3.270)	0.236 (1.177)	0.625 (0.438)	0.962 (1.240)	0.534 (1.214)
Export Intensity	-0.001 (0.005)	0.009* (0.005)	0.006 (0.005)	0.008 (0.005)	0.017*** (0.006)
5-19 workers	-0.092 (0.315)	-0.418 (0.554)	-0.426 (0.462)	1.649*** (0.578)	1.508** (0.678)
20-49 workers	-0.766** (0.370)	-0.010 (0.546)	0.012 (0.454)	0.956* (0.601)	0.128 (0.808)
50-199 workers	0.332 (0.404)	-0.014 (0.560)	0.021 (0.561)	-1.198 (1.159)	0.243 (0.820)
Manufacturing	-1.032** (0.553)	-1.407** (0.648)	-1.204** (0.655)	-0.079 (0.602)	0.713 (1.114)
Distribution	1.002** (0.470)	-0.126 (0.538)	0.086 (0.570)	-0.239 (0.591)	0.356 (1.136)
Non-Manufacturing	-0.524 (0.480)	-1.187** (0.856)	-1.002* (0.584)	-0.530 (0.560)	0.395 (1.075)

Multinomial Logit: number of observations = 646

Adjusted R²: 0.08.

Benchmark: Once a year. Standard errors in parentheses.

*** = significant at the 1% level, ** = significant at the 5% level, * = significant at the 10% level.

Table 10 reports results relating firm characteristics to the frequency with which the firm changes the price of its main product. The base category is a price change once per year. Lower perceived competition make very frequent (monthly or more often) price changes significantly less likely than annual changes and is positively related to less frequent changes.

6 Price and Wage Links

Next, the survey findings are employed to compare the characteristics of flexible price and sticky price firms by looking for a link between marginal cost pressures arising from wage changes and the potential feed-through to output prices. This gives some insight into the potential effect of wage dynamics on inflation persistence. The following analysis examines the relationship between price and wage dynamics by comparing characteristics of price flexible and price sticky firms. “Price flexible” firms are considered to be those firms who indicate they typically change their output prices every quarter or more frequently. It was less obvious how to define a “price sticky” firm, as in principle, all price-setting behaviour that differs from the flexible benchmark could be considered as sticky. For the purpose of this section, a “sticky” firm was, however, defined as having a duration between two consecutive price changes exceeding 12 months, meaning that price changes only occur less than once a year.

Table 11: Price flexible versus sticky firms

%	Flexible ¹	Sticky ²
Strong or severe competition	92.9	80.1
Turnover last year higher /much higher	55.1	58.0
Export orientation (% turnover foreign)	7.5	12.1
Price-setting rule considers competitors’ prices	37.9	32.1
Likely to decrease price if competitors cut their price	77.1	45.2
Likely to increase price if demand slowed	29.1	20.6
Likely to suffer reduced margins if demand slowed	63.9	47.8
Would increase prices if intermediate cost increased	53.5	33.0
Automatic indexation of wages	15.6	46.7
Frequent wage changes due to inflation	52.9	58.5
¹ Firms with an average duration between price changes of ≤ 3 months		
² Firms with an average duration between price changes of $>$ than 12 months		

The first conclusion drawn from this analysis in Table 11 above is that price-flexible firms tend to experience more intense competition. They are also more likely to face a higher elasticity of demand as a larger proportion of them attach importance to

competitors' prices in deciding to increase or decrease their output price and apply some form of pricing-to-market. Second, flexible price firms are slightly less export-oriented, the latter factor being compatible with the finding that they may have sufficient market power in a domestic market setting to set their own output (and market) prices. Exporting firms tend to be price-takers in a world market environment. Third, the results in the table show that sticky-price firms are much more likely to have an *automatic* indexation link between wages and inflation. They are marginally more likely to have at least one annual change in wages for inflation reasons.

Table 12: How the Timing of Price changes relate to Wage changes

%	All firms	Price-flexible	Price-sticky
There is no link between the two	64.8	70.5	66.9
There is a link but no particular pattern	18.1	18.2	18.8
Decisions are taken simultaneously	3.4	1.8	2.0
Price changes tend to follow wage changes	10.3	5.7	9.2
Wage changes tend to follow price changes	2.3	2.7	1.5
Don't know/not applicable	1.1	1.1	1.6
	100.0	100.0	100.0

The price-wages link is explored further in Table 12. It is important to highlight the effect of wage dynamics for inflation persistence and vice-versa. Macroeconomic models typically assume a tight relationship between wage and price dynamics. Typically a model would assume that a fraction of wages is negotiated every period, while the other fraction is adjusted according to past inflation. If the negotiated nominal wages are determined following the theory of efficiency wage and the bargaining model, expected real wages would depend on labour productivity, unemployment, and past indexed wages (Blanchard and Katz, 1997). Our survey evidence shows that this relationship may not be as tight as assumed in a macroeconomic sense. It is most likely that time-dependent rules for wage and price changes prevail. From Table 12 above, there is no strong link between the marginal

cost pressures of wage changes and its feed through to output price effects. Moreover, the more widespread indexation of wages, the smaller the impact of labour market conditions on inflation.

Table 13 shows that some sectoral heterogeneity is observed in the Irish data during the period of the study. Nearly four out of five firms in the trade and distribution sector report no link between price changes and wage changes, while for manufacturing the figure is 70 percent. The use of state-dependent rules (costs plus a required margin) is more common among construction firms, with approximately 30 percent of these firms reporting that prices tended to follow wage changes compared with just 10 percent of firms overall quoting this price-setting rule. By contrast, there is a slightly higher propensity for service sector firms (not Trade and Distribution) to follow a time-dependent rule where wage changes tend to follow price changes (3.5 percent of service firms compared with 2.5 percent of all firms).

Table 13: How does timing of price changes relate to Wage changes, by sector

Sector	Manufacturing	Construction	Trade & Distribution	Other services
There is no link between the two	69.6	39.4	77.3	58.8
There is a link but no particular pattern	16.9	26.5	13.9	20.0
Decisions are taken simultaneously	5.1	2.7	2.3	3.7
Price changes tend to follow wage changes	5.6	29.8	5.1	12.2
Wage changes tend to follow price changes	0.7	1.6	1.4	3.5
Don't know/not applicable	2.1	-	-	1.8

7. Price Reaction to a Demand Shock

The final section of this paper asks how likely firms are to use price adjustment when faced with a negative shock to demand. The firm is asked to consider how relevant a price change was in the event of an “unanticipated negative shock”, but the size of the

hypothetical shock was not indicated. The most prevalent explanation of price rigidity is the "menu cost model" which assumes there is a cost to changing prices (e.g. reprinting catalogues). This can result in the firms potentially keeping nominal prices unchanged in response to nominal shocks. Crucial to this explanation is the assumption that price adjustment is more costly than adjusting quantities (Andersen and Toulemonde, 2004). A sectoral analysis of the potential price responses to an unanticipated slowdown in demand is shown in Table 14. Price adjustments are most likely to be used to a significant extent in the services sectors.

Table 14: Potential Price Cut reaction to a slowdown in demand by Sector

	Little/No relevance	Relevant/very relevant	Don't Know	All
Manufacturing	69.1	23.4	7.5	100
Construction	77.6	21.0	1.4	100
Distribution	58.6	37.7	3.7	100
Other Services	69.1	27.4	3.5	100
Total	66.5	29.6	3.9	100

We try to determine which factors increase the probability of a price change. In line with Montornes and Sauner-Leroy (2009), explanations can be grouped into three types of explanations: the degree of pricing power/market competition, the structure for wage-setting at the firm and the labour cost intensity of the firm (inverse of the capital intensity/rate of technology). The measure of pricing power and competition is the perceived ability to independently change prices vis-à-vis competitor price changes. The importance of wage bargaining is an important driver of the second explanation and labour cost intensity identifies the third type of explanatory factors. A set of control variables are also used to account for exogenous factors such as size, sector and age of the firm, composition of its labour force, and prevailing business and trading conditions.

Table 15: Adjust Price after Slowdown in Demand

	Adjust Price
% Domestic sales	0.01*** (0.002)
Share of labour costs	-0.001 (0.002)
Frequency of price change	-0.04** (0.02)
Price follows competitor	0.30** (0.12)
Set own profit margin	0.31*** (0.12)
Ever frozen wages	0.25 (0.15)
Pay bonuses	0.20** (0.09)
% Minimum wage	0.0004 (0.001)
Size and Sector controls	Yes
Number of Observations	718
Pseudo R-squared	0.03
Ordered probit regressions on relevance categories.	
Standard errors in parentheses. Number of observations = 646	

The results contained in Table 15 are shown having controlled for certain characteristics of the firm, namely size and sector of activity. The nature of the response is shown to depend on the conditions external to the firm wage structure (i.e. flexible wage components in the form of bonuses, competition and labour cost intensity in some instances). The empirical results show that stronger competition is associated with more intensive adjustment in the aftermath of shocks. Price responses after a demand shock are more likely when the firm does not have pricing power and follows competitor prices i.e. competition in the product market is strong. Higher

labour cost share lowers price and output sensitivity to a demand shock. The more price flexibility exists (frequency of price changes), the more likely that prices will be adjusted following a demand shock.

8. Conclusions

This is the first paper to study the dynamics of price setting amongst Irish firms. In addition to documenting the frequency of price changes, the relationship between price and wage changes is also examined at the firm level. Evidence from a survey of almost a thousand firms answering qualitative questions on their price setting policies is presented and a number of stylised facts emerge. The first of these relates to the level of control firms have over their pricing strategy – the most common approach for firms is to set a price based on costs and a self-determined profit margin. However, one-third of firms said that their price is set primarily by following that of their closest competitors. The perceived intensity of competition was found to be one of the most significant factors in determining the price-setting approach.

The strength of competition faced by the firm was a central factor in determining price changes with over half of firms reporting that they were likely or very likely to reduce price if a main competitor did so. Beyond price changes in response to competitor actions, one-third of firms reported that the standard frequency with which they adjusted the price of their main product was once every six months. Approximately one-quarter of firms change prices more frequently than twice a year, while another quarter reported that they did not have any particular time frequency with which they changed prices. Firms with a high frequency of price changes were more likely to experience more intense competition than firms with stickier prices.

External shocks such as higher wage cost or a diminished demand for the product or service presents the firm with a changed trading position. The firm's reaction is found to be determined by the competitive environment and the associated pricing power held by the firm. Flexible price firms are most likely to face a higher elasticity of demand as a larger proportion of them attach importance to competitors' prices in deciding to increase or decrease their output price and apply some form of pricing-to-

market. In particular, uncompetitive labour costs impede the scope with which the firm can thus react and may ultimately cost the firm its survival.

A cross-country comparison was undertaken by Druant *et al.* (2009) in which they constructed a duration measure for the average number of months prices go unchanged using combined data from all of the WDN survey countries. They show that, at 8.5 months, the average price duration for Ireland was the shortest average duration of the Euro area countries surveyed and the second shortest of all WDN countries. The average across all WDN survey countries was a price duration of 9.6 months, which was slightly shorter than Fabiani *et al.* (2006) had found. In their study Fabiani *et al.* (2006) reported an average duration across nine Euro area countries of approximately 11 months. The results for Ireland are similar to those from a UK survey, which found that the most common occurrence was for firms to change prices twice a year (see: Hall, Walsh and Yates, 2000). In terms of the timing of price changes it was observed for Irish firms that most of the changes took place in the first quarter of the year, with 43 percent of firms reporting that price changes occurred at this time. Price changes in the rest of the year are reasonably evenly spread across the remaining quarters. A similar time pattern was found by Druant *et al.* (2009) across other European WDN countries.

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