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EVIDENCE FROM MICRO PPI DATA

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In 2005 all ECB publications will feature a motif taken from the €50 banknote.

1 This study was conducted in the context of the Eurosystem Inflation Persistence Network. We are extremely grateful to the Instituto Nacional de Estadística for providing us with the dataset, and particularly to Manuel Garrido for his help. In addition, we wish to thank Jerzy Konieczny, Philip Vermeulen, all the RG3 members and an anonymous referee for very helpful comments and suggestions.
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The Eurosystem Inflation Persistence Network

This paper reflects research conducted within the Inflation Persistence Network (IPN), a team of Eurosystem economists undertaking joint research on inflation persistence in the euro area and in its member countries. The research of the IPN combines theoretical and empirical analyses using three data sources: individual consumer and producer prices; surveys on firms' price-setting practices; aggregated sectoral, national and area-wide price indices. Patterns, causes and policy implications of inflation persistence are addressed.

Since June 2005 the IPN is chaired by Frank Smets; Stephen Cecchetti (Brandeis University), Jordi Galí (CREI, Universitat Pompeu Fabra) and Andrew Levin (Board of Governors of the Federal Reserve System) act as external consultants and Gonzalo Camba-Méndez as Secretary.

The refereeing process is co-ordinated by a team composed of Günter Coenen (Chairman), Stephen Cecchetti, Silvia Fabiani, Jordi Galí, Andrew Levin, and Gonzalo Camba-Méndez. The paper is released in order to make the results of IPN research generally available, in preliminary form, to encourage comments and suggestions prior to final publication. The views expressed in the paper are the author's own and do not necessarily reflect those of the Eurosystem.

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CONTENTS

Abstract

This paper identifies the basic features of price setting behaviour at the producer level in the Spanish economy using a large dataset containing the micro data underlying the construction of the PPI over the period 1991-1999. It explores how these general features are affected by some specific factors (cost structure, degree of competition, demand conditions, government intervention, level of inflation, seasonality, and the practice of using attractive prices) and presents a comparison of price setting practices at the producer and at the consumer level to ascertain whether the retail sector augments or mitigates price stickiness. We find that prices do not change often but do so by a large amount. The cost structure, proxied by the labour share and the relevance of raw materials, and the degree of competition, proxied by import penetration, affect price flexibility. We also find some evidence that producer prices are more flexible than consumer prices.

Keywords: price setting, producer prices, frequency of price changes.
JEL Codes: E31, D40.

Non-technical summary

This paper identifies the basic features of price setting behaviour at the producer level in the Spanish economy using a large dataset containing the micro price data underlying the construction of the Producer Price Index (PPI) over the period 1991-1999. The paper extends the empirical evidence on price setting behaviour in Spain obtained in other studies using micro consumer prices (Álvarez and Hernando, 2004) and survey data (Álvarez and Hernando, 2005) and contributes to enlarge the scant international evidence available on PPI individual data. Our analysis provides evidence on the frequency and size of price adjustments, distinguishing between price increases and price reductions, and reports direct estimates of the duration of price spells. Then, we document differences in the general features of price setting behaviour across types of products and explore how these general features are affected by some specific factors, including the cost structure, the degree of competition, demand conditions, government intervention, the level of inflation, seasonality, and the practice of using psychological and round prices. Finally, the paper presents a comparison of price setting practices at the producer and at the consumer level to try to ascertain whether the retail sector augments or mitigates price stickiness. The main conclusions of our empirical research are the following:

1. Producer prices are moderately sticky. The weighted average frequency of price changes is 21%. Alternatively, the direct computation of the duration of price spells indicates that average duration is slightly less than 1 year.

2. We find a great deal of heterogeneity in the frequency of price adjustment. As expected, the flexibility of prices is greatest for energy, other intermediate goods and food products and the highest degree of price stickiness is observed for capital goods and consumption durables. In turn, the size of price changes is almost identical for the different product categories.

3. While prices are moderately sticky, we do not find strong signs of a higher degree of downward rigidity. Price decreases are only slightly less frequent than price increases, which is consistent with positive and moderate trend inflation. Moreover, prices remain unchanged for shorter periods following a price reduction than a price increase.

4. Even though prices of most products do not change often, they typically change by a large amount (4.8% on average). There are no asymmetries between price increases and decreases. We also find a negative relationship between frequency of adjustment and size of price changes.

5. The cost structure of a firm affects the frequency of price change. Specifically, the prices are more flexible the lower the labour share and the higher the relevance of raw materials and outsourcing.

6. The degree of competition in markets affects price flexibility. Specifically, the higher import penetration the higher is the frequency of price change.

7. There is a marked seasonality in the frequency of price changes, which suggests that some companies follow time dependent strategies. In contrast, the size of price changes shows a mild seasonal pattern.

8. Firms seem to react to inflation by modifying the frequency of changing prices but hardly by changing their sizes. Specifically, price increases (decreases) are more (less) frequent when inflation is high. Conversely, price increases (decreases) are less (more) frequent when inflation is low. This dependence can be interpreted in favour of the use of state dependent pricing strategies.

9. The use of state-dependent pricing behaviour is also supported by the fact that the frequency of price changes is significantly affected by changes in indirect taxation. However, these changes do not generally affect the size of price adjustments, a fact that

could be due to their small magnitude with regard to the average size of a price change. We also find that sectors where prices are set by the government are characterised by a lower frequency of adjustment.

10. Use of attractive prices is associated with more sluggish price adjustments and with larger price changes. In absolute terms, price rises and decreases are larger for firms using attractive pricing strategies.

11. The unconditional hazard is downward sloping and presents local modes at 1, 12, 24 and 36 periods.

12. There is some evidence that producer prices are more flexible than consumer prices and that the size of their changes is smaller than that for consumer prices. However, there is marked degree of heterogeneity for the different groups of products.

1 Introduction

This paper identifies the basic features of price setting behaviour at the producer level in the Spanish economy. For this purpose, our analysis draws on the micro-dataset underlying the construction of the Producer Price Index (PPI). This dataset contains around 1.6 million price records over the period from November 1991 to February 1999. The broad coverage of the dataset (99.4% of the PPI) and its relatively large time dimension makes of this database an extremely valuable set of information to study price setting practices.

This paper extends the empirical evidence on price setting behaviour in Spain obtained in other studies using micro consumer prices (Álvarez and Hernando, 2004) and survey data (Álvarez and Hernando, 2005), contributes to enlarge the scant international evidence available on PPI individual data, and its aim is two-fold. Firstly, the main characteristics of price setting at the producer level are explored. Specifically, the paper provides evidence on the frequency and size of price adjustments, distinguishing between price increases and price reductions, and reports direct estimates of the duration of price spells. We document differences in the general features of price setting behaviour across types of products and explore how these general features are affected by some specific factors, including the cost structure, the degree of competition, government intervention, the level of inflation, seasonality, and the practice of using psychological and round prices. Secondly, the paper presents a comparison of price setting practices at the producer and at the consumer level to try to ascertain whether the retail sector augments or mitigates price stickiness.

The remainder of this paper is organised as follows. Section 2 describes the main characteristics of the dataset. Section 3 presents the main findings on the periodicity of price changes, while Section 4 reports the basic results on the size of price changes. Section 5 provides a comparison of price setting practices at the consumer and at the producer level, by jointly analysing our results with those obtained using the CPI micro data. Finally, section 6 summarises our conclusions.

2 The dataset

The available dataset contains the micro data collected by the Instituto Nacional de Estadística (INE) in order to compute the base 1990 Spanish Producer Price Index (PPI). The methodology of this index is described in Garrido (2001).

The PPI is a short-term indicator which measures monthly price developments of industrial products manufactured and sold on the domestic market, at the first commercialization stage, that is ex-works prices obtained by industrial establishments' transactions, not including transport and commercialization costs nor invoiced VAT[1]. The index covers all industrial sectors except building, that is, it covers energy, mining and manufactures.

The index surveys 224 branches of 4 digit level NACE (General Industrial Classification of Economic Activities within the European Communities)[2]. Every branch of activity is represented by a basket of products which are again disaggregated into varieties (products with sufficiently homogeneous technical characteristics) and sub-varieties (specific models of a variety manufactured by a particular establishment). In total, 869 products, 1114 varieties and about 22000 sub-varieties are considered. Prices are collected at more than 6000 industrial establishments[3]. Weights are computed according to the importance, in terms of turnover, of branches of activity and the production value of products in 1990, according to the Industrial Survey.

Our database is made up of 1640315 prices and contains monthly records for 7 years (November 1991 to February 1999). Overall, the branches of activity covered by this database represent 99.4% of the index, given that for statistical confidentiality reasons, there is no information for 5 branches of activity[4]. Table 1 provides some details on the sample composition.

Each individual price record corresponds to a precisely defined product (sub-variety) manufactured by a particular establishment in a given date. Therefore, prices of specific products can be followed over time within the same establishment. Along with each individual price quote, the following additional information is provided:

1. the year and month of the record
2. a NACE 3 digit code to identify the branch of activity
3. a numeric establishment code, which does not enable the name of the establishment to be identified
4. a numeric sub-variety code, which prevents the identification of the precise product
5. a numeric update code, which indicates product replacement

[1] Excise duties are included. They are levied on alcoholic drinks, hydrocarbons, tobacco products and cars.
[2] Note that although the PPI survey is designed on the basis of the sectoral classification at the NACE 4 digit level,, as it is later mentioned, in the information available to us we can only identify economic activity at the NACE 3 digit level.
[3] Prices for production and distribution of electricity were regulated during the sample period. Prices were taken from the *Boletín Oficial del Estado* (Official Journal).
[4] The excluded branches are Mining of non-ferrous metal ores, except uranium and thorium ores (NACE 132), Mining of chemical and fertilizer minerals (NACE 143), Other mining and quarrying (NACE 145), Manufacture of coke oven products (NACE 231) and Steam and hot water supply (NACE 403).

The NACE 3 digit code enables us to obtain a breakdown according to the economic purpose of the products using the correspondence of Table A1.1. Specifically, the following categories are identified: Consumer non durables food, non food non durables, consumer durables, intermediate goods, energy and capital goods. This classification is much in line with the EC regulation on Main Industrial Groupings[5]. The main differences are that we split consumer non durables into its food and non food components and that we consider cars as a consumer durable instead of a capital good[6]. This parsimonious classification is in our view very useful for the analysis of price setting behaviour since items within the same economic group are likely to display a more homogeneous behaviour.

[5] Commission Regulation (EC) No 586/2001 of 26 March 2001 on implementing Council Regulation (EC) No 1165/98 concerning short-term statistics as regards the definition of Main Industrial Groupings (MIGS).
[6] According to ANFAC (the Spanish association of car manufacturers), around 80% of cars produced in Spain are purchased by households.

3 The periodicity of price changes

The periodicity with which prices are changed by firms represents a key element to characterise their price-setting behaviour. Both the frequency of price changes and the duration of price spells are measures typically employed to quantify this periodicity. Obviously, these two measures are closely linked and should lead to similar conclusions in terms of the degree of price flexibility.

3.1 The frequency of price changes

We define the frequency of price changes as the proportion of non-zero price change observations divided by the total number of observations[7]. This statistic uses all the statistical information available, and consequently, is less potentially affected by selection biases that affect the direct computation of the average duration of price spells for a given product. The main bias stems from the fact that the direct computation of durations has to be done taking into account only uncensored spells (i.e. those spells that start and end with a price change), and longer price spells are more likely to be censored. Additionally, specific events such as tax rates changes can be easily taken into account within the frequency approach. However, the frequency approach does not give the full distribution of price durations, which can be compared to those predicted by theoretical models. For this reason we also report the direct computation of price durations.

In order to compute aggregate measures of the frequency of price changes it seems desirable to employ some weighting scheme. In the cases of the frequency and the size of price changes, we use the following. Since the NACE 3 level is the lowest level for which we have PPI weights, we first compute the frequency (or the size) of price changes using all the observations belonging to each NACE 3 group, and then average over NACE 3 groups using PPI weights.

3.1.1 MAIN FINDINGS

The main findings that we obtain with the frequency approach are the following:

Fact 1: The weighted average frequency of price changes is 21%

Table 2 reports average frequencies of price changes for our sample as well as for the main PPI groups. The weighted average frequency of price changes for all items taken together is 21%. This estimate is in line with Dias *et al.* (2004) for Portugal (23%) and slightly higher than Sabbatini *et al.* (2004) for Italy (15%) and Stahl (2004) for Germany (13%).

Fact 2: There is high heterogeneity in the frequency of price adjustment according to the different main PPI groups

As expected, there is a marked heterogeneity across products in the frequency of price change. The flexibility of prices is considerably larger for energy, intermediate goods and food than for the other PPI groups, which can be explained by the relative importance of supply shifts for these products. In particular, the highest frequency of price changes is observed for energy prices: 38% of these items change prices in any given month and the figure is 89% for refined petroleum products[8].

[7] A more detailed definition of the variables used to quantify the periodicity and the magnitude of price changes is found in Appendix A.
[8] Electricity prices were regulated during the sample period.

The frequency of price changes is much smaller for the other components and there are no differences between durables and non food non durables consumption goods. The highest degree of price stickiness is observed for capital goods, whose average frequency is 8%.

The marked heterogeneity in the degree of price flexibility across products is even more evident when considering NACE 3 groups. There are several microeconomic factors that explain such dispersion, including differences in the cost structure or the degree of market competition.

Fact 3: There is little evidence of nominal downward rigidity. Price increases represent 56.8% of price changes

Columns 2 and 3 of Table 2 report monthly frequencies of price increases and decreases, respectively, for all items and split by main economic groups and column 4 reports the share of price increases over the total number of price adjustments. As can be seen, price decreases are very frequent: over 43% of the price changes are price reductions, a fact that can be interpreted against the hypothesis of strong downward nominal rigidity. Again, there are marked differences in this pattern across the main groups. In particular, price reductions represent less than one third of all adjustments for non food consumption goods and capital goods. In turn, price decreases represent slightly less than half of the total number of price changes for food, intermediate goods and, particularly, for energy where 49% of price changes are price reductions. In general, we observe that the higher is the average frequency of price adjustment, the higher is the proportion of price reductions in price changes.

3.1.2 EXPLANATORY FACTORS OF THE FREQUENCY OF PRICE CHANGES: CROSS SECTIONAL EVIDENCE

So far, the evidence presented has shown a marked heterogeneity in the degree of price stickiness across products. In what follows we explore the role of a number of factors in explaining this heterogeneity. For this purpose, we first report the results of regressions that exploit the cross sectional variation while in section 3.1.3 we provide some time series evidence on the determinants of the frequency of price changes[9]. In the cross-sectional analysis, we mainly focus on the cost structure of the different industries and their prevailing competitive environments, as well as some other variables such as the existence of government set prices, the use of attractive prices and the typical size of a price change. We use throughout NACE 3 sectors[10].

To summarise the sectoral cost structure we consider the shares of labour costs, raw materials and works carried out by other firms in terms of total costs[11]. Given the low frequency of wage changes we expect more (less) labour intensive industries to carry out price revisions less (more) frequently. On the contrary, firms which are highly (lowly) intensive in the use of raw materials (e.g. energy) in the production process are expected to adjust their prices more (less) often, because prices of raw materials change often. In a similar vein, a higher (lower) degree of outsourcing is expected to result in a higher (lower) frequency of price change.

We characterise the degree of market power by considering both direct measures such as concentration indices or number of competitors in a sector and indirect measures such as import penetration, the relevance attached by firms to demand conditions or to gaining

[9] In Álvarez, Burriel and Hernando (2005b) we analyse the individual data employing duration models.
[10] See Appendix B for the definition of the variables used in this section.
[11] Defining shares in terms of total turnover led to very similar results.

market share. We expect a higher response to shocks by those firms operating in more competitive environments.

Other variables which may help in explaining the frequency of price adjustment are the relevance of attractive prices -expected to be negatively correlated with frequency-, the existence of government set prices –expected to result in more sluggish price adjustment-, and the average size of price changes –expected to be inversely related to the frequency of change-.

In Table 3 we report the estimates for the determinants of the frequency of price changes as well as those of the frequency of price increases and decreases. Our main results are the following:

Fact 4: The cost structure is a determinant of the frequency of price adjustment
All cost variables have the expected sign and are highly significant; the coefficient of the labour share is negative and those of the share of energy, non energy intermediate goods and outsourcing are positive.

Fact 5: The higher (lower) is the degree of competition the higher (lower) is the frequency of price changes
We find that a higher degree of competition results in more flexible price adjustment. Specifically, we find that the degree of import penetration, which proxies external competition, is significant. Furthermore, we find an additional effect from the relevance attached by firms to demand conditions, which proxies demand price elasticity. We have also considered many alternative direct measures of price competition such as the declared number of competitors, the average mark-up, the cumulative share in employment of leading firms, Herfindahl, Rosenbluth, Hannan Khay or Gini indices or an enthropy measure[12], but their effect on the frequency of price changes is never significantly negative. This probably reflects the fact that there are some competitive markets where a few firms have high market shares. On the contrary, there are also markets with a high number of firms with low market shares, which enjoy market power at the local level.

With respect to the other variables, we find that sectors where prices are set by the government are characterised by a lower frequency of adjustment and also that the use of attractive prices is generally associated with more sluggish price adjustments, in line with the evidence in Table 5. Moreover, larger price changes are generally accompanied by less frequent adjustments.

The analysis of the determinants of the frequencies of price increases and decreases maintains all qualitative results.

[12] If we denote the market share of firm i as $\alpha_i = q_i / \sum q_i$, most of these measures can be expressed as $\sum_{i=1}^{n} h(\alpha_i)\,\alpha_i$. For instance, the Herfindahl index is obtained setting $h(\alpha_i) = \alpha_i$ and the enthropy measure setting $h(\alpha_i) = Ln\,\alpha_i$. We use data from Núñez and Pérez (2001) based on employment data from the administrative registry of firms.

In addition to the marked heterogeneity in the degree of price stickiness across products, there is also, although to a lesser extent, some variation over time. Figure 1 illustrates this fact by plotting the time series of the frequency of price increases and decreases for the PPI. These time series are computed, for each date, as a weighted average of the frequency of price changes at the NACE 3 level in that date.

In this section we concentrate on the time series variation of the frequency of adjustment, given that some factors either depend on time (seasonality), are presumed to affect only specific time periods (changes in indirect taxation) or have an aggregate nature (inflation). This set up also allows us to shed some light on the issue of time versus state dependence of pricing strategies and the impact of attractive pricing behaviour.

To summarise the influence of these factors on the frequency of price changes, we run time-series regressions, both for the whole PPI as well as its main components. Specifically, we estimate the following regression model:

$$F_t = \alpha + \sum_i \beta_i \, M_i + \gamma \, DT95M1 + \delta \, PPI_t + \varphi \, ATR_t + \varepsilon_t$$

where F denotes the average frequency of price changes (alternatively F+ and F- will denote, the average frequency of price increases and decreases, respectively), PPI is the year-on-year overall PPI inflation rate (or the inflation rate of the corresponding PPI component in the case of the sectoral regressions), M are monthly dummies, DT95M1 is a dummy variable for a VAT rate change, ATR is the average share of attractive prices and **ε** is a residual term[13]. Models are estimated by maximum likelihood and results are reported in Table 4.

Fact 6: Seasonal factors are significant. This can be interpreted as evidence of the existence of firms with time-dependent pricing strategies

As can be seen in Figure 1, on average, prices are more frequently raised in January and less frequently over the summer months. The seasonal pattern is less marked for price decreases, although again more revisions are observed at the start of the year and less reductions over the summer period. The Wald seasonality tests in the regressions in Table 4 confirm the relevance of the seasonal pattern. These results, which are in line with the results of the Banco de España survey on pricing behaviour (see Álvarez and Hernando, 2005), can be interpreted as evidence that some firms follow time dependent price setting strategies. However, this interpretation has to be qualified by the fact that this seasonal pattern might be also the result of a similar seasonal pattern in the prices of intermediate goods. In that case, seasonality would be consistent with state-dependent pricing policies (i.e. prices change in reaction to cost shocks).

The seasonal pattern in the frequency of price changes is observed for all PPI components, with seasonality being always highly significant. Particularly marked seasonal patterns are observed for capital goods and non durables non food consumption goods. Seasonality in energy can be explained by the fact that revisions in the (regulated) price of electricity are generally carried out in January. In general, the seasonal pattern is stronger for price increases than for price decreases, except in the case of energy and durables where seasonality is also quite moderate.

[13] To account for possible autocorrelation of the residuals we consider Ljung-Box statistics and simple and partial correlograms. Although, we do not restrict a priori the ARIMA model generating the disturbance term we find that, when there is autocorrelation, an AR(1) process is sufficient. Its coefficient is reported as RHO.

Fact 7: Changes in indirect taxation affect the frequency of price changes. This can be interpreted as evidence of state dependent pricing policies

In January 1995 a 1 percentage point increase in VAT rates was introduced. Figure 1 shows that this tax change had a sizable impact on the aggregate frequency of price increases. Moreover, in Table 4 the coefficient on indirect taxation is highly significant for price changes and price increases, although not significant for price reductions. By components, the effect is significant again for price changes and increases with the exception of durable goods. Note that price records exclude invoiced VAT. Our interpretation of this phenomenon is that firms take advantage of the need to change their prices (including VAT) to carry out additional revisions. However, the percentage of firms that changed their prices in that particular period is still relatively low. This possibly reflects the fact that the size of the tax change rate was small relative to the average size of price changes.

Fact 8: The frequency of price adjustments is affected by the level of inflation. Price increases (decreases) are more (less) frequent when inflation is high. Conversely, price increases (decreases) are less (more) frequent when inflation is low. This dependence can be interpreted in favour of the use of state dependent pricing strategies.

To obtain a clearer view of the relationship between the frequency of price adjustment and aggregate inflation Figure 2 plots the frequency of price changes, increases and decreases against the average inflation rate. These series are adjusted for seasonality and indirect tax changes. This figure indicates that upward (downward) changes in prices are more (less) frequent when inflation is high. Analogously, downward (upward) changes in prices are more (less) frequent with low inflation rates. If we jointly consider upward and downward changes, we find that the positive relationship between frequency and inflation dominates. This evidence is confirmed by the significance of the PPI inflation variable in the time series regression (see Table 4). Nevertheless, the magnitude of this effect is moderate: a one percentage point increase in inflation increases the frequency of upward price adjustment by 0.007 percentage points (approximately 6% of the average frequency of price increases which is 0.12). Similarly, inflation has a negative effect on the frequency of price reductions. Note, however, that time variation of the inflation rate in the sample period is quite moderate. By components, price increases and decreases are significantly affected by sectoral inflation, with the exception of consumer durables and, in the case of price decreases, also other non food consumption goods.

Fact 9: The use of attractive prices is generally associated with more sluggish price adjustments.

It is well known that certain digits are more likely than others to appear as rightmost digit or ending of prices. In particular, the digits 0, 5 and 9 are considerably more frequent in practice than a uniform distribution across endings would suggest. Among other factors, the use of so-called round prices (those ending in 0 or 5) reflects the higher cognitive accessibility (see Dehaene and Mehler, 1992) of these numbers, which facilitates the communication of buyers and sellers (see Schindler and Kirby, 1997). Moreover, the denominations of coins and banknotes in circulation are an additional factor supporting the use of round prices.

The existence of attractive pricing can be seen as a rigidity in the price setting process. Given a certain disturbance, firms may decide not to reset their prices until a new attractive price point is appropriate. This would result in longer price durations and larger sizes of price changes. In our sample attractive prices, defined as those ending in 0, 5 or 9, represent 59% of all prices. Producer prices ending in 0 (39.3%) and 5 (14.5%) are the most frequent, whereas those ending in 9 (5%) are not so important, suggesting that psychological prices

are hardly relevant in the case of producer prices. Again, there also exist considerable differences across the main PPI components. The highest shares of attractive prices are observed for the more sluggish components: capital goods (70.3%) and durables (74%) and the lowest for energy products (19%). The corresponding figures for food, non food non durables and intermediate goods are 50%, 54% and 46%, respectively.

However, defining attractive prices in terms of their rightmost digit is too general, since not all prices with these endings can be considered attractive (e.g. 69 or 45 pesetas). As a narrower definition[14], we consider attractive those prices ending in 00, 25, 50, 75, 90, 95 and 99 peseta. Using this narrower definition, attractive prices represent around 31% of all prices in our sample. Employing this definition results in the frequency of price adjustment reported in Table 5. For all items, the frequency of price adjustment for attractive prices is 16%, whereas 24% is obtained for non attractive prices. For the main PPI components the same pattern is observed, except in the case of energy, and attractive pricing leads to more sluggish adjustments. However, there are strong differences across categories. Analysis of price increases and decreases shows similar features. However, the estimated coefficients for the attractive pricing variable in the time series regressions are not significant in general. This is not surprising since the relevance of attractive prices in terms of the frequency of price adjustment should be more pronounced in the cross sectional dimension. This is consistent with the results presented in section 3.1.2.

3.2 The duration of price spells

The main disadvantages of using the frequency approach to analyse the duration of price spells are the difficulties both in obtaining an aggregate measure of average price duration and in deriving the distribution of price durations[15].

Fact 10: Prices remain unchanged for long time periods. There is also a marked heterogeneity across groups of products

In Table 6 the main features of the distribution of price durations are presented. Panel A of Table 6 reports the summary statistics of the unweighted distribution. This distribution is extremely skewed and there is a high concentration of price spells with very short durations: the overall mode of the distribution as well as the median is at duration 1 month. The average unweighted duration is 5.1 months and there is a very long right-side tail. To take into account the fact that price spells with very short durations are overrepresented in this distribution (since for a given time horizon, a larger number of spells are observed for products with short durations), we also report the main statistics for the weighted distribution. The weighting scheme we use is as follows: we first average durations within the same trajectory and then the weight assigned to the duration of each trajectory is the PPI weight of the NACE 3-digit category divided by the number of trajectories in that category. The use of weights results, as reported in Panel B of Table 6, in higher statistics for durations. The average duration is 10.4 months and the median is 7.8 months. Finally, it is worth mentioning that the results reported in Table 6 are obtained using non-left censored spells only.

As regards the distributions of price durations for the main PPI groups, there are some important differences across them, in line with the results using the frequency approach. The categories that display shorter durations are processed food, energy and other intermediate

[14] This definition takes into account the importance of 25 and 75 price endings which are associated with the importance of the 25 peseta coin.

[15] Average duration may be computed as the inverse of the weighted average frequency, which is a weighted harmonic mean of durations at the group level. However, this indicator is not consistent with the assumption of homogeneity that is required to obtain a theoretical relationship between frequency and duration. Moreover, the harmonic mean cannot exceed the arithmetic mean, so this measure is a downward biased estimator of the arithmetic average duration.

goods. The weighted average durations for these three categories are 9.3, 8.4 and 9.3 months, respectively, and the median of the unweighted distribution is at duration 1 month. At the other extreme, the longer durations are observed in capital goods, with a weighted average duration of 13.8 months. In most product categories, the existence of a local mode at 12 months suggests that there is a significant portion of firms that review their prices once a year. Interestingly, within the energy category there is a very high proportion of spells with duration one month (mostly corresponding to manufacture of refined petroleum products) but there is also a significant proportion of companies changing their prices every 12 months (mostly in the distribution of electricity, gas and water supply).

Fact 11: There are asymmetries in price durations. Prices remain unchanged for a shorter period following a price reduction than after a price increase

There is some evidence suggesting that the duration of a price spell is shorter after a price decrease than after a price increase. Table 7 reports the main statistics of the unweighted distribution of price durations after price increases and decreases. Higher frequencies for very short durations are observed in the case of the distribution of durations after a price decrease. The unweighted average duration of price spells after a price decrease is 3.5 months, compared to 6.2 for the distribution of durations after a price increase. Similarly, the percentile 75^{th} is 2 months in the distribution of durations after a price reduction compared to 8 months in the distribution of durations after a price increase. This pattern of results also holds for all product categories.

3.3 The unconditional hazard function

The hazard function is a frequently used tool to describe economic duration data. In our context, this function relates the probability of a change in price to the elapsed duration of the price spell.

Fact 12: The unconditional hazard is downward sloping and presents local modes at 1,12,24 and 36 periods

Figure 3 displays the hazard function for the whole sample. Three main characteristics stem from this figure:

1. The hazard function is downward sloping
2. There is a large fraction of spells with duration 1 month
3. The hazard function displays a large spike at 12 months and, to a lesser extent, at 24 and 36 months.

The first feature, which is at odds with standard models of price setting, may be explained as being the result of aggregating heterogeneous price setters with non-decreasing hazards at the individual level (see Álvarez *et al.*, 2005a). The second characteristic is the consequence of the existence of a large fraction of firms changing their prices monthly. However, this characteristic is exacerbated by the fact that short spells tend to be overrepresented since a larger number of spells are observed for products with short durations. Finally, the third feature reflects that a significant number of companies review their prices once a year and change them every 12, 24, 36 months… In fact, as shown in Álvarez *et al.* (2005) the data may be accurately described by considering three group of Calvo agents with different degrees of price stickiness, plus a group of annual Calvo price-setters.

Figure 4 shows the hazard functions for the main product categories. All of them display the three abovementioned features, although to different degrees. In particular, the spike at 1-

month is more pronounced for the categories with more flexible prices: energy, intermediate goods and processed food. Moreover, the energy category is characterised by very short durations and, within this category, very few price spells are observed with durations longer than 24 months, which makes the estimation of the hazard rates for longer durations very imprecise. Hazard functions for all main groups of products present peaks at yearly frequencies, but they are clearer for categories with more sluggish prices: non durables non food, consumer durables and for capital goods.

It is worth noting that hazard functions for all main product categories, perhaps with the exception of energy items, are decreasing. This result implies that other sources of heterogeneity, either observed or unobserved, must be behind the composition effect explaining the decreasing pattern of the hazard function. The heterogeneity that is observed in frequencies of price change for the different NACE 3 categories is in line with this result.

4 Size of price changes

In this section we present results on the size of price changes, which are defined as logarithmic changes. Here, our assumption is that prices change only once within a given month. This assumption seems to be realistic with the exception of some energy items for which the duration of prices is often shorter than a month. Moreover, temporary price cuts are not very likely to be present for producer prices. Note that in these cases the computed change is the sum of those actually made within a given month.

4.1 Main findings

Fact 13: Average price changes are sizable (4.8%) and there are no asymmetries between price increases and decreases.
Table 8 reports the average absolute size of price changes for the whole PPI, as well as for its main groups of products. Results for average price increases and decreases are also reported. The size of the average change in prices is 4.8%. Moreover, the average size of price increases (4.9%) is broadly similar to that of price reductions (-4.7%). This similarity of the magnitudes of price increases and decreases as well as the slightly higher frequency of price increases than of price decreases explains the moderate positive inflation rate observed over the sample period. Our estimates for the size of price changes are close to the estimates available for other European countries. For positive price changes, Dias *et al.* (2004) and Sabbatini *et al.* (2004) report estimates of 4.6 and 4.5% for Portugal and Italy, respectively, whereas average price decreases are -4.8% and -4.1%[16].

Fact 14: There is no marked heterogeneity in the size of changes across groups of products.
Unlike what is observed in the case of the frequency of price adjustment, there is a notable homogeneity across products in the magnitude of price changes. In addition, the similarity between the average size of price increases and decreases also holds for the main PPI groups. The highest average size of price changes corresponds to food products, for which the average size of price increases and decreases are 6.0% and -5.4%, respectively. At the other extreme, the smallest changes correspond to energy products, whose prices tend to be highly flexible. The average price increase is 3.8% and the average price decrease is 4.2%.

4.2 Factors affecting the size of price changes

As in section 3.2.1, where we analysed the frequency of price adjustment, we explore in this section the effect of seasonality, changes in indirect taxation, inflation and attractive price setting strategies on the time series variation of the size of price changes. It has to be stressed that, in contrast to the other determinants, the impact of attractive pricing is expected to be greater in the cross sectional dimension.

To summarise the influence of these factors on the size of price changes, we run time-series regressions, both for the whole PPI as well as for its main industrial groupings. We estimate the following regression model:

$$S_t = \alpha + \sum_i \beta_i \, M_i + \gamma \, DT95M1 + \delta \, INF_t + \varphi \, ATR_t + \varepsilon_t$$

16 Estimates for Portugal refer to median price changes. Median sizes tend to be smaller than mean sizes.

where S denotes the average size of price changes in absolute terms (alternatively S+ and S- denote, respectively, the average size of price increases and decreases), and the rest of the variables have been defined in section 3.2. Models are estimated by maximum likelihood and results are reported in Table 9[17].

Figure 5 plots the time series of the absolute size of price increases and decreases for the whole PPI. Overall, the explanatory power of these factors on the time series variation of the average magnitude of price changes is substantially smaller than that on the time series variation of the average frequency of price adjustment.

Fact 15: Seasonality is very mild for the size of price changes

Figure 5 shows that the size of price changes displays a mild seasonal pattern, although it is considerably less pronounced than that of the frequency of price adjustment. On average, price changes tend to be larger in January. If anything, the seasonal pattern is more marked in the case of price reductions. Analysing the main PPI categories, the seasonal pattern is particularly marked in the food category. In addition, in the case of the average size of price reductions, a seasonal pattern is also found for non durables non food items and for capital goods. In both categories, the size of price reductions is considerably higher in absolute value in January than in the rest of the year. The evidence of seasonality is generally supported by Wald tests.

Fact 16: There is no evidence of an impact of indirect tax changes on the size of price changes

Figure 5 also shows that the impact of the 1 percentage point increase in VAT rates that was introduced in January 1995 did not have any impact on the size of price increases or decreases. This result is confirmed by the regression analysis where the coefficient for the tax change dummy is never significant. The relatively small change in the tax rate relative to average price changes could explain this result.

Fact 17: Evidence of a relationship between aggregate inflation and the size of price changes is quite weak

To the extent that firms follow state-dependent pricing strategies, we would expect that periods with high inflation would be characterised by larger price increases and vice versa. On the other hand, price decreases should be smaller in high inflation periods and higher in low inflation periods. To obtain a clearer view of the relationship between the size of price changes and aggregate inflation, Figure 6 plots the monthly time series of the average size of price changes, increases and decreases against the average inflation rate. Both inflation and average size series are adjusted for seasonality and indirect tax changes in the way described in section 3.2. This figure seems to suggest that the size of price increases is greater the higher the rate of inflation. As expected, for the size of price decreases, we find that periods of higher inflation are associated with smaller –in absolute terms- price decreases. Nevertheless, in both cases the relationship between inflation and the size of price changes seems to be quite weak. Firms seem to respond to inflation mostly by changing their prices more often and not by making greater price changes. The regression analysis corroborates this result. Focusing on the results for the whole sample, the inflation rate has the expected sign in the regressions but is not significant. In the regressions for the product categories, sectoral inflation is also not significant.

17 We find that an AR(1) process is sufficient to pick up the autocorrelation present in some cases.

Fact 18: Firms using attractive pricing strategies typically change their prices by a larger amount

Finally, as mentioned above, firms using attractive pricing strategies may decide to delay their response to a given shock until a new attractive price point is appropriate. This would result in price changes being less frequent but of a greater -in absolute terms- magnitude than in the case of firms not using attractive pricing policies. Table 10 provides evidence on this issue. As can be seen in the table, for all product categories, the average absolute size of a price change is higher for firms using attractive pricing strategies than for those that do not employ them. Specifically, for the whole sample, the typical price change for a firm setting attractive prices is 6.2% whereas it is 4.6% for the rest of firms. For the main product categories the same pattern is observed and attractive pricing leads to larger adjustments. Table 10 also reports the size of price increases and decreases for firms using attractive price setting strategies and the rest. As expected, we observe that attractive pricing strategies lead to greater positive and negative changes. For the main PPI components the same pattern is observed. However, in the regression analysis the effect of the share of attractive prices is rather weak. The size of prices changes is greater the larger is the share of attractive prices, but only for the aggregate, for intermediate goods and for capital goods. The effect of attractive pricing is never significant in the case of price decreases. Nevertheless, as already mentioned, the effect of attractive pricing should be more pronounced in the cross sectional rather than in the time series dimension.

5 A comparison of consumer and producer price setting practices

In this section, we provide a comparison of price setting practices at the consumer and at the producer level. For this purpose, we compare results obtained with the micro PPI data used in this paper and the micro CPI data used in Álvarez and Hernando (2004). In this section we focus on the seasonally balanced sample period running from January 1993 to January 1999. Note that although February 1999 is included in both databases we decided to exclude it from the comparison in order to have a seasonally balanced sample period since the potentially different seasonal patterns of producer and consumer prices could bias the results[18]. Given the important methodological differences in the construction of both price indices, the comparison necessarily suffers from several limitations. First, the sectoral coverage is very different in both indices. In particular, services are not included in the PPI and non-energy intermediate goods and capital goods are not included in CPI. Moreover, energy is not included in the sample of the CPI micro data used in Álvarez and Hernando (2004). Second, PPI refers to prices of products manufactured for the domestic market, while CPI refers to prices of products sold in the domestic market and, therefore, includes prices of imported products. Third, PPI considers prices that are net of invoiced VAT, whereas CPI includes final prices.

Fact 19: There is some evidence that producer prices are more flexible than consumer prices and that the size of their changes is smaller than that for consumer prices. However, there is a marked degree of heterogeneity.

To address the different sectoral coverage, we restrict the comparison to those products that are included in both databases: processed food items and non-food consumption items. Panel A of Table 11 reports average frequencies and sizes of price adjustments for these two aggregate components of the CPI and PPI. Overall, this admittedly rough comparison, indicates that producer prices are more flexible than consumer prices. Average frequency of price changes of processed food items is 0.24 in the PPI compared to 0.18 in the CPI. Analogously, average frequency of price changes of non-food consumer goods is 0.10 in the PPI compared to 0.07 in the CPI. Similar differences are found in the average frequencies of price increases and decreases. As regards the magnitude of price changes, larger price changes are found for the CPI than for the PPI, regardless of the sign of the change. Average price changes of processed food items and non-food consumer items are 7.5% and 6.6%, respectively, in the CPI, while the corresponding figures for the PPI sample are 5.7% and 4.4%. The pattern of results is similar when comparing magnitudes of price increases and decreases.

These results seem to suggest that the retail sector increases the degree of price rigidity. Nevertheless, before going into the reasons potentially explaining this result, it is worth refining the comparison. In particular, the weights used in the CPI and in the PPI are not the same for the items included in the broad two categories considered in Table 11 (processed food and non-food consumer goods). Moreover, there are some items that have been excluded from the available CPI database. To avoid that these differences in weighting schemes or in the covered items bias the comparison, a finer analysis has been conducted. To this end, items have been matched at the most detailed level: the 4-digit classification of the CPI items (subclass) and the 3-digit NACE codes for the PPI items. This matching process provides 16 pairs of comparable items (5 processed food items and 11 non-food items). Note however

[18] In the CPI database the sample period covers from January 1993 to December 2001 and in the PPI database it goes from November 1991 to February 1999.

that since the exact product is not known the matching is not perfect and there are still some differences in the composition of the elements of each pair.

The results of this finer comparison are summarized in panel B of Table 11 and in Figure 7. Panel B of Table 11 reports average frequencies and sizes of price adjustments for the two common aggregate components of the CPI and PPI, but considering only the 16 comparable items and using CPI weights. Figure 7 plots the average frequencies and sizes of price changes for each of the comparable categories of items. The main conclusions are less marked than those arising from the comparison of the statistics for the broad components (panel A of Table 11). As far as the comparison of the average frequency of price adjustment is concerned, the aggregate figures for the main components are still higher in the PPI data. Nevertheless, when looking at the results for the 16 comparable items, most observations are close to the 45º degree line, which means that average frequencies for the CPI items are similar to those for the comparable PPI items, but they are not systematically above (or below) the 45º degree line. As regards the magnitude of price changes, average changes are larger at the retail level in 10 out of the 16 comparable categories (4 out of 5 in the case of the food items), but, with a few exceptions, are again very close to the diagonal line. However, the average size for the non-food category is larger in the PPI data, but this result is driven mainly by one pair.

Overall, these results suggest that producer prices are somewhat more flexible than consumer prices and that the size of their changes is smaller than that observed for consumer prices. Expressed in other terms, it seems that the retail sector tends to magnify price rigidities. In this sense, retail trade is typically characterised by a higher dependence on labour costs, lower non-local competition and higher use of attractive pricing strategies than manufacturing firms. In fact, as shown in section 3.1.2, these factors are associated with a lower degree of price flexibility. Nevertheless, the small magnitude of the differences and the abovementioned methodological divergences in the construction of both datasets prevent from drawing firm conclusions on the relative degree of stickiness at the producer or at the retail level.

6 Conclusions

This paper documents the main stylised facts of price setting behaviour of Spanish firms over the period 1991-1999. To this end, we exploit the individual prices underlying the Spanish producer price index. Our analysis mainly focuses on the frequency and size of price changes as well as on the duration of price spells. The main conclusions of our empirical research are the following:

1. Producer prices are moderately sticky. The weighted average frequency of price changes is 21%. Alternatively, the direct computation of the duration of price spells indicates that average duration is slightly less than 1 year.

2. We find a great deal of heterogeneity in the frequency of price adjustment. As expected, the flexibility of prices is greatest for energy, other intermediate goods and food products and the highest degree of price stickiness is observed for capital goods and consumption durables. In turn, the size of price changes is almost identical for the different product categories.

3. While prices are moderately sticky, we do not find strong signs of a higher degree of downward rigidity. Price decreases are only slightly less frequent than price increases, which is consistent with positive and moderate trend inflation. Moreover, prices remain unchanged for shorter periods following a price reduction than a price increase.

4. Even though prices of most products do not change often, they typically change by a large amount (4.8% on average). There are no asymmetries between price increases and decreases. We also find a negative relationship between frequency of adjustment and size of price changes.

5. The cost structure of a firm affects the frequency of price change. Specifically, the prices are more flexible the lower the labour share and the higher the relevance of raw materials and outsourcing.

6. The degree of competition of markets affects price flexibility. Specifically, the higher import penetration the higher is the frequency of price change.

7. There is a marked seasonality in the frequency of price changes, which suggests that some companies follow time dependent strategies. In contrast, the size of price changes shows a mild seasonal pattern.

8. Firms seem to react to inflation by modifying the frequency of changing prices but hardly by changing their sizes. Specifically, price increases (decreases) are more (less) frequent when inflation is high. Conversely, price increases (decreases) are less (more) frequent when inflation is low. This dependence can be interpreted in favour of the use of state dependent pricing strategies.

9. The use of state-dependent pricing behaviour is also supported by the fact that the frequency of price changes is significantly affected by changes in indirect taxation. However, these changes do not generally affect the size of price adjustments, a fact that could be due to their small magnitude with regard to the average size of a price change. We also find that sectors where prices are set by the government are characterised by a lower frequency of adjustment.

10. Use of attractive prices is associated with more sluggish price adjustments and with larger price changes. In absolute terms, price rises and decreases are larger for firms using attractive pricing strategies.

11. The unconditional hazard is downward sloping and presents local modes at 1, 12, 24 and 36 periods.

12. There is some evidence that producer prices are more flexible than consumer prices and that the size of their changes is smaller than that for consumer prices. However, there is marked degree of heterogeneity for the different groups of products.

In future work, we plan to study producer price setting behaviour at the individual level through the use of duration models.

Table 1

Sample composition

Main component	PPI weight	No. of observations
Consumer non durables food	159.8	399190
Non food non durables	123.7	292612
Consumer durables	129.8	156818
Intermediate goods	353.4	618976
Energy	109.9	20347
Capital goods	117.5	152372
All items	994.1	1640315

Table 2

Monthly frequency of price changes

Weighted results

Main component	Frequency of price changes	Frequency of price increases	Frequency of price decreases	% of price increases
Consumer non durables food	0.24	0.14	0.10	57.5%
Non food non durables	0.10	0.07	0.03	65.5%
Consumer durables	0.10	0.08	0.02	75.4%
Intermediate goods	0.28	0.15	0.13	54.4%
Energy	0.38	0.19	0.18	51.0%
Capital goods	0.08	0.05	0.03	65.7%
All items	0.21	0.12	0.09	56.8%

Table 3

Determinants of the frequency of price changes

	Frequency of price changes		Frequency of price increases		Frequency of price decreases	
	Coefficient	t ratio	Coefficient	t ratio	Coefficient	t ratio
Labour share	-0.46 ***	-4.53	-0.22 ***	-4.19	-0.24 ***	-4.81
Energy	1.77 ***	4.62	0.86 ***	4.32	0.91 ***	4.81
Non energy intermediate goods	0.17 ***	4.11	0.07 ***	3.51	0.09 ***	4.55
Outsourcing	0.82 ***	3.08	0.41 ***	2.87	0.41 ***	3.25
Import penetration	0.24 ***	2.85	0.11 **	2.40	0.13 ***	3.18
Demand conditions	0.03 **	2.10	0.02 **	2.01	0.02 **	2.13
Attractive prices	-0.13 **	-2.62	-0.06 ***	-2.64	-0.06 **	-2.47
Size	-2.08 ***	-3.03	-1.21 ***	-3.29	-0.87 **	-2.60
Government set	-0.18 ***	-3.40	-0.10 ***	-3.56	-0.08 ***	-3.11
Electricity dummy	-0.29 ***	-6.10	-0.16 ***	-6.60	-0.13 ***	-5.40
Textile fibers dummy	0.61 ***	12.78	0.31 ***	12.54	0.30 ***	12.47
Food	0.06	1.28	0.04	1.61	0.02	0.86
Non durables non food	-0.06 *	-1.86	-0.02	-1.45	-0.03 **	-2.28
Consumer durables	-0.06 *	-1.72	-0.02	-1.19	-0.04 **	-2.19
Energy	-0.66 ***	-2.69	-0.31 **	-2.42	-0.35 ***	-2.90
Capital goods	-0.05 *	-1.79	-0.02	-1.60	-0.03 *	-1.91
Constant	0.13 **	2.19	0.09 ***	2.89	0.04	1.35
Number of observations	84		84		84	
R-squared	0.78		0.76		0.79	
Root MSE	0.09		0.05		0.04	

See Appendix B for the definition of the variables
Huber-White heteroskedasticity consistent standard errors
***/**/* denote coefficient significant at the 1%/5%/10% level

Table 4

Frequency of price changes

	All items	Food	Non durables non food	Consumer durables	Intermediate goods	Energy	Capital goods
DUM95Q1	0.067	0.045	0.069	0.046	0.064	0.117	0.048
	'(6.46)**	'(2.68)**	'(5.28)**	'(0.87)	'(4.78)**	'(2.06)*	'(3.90)**
INF	0.002	0.003	0.002	0.002	0.002	-0.002	0.004
	'(3.54)**	'(2.43)*	'(3.68)**	'(0.23)	'(4.12)**	'(1.72)	'(2.11)*
FREQ_ATR	-0.322	-0.232	-0.181	-0.034	-0.444	-1.223	0.057
	'(2.76)**	'(0.84)	'(0.83)	'(0.24)	'(2.19)*	'(3.16)**	'(0.89)
Intercept	0.276	0.265	0.157	0.092	0.357	0.397	0.069
	'(9.04)**	'(4.56)**	'(2.42)*	'(1.69)	'(7.95)**	'(14.98)**	'(2.21)*
RHO1	0.164	0.525			0.373		0.321
	'(1.49)	'(5.34)**			'(3.29)**		'(3.04)**
Number of observations	87	87	87	87	87	87	87
Residual standard error	0.009	0.017	0.012	0.049	0.013	0.053	0.012
Wald joint significance test	1969.62	452.05	1050.40	48.53	638.40	534.02	899.61
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Log likelihood	283.60	229.99	260.62	139.51	253.77	132.52	261.80
Wald sesonality test	1543.93	335.07	831.06	43.13	462.45	400.32	727.19
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Frequency of price increases

	All items	Food	Non durables non food	Consumer durables	Intermediate goods	Energy	Capital goods
DUM95Q1	0.072	0.044	0.063	0.051	0.068	0.218	0.043
	'(5.04)**	'(2.36)*	'(5.38)**	'(1.13)	'(4.64)**	'(2.50)*	'(4.75)**
INF	0.007	0.007	0.002	0.005	0.006	0.006	0.007
	'(5.75)**	'(4.15)**	'(4.34)**	'(0.93)	'(5.38)**	'(2.80)**	'(3.85)**
FREQ_ATR	-0.163	-0.511	-0.297	0.024	0.127	-0.324	-0.065
	'(0.71)	'(1.64)	'(1.51)	'(0.20)	'(0.39)	'(0.55)	'(1.05)
Intercept	0.135	0.207	0.153	0.051	0.089	0.216	0.094
	'(2.26)*	'(3.17)**	'(2.61)**	'(1.09)	'(1.22)	'(5.36)**	'(3.10)**
RHO1	0.418	0.533			0.687		0.493
	'(4.06)**	'(5.44)**			'(8.52)**		'(5.01)**
Number of observations	87	87	87	87	87	87	87
Residual standard error	0.01	0.02	0.011	0.042	0.02	0.08	0.01
Wald joint significance test	578.83	283.37	865.00	39.86	438.03	85.42	891.73
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Log likelihood	247.49	219.86	269.17	153.19	233.81	95.79	261.42
Wald sesonality test	376.76	193.36	650.1	32.91	229.88	50.95	793.05
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Frequency of price decreases

	All items	Food	Non durables non food	Consumer durables	Intermediate goods	Energy	Capital goods
DUM95Q1	-0.010	-0.003	0.008	-0.005	-0.006	-0.085	-0.003
	'(0.91)	'(0.20)	'(1.12)	'(0.24)	'(0.47)	'(1.05)	'(0.37)
INF	-0.005	-0.003	0.000	-0.004	-0.004	-0.008	-0.003
	'(4.67)**	'(4.23)**	'(0.48)	'(1.51)	'(2.76)**	'(3.35)**	'(3.62)**
FREQ_ATR	-0.085	0.208	0.074	-0.058	-0.022	-0.587	0.116
	'(0.40)	'(1.04)	'(0.57)	'(1.11)	'(0.07)	'(0.95)	'(3.88)**
Intercept	0.121	0.072	0.016	0.041	0.147	0.167	-0.021
	'(2.21)*	'(1.71)	'(0.42)	'(2.06)*	'(2.04)*	'(4.03)**	'(1.43)
RHO1	0.459	0.264	0.235		0.783	0.218	
	'(4.32)**	'(2.49)*	'(2.17)*		'(11.68)**	'(2.01)*	
Number of observations	87	87	87	87	87	87	87
Residual standard error	0.012	0.014	0.007	0.018	0.015	0.077	0.008
Wald joint significance test	143.08	72.63	119.92	37.24	197.65	74.76	124.17
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Log likelihood	264.19	248.58	314.51	226.30	241.17	99.08	297.25
Wald sesonality test	86.06	50.06	101.03	31.76	39.72	49.60	96.75
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Monthly dummies not reported to save space. The Wald seasonality test reported in the table indicates their significance.

Table 5

Frequency of price changes

Main component	Attractive prices	Non attractive prices
Consumer non durables food	0.16	0.27
Non food non durables	0.08	0.11
Consumer durables	0.07	0.12
Intermediate goods	0.19	0.30
Energy	0.60	0.39
Capital goods	0.06	0.11
All items	0.16	0.24

Frequency of price increases

Main component	Attractive prices	Non attractive prices
Consumer non durables food	0.10	0.15
Non food non durables	0.05	0.07
Consumer durables	0.06	0.09
Intermediate goods	0.11	0.16
Energy	0.29	0.20
Capital goods	0.04	0.07
All items	0.09	0.13

Frequency of price decreases

Main component	Attractive prices	Non attractive prices
Consumer non durables food	0.06	0.12
Non food non durables	0.03	0.04
Consumer durables	0.02	0.03
Intermediate goods	0.08	0.14
Energy	0.30	0.19
Capital goods	0.02	0.04
All items	0.07	0.10

Table 6

Duration of price spells								
Unweighted average of individual price spells								
		Observations	**mean**	**min**	**p25**	**p50**	**p75**	**max**
All items		244864	5.1	1.0	1.0	1.0	5.0	87.0
Special components								
Consumer non durables food	1	70187	4.6	1.0	1.0	1.0	4.0	86.0
Non food non durables	2	25880	7.7	1.0	1.0	4.0	11.0	87.0
Consumer durables	3	12311	9.7	1.0	1.0	7.0	13.0	86.0
Intermediate goods	4	115052	4.1	1.0	1.0	1.0	3.0	87.0
Energy	5	9988	1.8	1.0	1.0	1.0	1.0	79.0
Capital goods	6	11446	9.5	1.0	1.0	5.0	12.0	87.0
Weighted average of individual price spells (*)								
		Observations	**mean**	**min**	**p25**	**p50**	**p75**	**max**
All items		244864	10.4	1.0	2.0	7.8	14.0	87.0
Special components								
Consumer non durables food	1	70187	9.3	1.0	1.7	6.9	12.7	86.0
Non food non durables	2	25880	12.7	1.0	4.9	9.8	16.0	87.0
Consumer durables	3	12311	11.2	1.0	4.1	7.7	14.0	86.0
Intermediate goods	4	115052	9.3	1.0	1.3	5.4	12.4	87.0
Energy	5	9988	8.4	1.0	1.0	12.3	12.3	21.5
Capital goods	6	11446	13.8	1.0	6.1	11.5	17.0	87.0

(*) The weighting scheme is as follows: First, we average durations within the same trajectory. Second, the weight assigned to the duration of each trajectory is th PPI weight of the NACE 3-digit category divided by the number of observed trajectories in that category.

Table 7

Duration of price spells

After a price increase

		Observations	mean	min	p25	p50	p75	max
All items		145195	6.2	1.0	1.0	1.0	9.0	87.0
Special components								
Consumer non durables food	1	41045	5.7	1.0	1.0	1.0	8.0	86.0
Non food non durables	2	17117	8.6	1.0	1.0	5.0	12.0	87.0
Consumer durables	3	9315	10.8	1.0	2.0	10.0	13.0	86.0
Intermediate goods	4	64595	4.9	1.0	1.0	1.0	4.0	87.0
Energy	5	5151	1.9	1.0	1.0	1.0	1.0	50.0
Capital goods	6	7972	10.4	1.0	1.0	8.0	13.0	87.0

After a price decrease

		Observations	mean	min	p25	p50	p75	max
All items		99669	3.5	1.0	1.0	1.0	2.0	87.0
Special components								
Consumer non durables food	1	29142	3.1	1.0	1.0	1.0	2.0	85.0
Non food non durables	2	8763	5.9	1.0	1.0	2.0	7.0	82.0
Consumer durables	3	2996	6.0	1.0	1.0	2.0	8.0	82.0
Intermediate goods	4	50457	3.1	1.0	1.0	1.0	2.0	87.0
Energy	5	4837	1.7	1.0	1.0	1.0	1.0	79.0
Capital goods	6	3474	7.3	1.0	1.0	2.0	10.0	87.0

Table 8

Size of price changes

Weighted results

CPI component	Average price change	Average price increase	Average price decrease
Consumer non durables food	5.8%	6.0%	-5.4%
Non food non durables	5.0%	5.2%	-4.7%
Consumer durables	4.1%	4.0%	-4.3%
Intermediate goods	4.7%	4.8%	-4.6%
Energy	4.0%	3.8%	-4.2%
Capital goods	4.9%	4.9%	-4.6%
All items	4.8%	4.9%	-4.7%

Table 9

Size of price changes

	All items	Food	Non durables non food	Consumer durables	Intermediate goods	Energy	Capital goods
DUM95Q1	-0.003	0.005	-0.013	-0.011	0.012	-0.008	-0.024
	(0.33)	(0.49)	(0.33)	(0.48)	(1.07)	(0.56)	(0.54)
INF	0.001	0.000	0.002	0.006	0.000	-0.001	0.000
	(0.87)	(0.50)	(1.07)	(2.00)*	(0.43)	(1.26)	(0.07)
FREQ_ATR	0.266	-0.073	0.491	0.082	0.315	0.034	0.397
	(2.11)*	(0.53)	(0.76)	(1.38)	(2.12)*	(0.32)	(2.64)**
Intercept	-0.006	0.077	-0.066	0.003	-0.011	0.059	-0.124
	(0.19)	(2.67)**	(0.34)	(0.13)	(0.33)	(8.00)**	(1.67)
RHO1	0.301	0.234			0.320	0.368	
	(2.92)**	(2.23)*			(3.07)**	(3.41)**	
Number of observations	87	87	87	87	87	87	87
Residual standard error	0.009	0.01	0.036	0.021	0.011	0.013	0.04
Wald joint significance test	54.85	66.72	16.54	17.37	39.30	56.07	25.66
p-value	0.00	0.00	0.28	0.24	0.00	0.00	0.03
Log likelihood	287.20	278.74	165.96	214.47	266.51	251.75	156.66
Wald sesonality test	39.43	55.99	15.47	9.47	16.35	35.66	16.54
p-value	0.00	0.00	0.16	0.58	0.13	0.00	0.12

Size of price increases

	All items	Food	Non durables non food	Consumer durables	Intermediate goods	Energy	Capital goods
DUM95Q1	-0.003	0.005	-0.008	-0.02	0.012	-0.012	0.008
	(0.28)	(0.39)	'(0.16)	'(0.95)	'(1.12)	'(0.37)	'(0.14)
INF	0.001	0.001	0.002	0.004	0.000	0.000	-0.001
	'(0.95)	'(1.49)	'(0.88)	'(1.59)	'(0.84)	'(0.05)	'(0.22)
FREQ_ATR	0.202	-0.284	0.017	0.061	0.326	-0.221	0.382
	'(1.19)	'(1.88)	'(0.02)	'(1.09)	'(2.10)*	'(0.90)	'(1.93)
Intercept	0.003	0.118	0.081	0.009	-0.016	0.075	-0.112
	'(0.07)	'(3.75)**	'(0.31)	'(0.41)	'(0.47)	'(4.48)**	'(1.14)
RHO1	0.320				0.407	0.220	
	'(3.12)**				'(4.09)**	'(1.98)*	
Number of observations	87	87	87	87	87	87	87
Residual standard error	0.012	0.013	0.049	0.019	0.011	0.031	0.053
Wald joint significance test	31.72	42.74	10.83	20.80	51.55	23.15	14.83
p-value	0.01	0.00	0.70	0.11	0.00	0.08	0.39
Log likelihood	262.83	257.44	139.80	220.55	270.15	177.42	132.57
Wald sesonality test	19.25	35.06	9.52	15.84	20.02	17.10	10.08
p-value	0.06	0.00	0.57	0.1472	0.05	0.11	0.52

Size of price decreases

	All items	Food	Non durables non food	Consumer durables	Intermediate goods	Energy	Capital goods
DUM95Q1	0.010	-0.010	0.019	-0.024	-0.026	0.018	0.100
	'(0.64)	(0.59)	(0.66)	(0.44)	(1.05)	(1.12)	(1.35)
INF	-0.001	0.000	0	-0.012	0.001	0.001	-0.003
	'(1.03)	(0.22)	(0.10)	(1.86)	(1.01)	(1.91)	(0.40)
FREQ_ATR	-0.257	-0.104	-0.473	-0.156	-0.401	-0.027	-0.221
	'(1.73)	(0.43)	(0.96)	(1.10)	(1.87)	(0.22)	(0.86)
Intercept	-0.005	-0.041	0.058	0.016	0.023	-0.054	0.042
	'(0.12)	(0.81)	(0.40)	(0.28)	(0.48)	(6.55)**	(0.33)
RHO1		0.302				0.311	
		(2.92)**				(2.95)**	
Number of observations	87	87	87	87	87	87	87
Residual standard error	0.014	0.016	0.027	0.049	0.022	0.015	0.068
Wald joint significance test	62.48	53.49	49.33	19.44	16.53	31.38	26.41
p-value	0.00	0.00	0.00	0.50	0.28	0.01	0.02
Log likelihood	250.33	234.80	189.78	138.90	206.76	240.88	110.26
Wald sesonality test	56.11	41.83	47.71	13.12	8.59	14.14	24.78
p-value	0.00	0.00	0	0.286	0.66	0.23	0.01

Monthly dummies not reported to save space. The Wald seasonality test reported in the table indicates their significance.

Table 10

Absolute size of price changes

Main component	Attractive prices	Non attractive prices
Consumer non durables food	7.5%	5.6%
Non food non durables	6.3%	4.7%
Consumer durables	5.2%	3.7%
Intermediate goods	5.8%	4.6%
Energy	6.6%	4.0%
Capital goods	6.2%	4.4%
All items	6.2%	4.6%

Size of price increases

Main component	Attractive prices	Non attractive prices
Consumer non durables food	7.6%	5.7%
Non food non durables	6.4%	4.9%
Consumer durables	5.1%	3.6%
Intermediate goods	5.9%	4.7%
Energy	7.6%	3.8%
Capital goods	6.3%	4.4%
All items	6.3%	4.6%

Size of price decreases

Main component	Attractive prices	Non attractive prices
Consumer non durables food	-7.5%	-5.2%
Non food non durables	-6.4%	-4.3%
Consumer durables	-5.8%	-3.9%
Intermediate goods	-5.6%	-4.5%
Energy	-5.7%	-4.2%
Capital goods	-5.8%	-4.2%
All items	-6.1%	-4.5%

Table 11

Comparison of consumer and producer price setting practices

Panel A. Main components of CPI and PPI data

Monthly frequency of price changes

Main component	Frequency of price changes		Frequency of price increases		Frequency of price decreases	
	CPI	PPI	CPI	PPI	CPI	PPI
Consumer non durables food	0.18	0.24	0.10	0.13	0.07	0.10
Consumer non food	0.07	0.10	0.05	0.07	0.02	0.03

Size of price changes

Main component	Average price change		Average price increase		Average price decrease	
	CPI	PPI	CPI	PPI	CPI	PPI
Consumer non durables food	7.5%	5.7%	7.0%	5.9%	-8.2%	-5.3%
Consumer non food	6.6%	4.4%	6.1%	4.5%	-8.6%	-4.4%

Panel B. Subset of comparable product categories using CPI weights

Monthly frequency of price changes

Main component	Frequency of price changes		Frequency of price increases		Frequency of price decreases	
	CPI	PPI	CPI	PPI	CPI	PPI
Consumer non durables food	0.24	0.27	0.13	0.15	0.11	0.12
Consumer non food	0.07	0.09	0.05	0.06	0.02	0.03

Size of price changes

Main component	Average price change		Average price increase		Average price decrease	
	CPI	PPI	CPI	PPI	CPI	PPI
Consumer non durables food	7.9%	6.4%	7.5%	6.4%	-8.5%	-6.4%
Consumer non food	6.4%	8.5%	6.0%	7.9%	-7.8%	-9.4%

Table A1.1

Correspondence between branches of activity (NACE codes) and economic purpose (Main Industrial Groupings)

NACE code	Name
Consumer food products	
151	Production, processing and preserving of meat and meat products
152	Processing and preserving of fish and fish products
153	Processing and preserving of fruit and vegetables
154	Manufacture of vegetable and animal oils and fats
155	Manufacture of dairy products
158	Manufacture of other food products
159	Manufacture of beverages
160	Manufacture of tobacco products
Consumer non food non durables	
174	Manufacture of made-up textile articles, except apparel
175	Manufacture of other textiles
177	Manufacture of knitted and crocheted articles
181	Manufacture of leather clothes
182	Manufacture of other wearing apparel and accessories
183	Dressing and dyeing of fur; manufacture of articles of fur
191	Tanning and dressing of leather
192	Manufacture of luggage, handbags and the like, saddlery and harness
193	Manufacture of footwear
221	Publishing
222	Printing and service activities related to printing
244	Manufacture of pharmaceuticals, medicinal chemicals and botanical products
245	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
364	Manufacture of sports goods
365	Manufacture of games and toys
366	Miscellaneous manufacturing n.e.c.
Consumer durables	
297	Manufacture of domestic appliances n.e.c.
323	Manufacture of television and radio receivers, sound or video recording or
334	Manufacture of optical instruments and photographic equipment
335	Manufacture of watches and clocks
341	Manufacture of motor vehicles
354	Manufacture of motorcycles and bicycles
361	Manufacture of furniture
362	Manufacture of jewellery and related articles
363	Manufacture of musical instruments
Intermediate goods	
141	Quarrying of stone
142	Quarrying of sand and clay
144	Mining of chemical and fertilizer minerals
156	Manufacture of grain mill products, starches and starch products
157	Manufacture of prepared animal feeds
171	Preparation and spinning of textile fibres
172	Textile weaving
173	Finishing of textiles
176	Manufacture of knitted and crocheted fabrics
201	Sawmilling and planing of wood; impregnation of wood
202	Manufacture of veneer sheets; manufacture of plywood, laminboard, particle board, fibre board and other panels and boards
203	Manufacture of builders' carpentry and joinery
204	Manufacture of wooden containers
205	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials
211	Manufacture of pulp, paper and paperboard
212	Manufacture of articles of paper and paperboard

Table A1.1 (cont.)

241	Manufacture of basic chemicals
242	Manufacture of pesticides and other agro-chemical products
243	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
246	Manufacture of other chemical products
247	Manufacture of man-made fibres
251	Manufacture of rubber products
252	Manufacture of plastic products
261	Manufacture of glass and glass products
262	Manufacture of non-refractory ceramic goods other than for construction purposes; manufacture of refractory ceramic products
263	Manufacture of ceramic tiles and flags
264	Manufacture of bricks, tiles and construction products, in baked clay
265	Manufacture of cement, lime and plaster
266	Manufacture of articles of concrete, plaster and cement
267	Cutting, shaping and finishing of ornamental and building stone
268	Manufacture of other non-metallic mineral products
271	Manufacture of basic iron and steel and of ferro-alloys
272	Manufacture of tubes
273	Other first processing of iron and steel
274	Manufacture of basic precious and non-ferrous metals
286	Manufacture of cutlery, tools and general hardware
287	Manufacture of other fabricated metal products
312	Manufacture of electricity distribution and control apparatus
313	Manufacture of insulated wire and cable
314	Manufacture of accumulators, primary cells and primary batteries
315	Manufacture of lighting equipment and electric lamps
316	Manufacture of electrical equipment n.e.c.
321	Manufacture of electronic valves and tubes and other electronic components
Energy	
101	Extraction and agglomeration of peat
102	Mining and agglomeration of lignite
232	Manufacture of refined petroleum products
401	Production and distribution of electricity
402	Manufacture of gas; distribution of gaseous fuels through mains
Capital goods	
281	Manufacture of structural metal products
282	Manufacture of tanks, reservoirs and containers of metal; manufacture of central heating radiators and boilers
283	Manufacture of steam generators, except central heating hot water boilers
291	Manufacture of machinery for the production and use of mechanical power, except aircraft, vehicle and cycle engines
292	Manufacture of other general purpose machinery
293	Manufacture of agricultural and forestry machinery
294	Manufacture of machine tools
295	Manufacture of other special purpose machinery
296	Manufacture of weapons and ammunition
300	Manufacture of office machinery and computers
311	Manufacture of electric motors, generators and transformers
322	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
331	Manufacture of medical and surgical equipment and orthopaedic appliances
332	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control
342	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
343	Manufacture of parts and accessories for motor vehicles and their engines

Figure 1

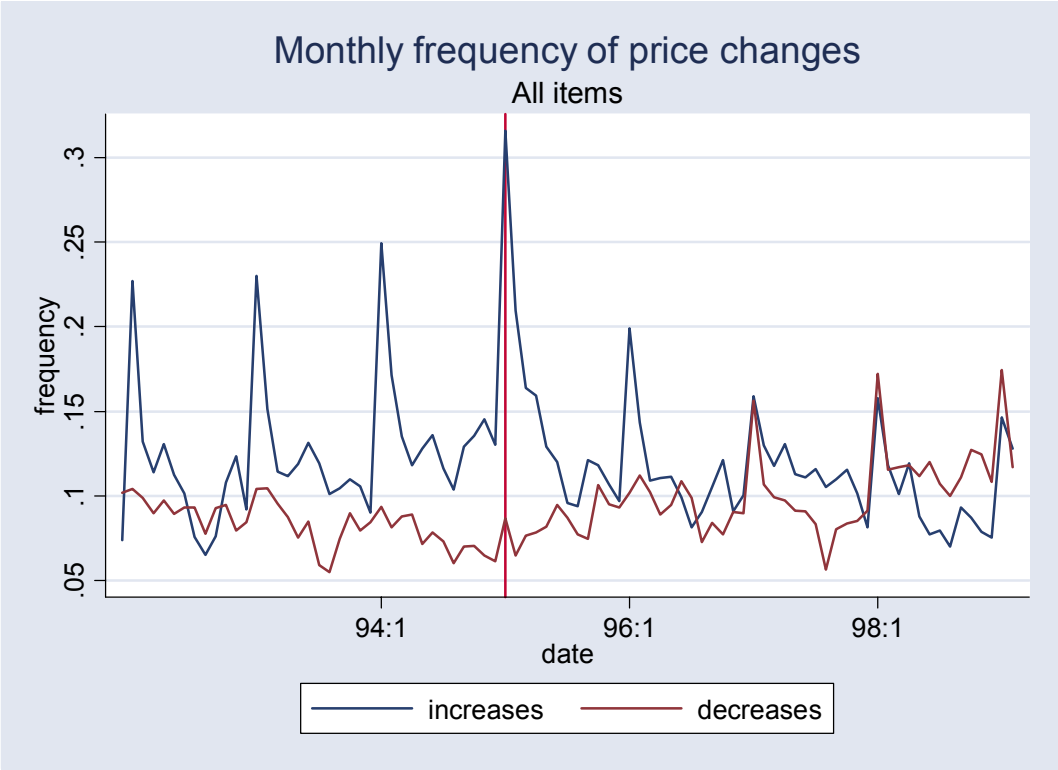

Monthly frequency of price changes
All items
frequency
.05
.1
.15
.2
.25
.3
94:1
96:1
98:1
date
increases
decreases

Figure 2

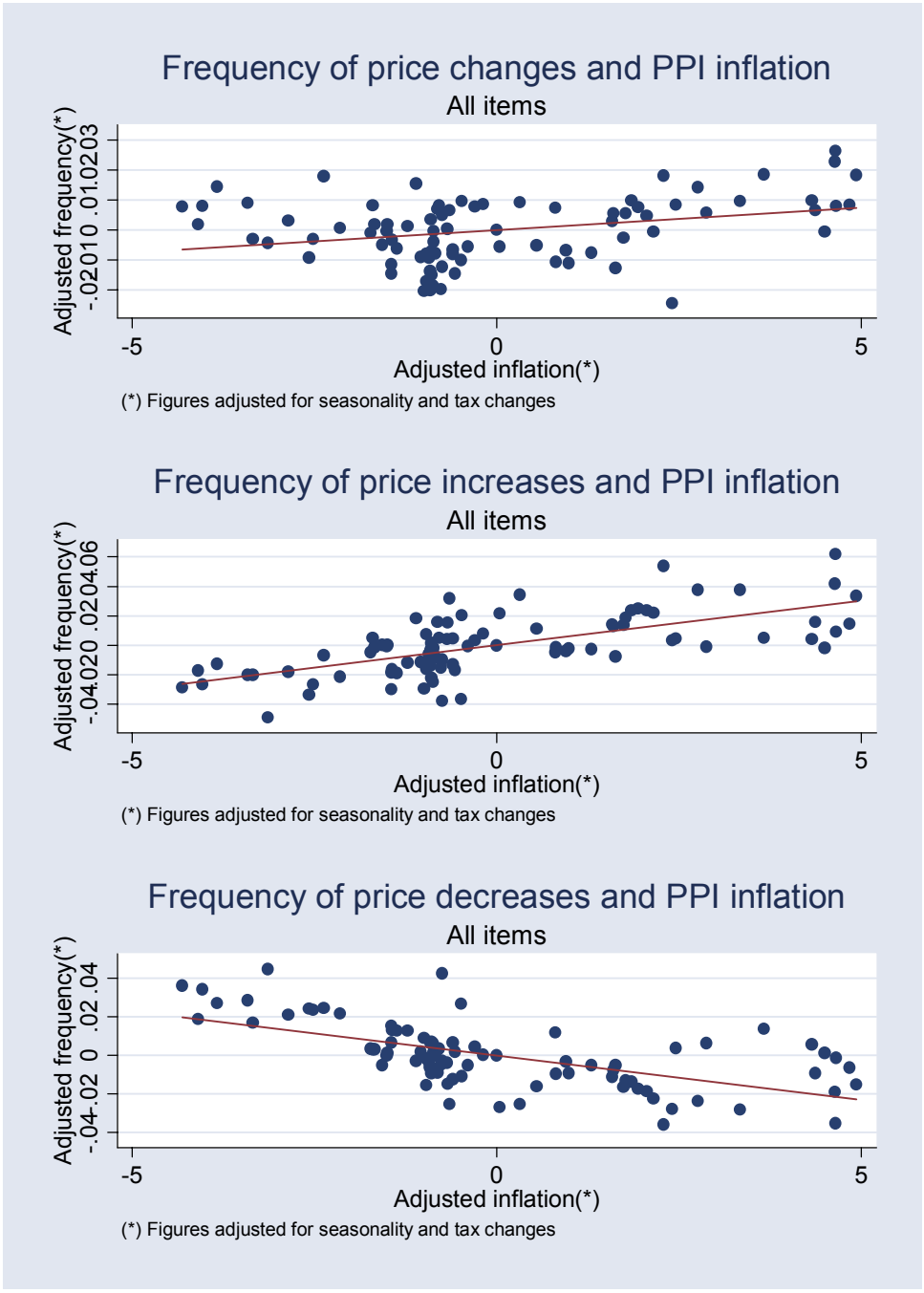

Frequency of price changes and PPI inflation
All items
Adjusted frequency(*)
-.02 0 .01 .02 .03
-5
0
5
Adjusted inflation(*)
(*) Figures adjusted for seasonality and tax changes
Frequency of price increases and PPI inflation
All items
Adjusted frequency(*)
-.04 .02 0 .02 .04 .06
-5
0
5
Adjusted inflation(*)
(*) Figures adjusted for seasonality and tax changes
Frequency of price decreases and PPI inflation
All items
Adjusted frequency(*)
-.04 -.02 0 .02 .04
-5
0
5
Adjusted inflation(*)
(*) Figures adjusted for seasonality and tax changes

Figure 3

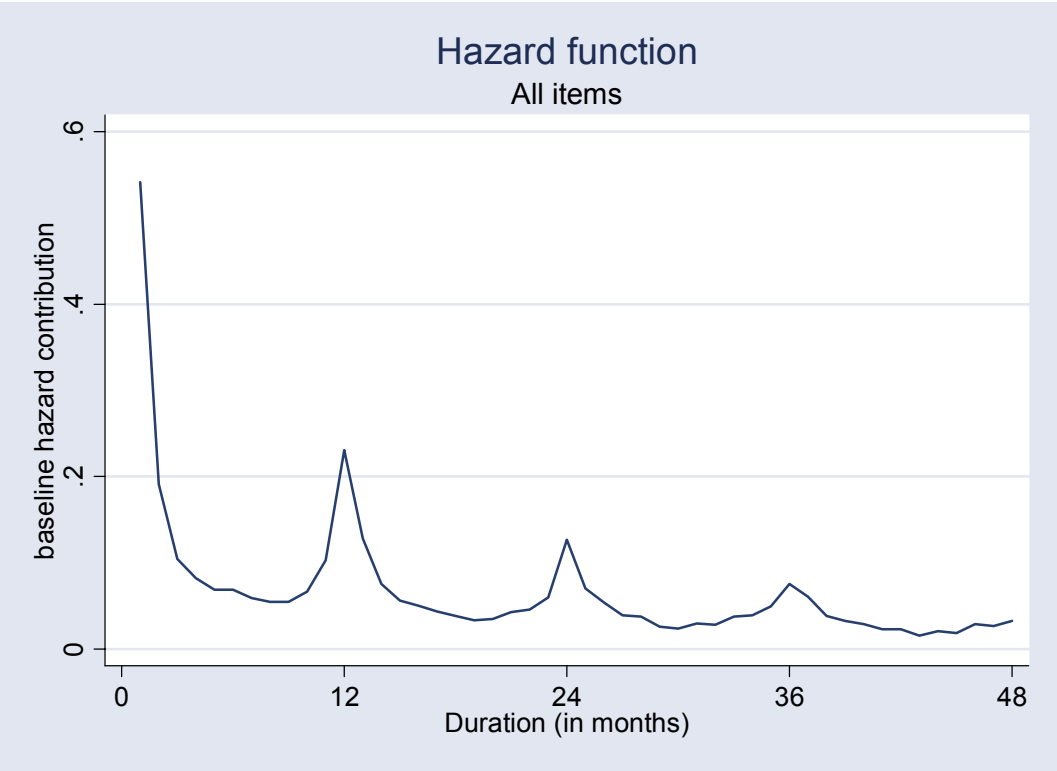


Figure 4

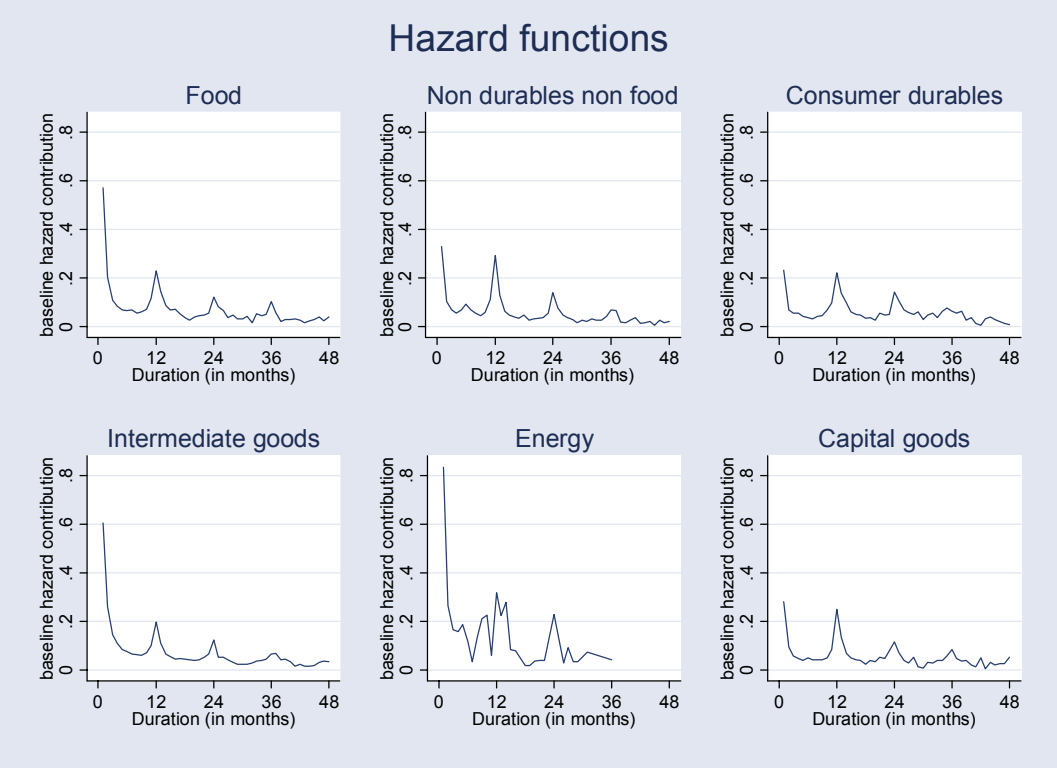


Figure 5

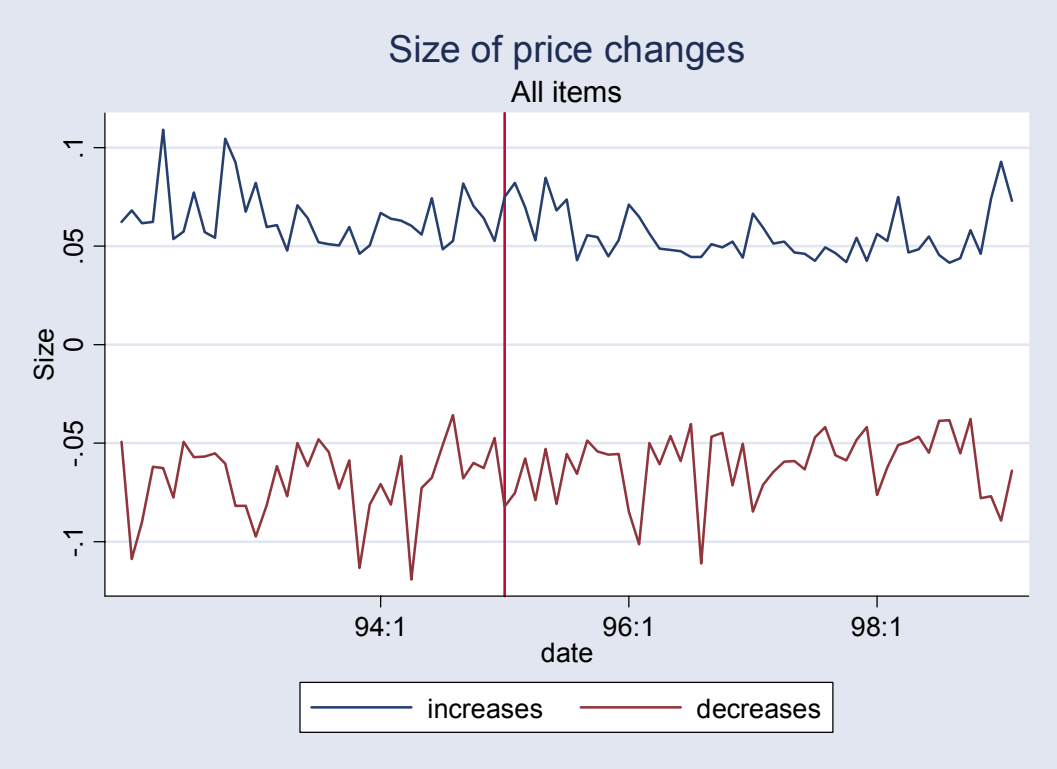
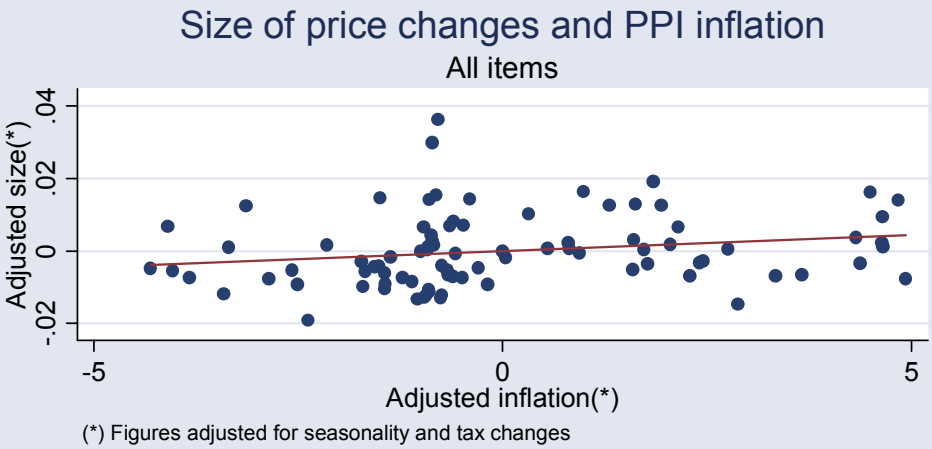
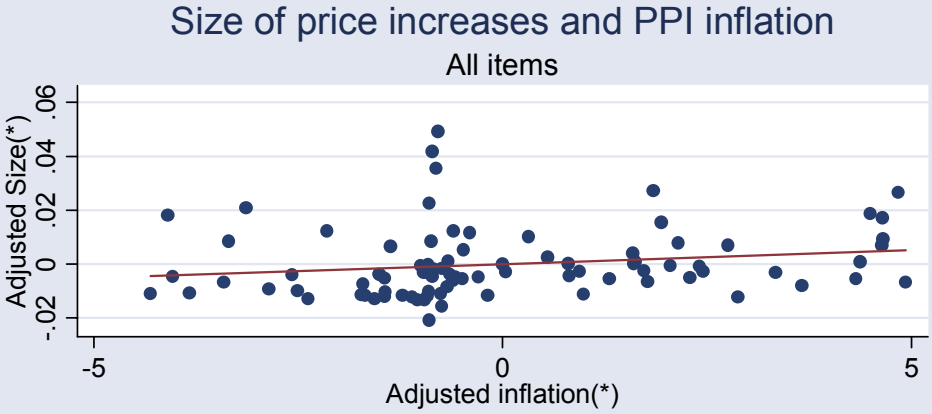

Size of price changes
All items
Size
.1
.05
0
-.05
-.1
94:1
96:1
98:1
date
increases
decreases

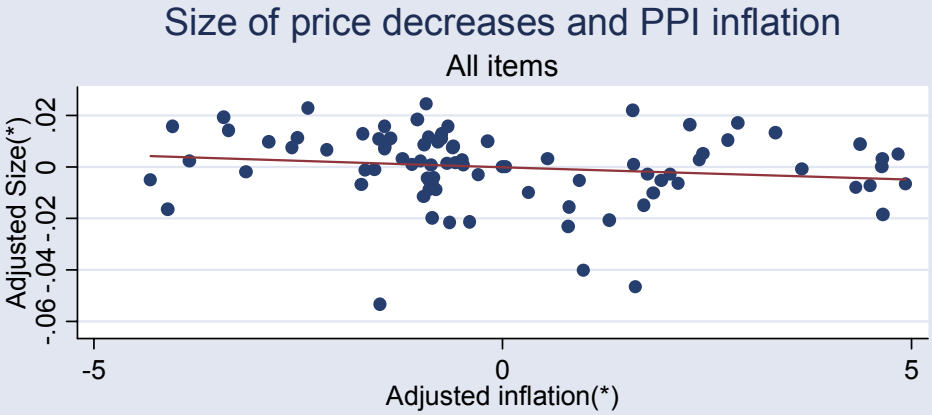
Figure 6



(*) Figures adjusted for seasonality and tax changes



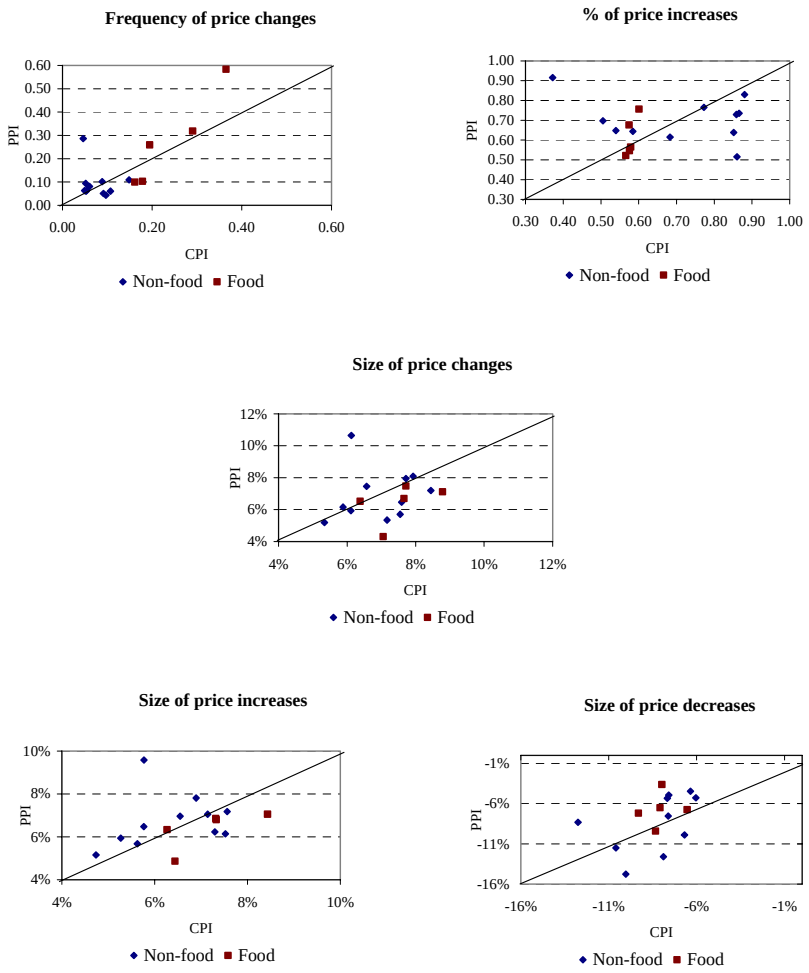
(*) Figures adjusted for seasonality and tax changes



(*) Figures adjusted for seasonality and tax changes

Figure 7

A comparison of consumer and producer price setting practices



Appendix A: Definitions and formulas

- Variables. We define the following binary variables for each price quote ijt where i, j and t, denote establishment, product (NACE 3-digit category) and time, respectively.

(1) $$DEN_{ijt} = \begin{cases} 1 & if\ P_{ijt}\ and\ P_{ij,t-1}\ are\ observed \\ 0 & if\ P_{ijt}\ exists\ but\ not\ P_{ij,t-1} \end{cases}$$

(2) $$NUM_{ijt} = \begin{cases} 1 & if\ P_{ijt} \neq P_{ij,t-1} \\ 0 & otherwise \end{cases}$$

(3) $$NUMUP_{ijt} = \begin{cases} 1 & if\ P_{ijt} > P_{ij,t-1} \\ 0 & otherwise \end{cases}$$

(4) $$NUMDW_{ijt} = \begin{cases} 1 & if\ P_{ijt} < P_{ij,t-1} \\ 0 & otherwise \end{cases}$$

On the basis of the above variables we define (at the product level) the main variables analysed in the paper. The weighting scheme used to obtain aggregate figures is described in the main text.

- Basic statistics for each product (NACE 3-digit category) *j* :

-frequency of price changes:

(5) $$F_j = \frac{\sum_{i=1}^{n_j}\sum_{t=2}^{\tau} NUM_{ijt}}{\sum_{i=1}^{n_j}\sum_{t=2}^{\tau} DEN_{ijt}}$$

-implied median price duration (continuous time):

(6) $$T_j^{50} = \frac{ln(0.5)}{ln(1-F_j)}$$

-implied mean price duration (continuous time):

(7) $$\overline{T}_j = -\frac{1}{ln(1-F_j)}$$

-frequency of price increases:

(8) $$F_j^{+} = \frac{\sum_{i=1}^{n_j}\sum_{t=2}^{\tau} NUMUP_{ijt}}{\sum_{i=1}^{n_j}\sum_{t=2}^{\tau} DEN_{ijt}}$$

-frequency of price decreases

$$F_j^- = \frac{\sum_{i=1}^{n_j}\sum_{t=2}^{\tau} NUMDW_{ijt}}{\sum_{i=1}^{n_j}\sum_{t=2}^{\tau} DEN_{ijt}} \tag{9}$$

-duration of price spells

$$d_j = \frac{\sum_{i=1}^{N_j}\sum_{s=1}^{NS_i} \frac{d_{ijs}}{NS_i}}{N_j} \tag{10}$$

where d_{ijs} is the duration of spell s of product j in establishment i, N_j is the number of establishment selling product j and NS_i refers to the number of spells observed for establishment i.

-average price change in p.c.

$$\Delta P_j = \frac{\sum_{i=1}^{n_j}\sum_{t=2}^{\tau} NUM_{jt} \,|\ln P_{jt} - \ln P_{j,t-1}|}{\sum_{i=1}^{n_j}\sum_{t=2}^{\tau} NUM_{jt}} \tag{11}$$

-average price increase in p.c.

$$\Delta_j^+ = \frac{\sum_{i=1}^{n_j}\sum_{t=2}^{\tau} NUMUP_{ijt}\left(\ln P_{ijt} - \ln P_{ij,t-1}\right)}{\sum_{i=1}^{n_j}\sum_{t=2}^{\tau} NUMUW_{ijt}} \tag{12}$$

-average price decrease in p.c.

$$\Delta P_j^- = \frac{\sum_{i=1}^{n_j}\sum_{t=2}^{\tau} NUMDW_{ijt}\left(\ln P_{ij,t-1} - \ln P_{ijt}\right)}{\sum_{i=1}^{n_j}\sum_{t=2}^{\tau} NUMDW_{ijt}} \tag{13}$$

Appendix B: Definition and sources of the variables used in the cross-sectional analysis of the determinants of the frequency of price changes

The variables described below are defined at the NACE 3 digit level, with the exception of IMPORT PENETRATION, which is defined at the NACE 2 digit level.

LABOUR SHARE: Share of labour costs in terms of total costs. Source: Industrial Survey.

ENERGY: Share of energy inputs in terms of total costs. Source: Industrial Survey.

NON ENERGY INTERMEDIATE GOODS: Share of non energy intermediate goods in terms of total costs. Source: Industrial Survey.

OUTSOURCING: Works carried out by other firms in terms of total costs. Source: Industrial Survey.

IMPORT PENETRATION: Total imports over total resources (production plus total imports). Source: Input-Output Tables.

DEMAND CONDITIONS: Importance attached by firms to demand conditions in explaining price changes. Source: Banco de España survey on pricing behaviour. See Álvarez and Hernando (2005).

ATTRACTIVE PRICES: Fraction of prices set in attractive terms. Source: PPI database.

SIZE: Average size of price changes (in absolute value). Source: PPI database.

GOVERNMENT SET: Fraction of companies whose price is set by the government. Source: Banco de España survey on pricing behaviour. See Álvarez and Hernando (2005).

ELECTRICITY DUMMY: Dummy variable that is equal to one for "Production and distribution of electricity" (NACE 3-digt code 401).

TEXTILE FIBERS DUMMY: Dummy variable that is equal to one for "Manufacture of man-made fibres" (NACE 3-digit code 247).

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