EUROPEAN CENTRAL BANK

EUROSYSTEM

EUROSYSTEM INFLATION PERSISTENCE NETWORK

WORKING PAPER SERIES

NO 727 / FEBRUARY 2007

PRICE SETTING IN THE EURO AREA

SOME STYLISED FACTS FROM INDIVIDUAL PRODUCER PRICE DATA

by Philip Vermeulen, Daniel Dias, Maarten Dossche, Erwan Gautier, Ignacio Hernando, Roberto Sabbatini and Harald Stahl

EUROPEAN CENTRAL BANK

EUROSYSTEM

WORKING PAPER SERIES

NO 727 / FEBRUARY 2007

EUROSYSTEM INFLATION PERSISTENCE NETWORK

PRICE SETTING IN THE EURO AREA

SOME STYLISED FACTS FROM INDIVIDUAL PRODUCER PRICE DATA [1]

by Philip Vermeulen [2], Daniel Dias [3], Maarten Dossche [4], Erwan Gautier [5], Ignacio Hernando [6], Roberto Sabbatini [7] and Harald Stahl [8]

In 2007 all ECB publications feature a motif taken from the €20 banknote.

This paper can be downloaded without charge from http://www.ecb.int or from the Social Science Research Network electronic library at http://ssrn.com/abstract_id=961329.

1 The views expressed in this paper are those of the authors and do not necessarily reflect the views of the ECB nor the National Central Bank to which they are affiliated. This paper is based on a set of studies, each related to a euro area country, conducted in the context of a Eurosystem research project (Inflation Persistence Network, hereafter IPN). The authors belong to the ECB and to the National Central Banks that have been involved in a research sub-group of the IPN devoted to the analysis of micro producer prices. The contribution of many other members of this research group and co-authors of country studies, (Luis Álvarez, Pablo Burriel, David Cornille, Monica Dias, Silvia Fabiani, Angela Gatulli, Claire Loupias, Pedro Neves, Patrick Sevestre and Giovanni Veronese), without whom this study would not have been possible, is strongly acknowledged. The authors would also like to thank the national statistical institutes for providing the data, and the many members of the IPN and an anonymous referee for helpful comments.

2 Corresponding author: European Central Bank, Kaiserstrasse 29, 60311 Frankfurt am Main, Germany; e-mail: Philip.vermeulen@ecb.int

3 Bank of Portugal, 1150 Lisbon, Portugal; e-mail: dbdias@bportugal.pt

4 National Bank of Belgium, 1000 Brussels, Belgium; e-mail: maarten.dossche@nbb.be

5 Banque de France – Centre de Recherche, 31 rue Croix des Petits Champs, 75049 Paris Cedex 01, France; e-mail: erwan.gautier@banque-france.fr

6 Bank of Spain, Alcalá 50, 28014 Madrid, Spain; e-mail: hernando@bde.es

7 Bank of Italy – Research Department, Via Nazionale 91, 00184 Roma, Italy; e-mail: Roberto.sabbatini@bancaditalia.it

8 Deutsche Bundesbank – Economics Department, Wilhelm-Epstein-Strasse 14, 60431 Frankfurt am Main, Germany; e-mail: harald.stahl@bundesbank.de

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-Mendez 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-Mendez. 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.

Address
Kaiserstrasse 29
60311 Frankfurt am Main, Germany

Postal address
Postfach 16 03 19
60066 Frankfurt am Main, Germany

Telephone
+49 69 1344 0

Internet
http://www.ecb.int

Fax
+49 69 1344 6000

Telex
411 144 ecb d

ISSN 1561-0810 (print)
ISSN 1725-2806 (online)

CONTENTS

Abstract

This paper documents producer price setting in 6 countries of the euro area: Germany, France, Italy, Spain, Belgium and Portugal. It collects evidence from available studies on each of those countries and also provides new evidence. These studies use monthly producer price data. The following five stylised facts emerge consistently across countries. First, producer prices change infrequently: each month around 21% of prices change. Second, there is substantial cross-sector heterogeneity in the frequency of price changes: prices change very often in the energy sector, less often in food and intermediate goods and least often in non-durable non-food and durable goods. Third, countries have a similar ranking of industries in terms of frequency of price changes. Fourth, there is no evidence of downward nominal rigidity: price changes are for about 45% decreases and 55% increases. Fifth, price changes are sizeable compared to the inflation rate. The paper also examines the factors driving producer price changes. It finds that costs structure, competition, seasonality, inflation and attractive pricing all play a role in driving producer price changes. In addition producer prices tend to be more flexible than consumer prices.

JEL Codes: E31, D40, C25
Keywords: Price-setting, producer prices

NON-TECHNICAL SUMMARY

In this paper, we document producer price setting in 6 countries of the euro area: Germany, France, Italy, Spain, Belgium and Portugal. We collect evidence from available studies of the Inflation Persistence Network (a network of researchers of the Eurosystem) on each of those countries and also provide new evidence. These studies use monthly producer price data from price records used to construct official producer price indexes. The following five stylised facts emerge consistently across countries. First, producer prices change infrequently: each month around 21% of prices change. Second, there is substantial cross-sector heterogeneity in the frequency of price changes: prices change very often in the energy sector, less often in food and intermediate goods and least often in non-durable non- food and durable goods. Third, countries have a similar ranking of industries in terms of frequency of price changes. Fourth, there is no evidence of downward nominal rigidity: price changes are for about 45% decreases and 55% increases. Fifth, price changes are sizeable compared to the inflation rate. We also examine the factors driving producer price changes such as costs structure, competition, seasonality, inflation and attractive pricing. In particular, we find that a higher share of labour costs in the total cost of manufacturing the product corresponds to a lower frequency of price changes where on the contrary, a higher share of non-energy intermediate inputs and of energy goods correspond to a higher frequency of price adjustments. We also find that a higher degree of competition is associated with more flexible prices and that higher inflation is positively correlated with a higher frequency of price adjustment. We also show that price changes occur more often in January. By contrast, price changes tend to occur less over the summer months, particularly in August, and in December. In addition we compare producer prices with consumer prices. We find that producer price tend to be more flexible than consumer prices. This indicates that the retail level adds an additional level of stickiness to prices above the producer level. The new results in this paper broaden our understanding of producer price setting and should help macro economic modelling and ultimately be beneficial for conducting monetary policy.

1. INTRODUCTION

During the period from 2003 to 2005, the Eurosystem embarked on a wide study of inflation persistence and price stickiness in the euro area (Inflation Persistence Network, IPN). The IPN analysed price setting practices in the euro area by looking at various databases never exploited in previous empirical research. In particular, micro consumer prices were analysed (Dhyne et al., 2006) as well as information on price setting was collected through firms' surveys (Fabiani et al., 2006). This paper presents a set of new empirical insights in producer price behaviour based on the analysis of detailed micro data provided for the first time by National Statistical Institutes. It brings together results obtained in national studies and it produces empirical evidence for the euro area as a whole, based on a coordinated approach. The approach and the structure of the paper is closely related to the complementary analysis of consumer prices by Dhyne et al. (2006); similarly, its main scope is to collect the stylized facts on producer price setting that can be derived from the analysis of the available data.

The emphasis of the paper is on the rigidity of prices. How rigid are producer prices? Do they change often or not? The existent literature on the nature of consumer price setting (Cecchetti, 1986; Kashyap 1995) for a limited set of goods has recently been revived by new evidence stemming from much broader datasets spanning the U.S. and Euro area CPI (Bils and Klenow, 2004; Dhyne et al., 2006). The general finding of those studies is that consumer prices are relatively rigid. Whereas consumer prices are of course relevant for the monitoring of inflation by central banks, it is the prices at the producer level that are ultimately modelled in economists macro-economic models. For instance, rigidity of prices measured by the frequency of price setting is a key element of new Keynesian models that traditionally describe producers as Calvo price-setters (Yun, 1996). A deeper knowledge of producer price setting should help macro economic modelling and ultimately be beneficial for conducting monetary policy.

This paper describes the characteristics of producer price setting behaviour based on price records used to construct official producer price indexes. Where they are relevant, complementary findings from one-time surveys of producers are mentioned. In the first part, the behaviour of individual product prices at the establishment level is investigated. The empirical assessment of the periodicity and size of individual price changes using micro price

data has been scarce and partial until very recently, due to the limited amount of data available to researchers. Earlier micro-studies on price setting referred mostly to consumer prices and focused on a very limited number of products. The evidence based on individual producer prices is even scarcer. Stigler and Kindahl (1970) and Carlton (1986), analysing transaction prices of intermediate products used in manufacturing, are among the few micro-studies on producer prices. Carlton's (1986) findings indicate quite rigid producer prices. A larger literature studies the managerial decision making processes and practices that are involved with price changes of producers. For instance, the work by Bergen et al. (2003), and Zbaracki et al. (2004) shows that changing prices is a quite involved process that often includes costly information gathering, decision making, communication and customer costs, at least for large enterprises. This could explain the observed rigidity.

More recently, in the context of the IPN, some researchers have exploited the large-scale data sets of individual prices underlying the official Producer Price Index (PPI). In particular, the statistical offices of Germany, France, Italy, Spain, Belgium and Portugal allowed researchers to investigate individual price records under strict confidentiality agreements. In this paper their findings on the behaviour of individual producer prices are collected and presented uniformly.

The paper is structured as follows. Section 2 presents the main characteristics of the databases. Section 3 provides a set of stylized facts on producer prices that can be derived from the data. Section 4 analyses the determinants of producer price changes. Section 5 compares the flexibility of producer prices with consumer prices. Section 6 concludes.

2. MICRO QUANTITATIVE PRODUCER PRICES FOR THE EURO AREA

The statistical offices of individual countries collect monthly price records on individual products at the establishment level to construct the producer price index at the industry and country level. The monthly collection by the statistical offices of price records of products sold by all domestic establishments is done by means of a statistical survey, that is, price records are obtained from a representative sample of establishments and products. The national indices constructed on the basis of the individual price data are further aggregated to obtain euro area wide producer price indices. In Europe, the price record data collection is harmonized by a Directive (that is a European law) of the European Union. In

particular, the methodological manual from Eurostat (Eurostat, 2002) explains that the following rules apply for the collection of prices by the statistical offices:

- The appropriate price is the ex-factory price including all duties and taxes except value added tax (VAT).
- All price-determining characteristics of the products are taken into account, including quantity of units sold, transport provided, rebates, service conditions, guarantee conditions and destination. The specification of the product must be such that in subsequent reference periods, the establishment is able uniquely to identify the product and to provide the appropriate price per unit of the product.
- The prices are actual transaction prices, not list prices.
- The price collected in period *t* should refer to orders booked during period *t* not the moment when the commodities leave the factory gate.
- If transport costs are included, this should be part of the product specification.

All statistical offices apply these rules so that price records are comparable across countries. Notwithstanding the above, we are aware that statistical offices are likely not to be able to follow strictly the guidelines for all products at all times (e.g. a list price might be used if no transaction occurred during the month); consequently, there might be some random variation left due to procedures internal to statistical offices, we are not aware of. There might also be some random variation (and even errors) in the reporting by establishments. Note for instance that the guidelines from Eurostat for the price record taking do not say anything about whether the establishment has to follow the same customer over time (if possible). Some establishments with long term relationships may report prices for the same product and the same customer, month after month (so that prices might not change much), whereas other establishments may have varying customers month after month.

Although it is a priori possible that part of the differences across countries in the statistics provided in this paper could be due to methodological rather than economic differences, we do not believe this to be a major issue. In addition, as it will be shown below, the fact that statistics are remarkably similar across countries is reassuring of the possibility of deriving broad stylized facts that are relatively robust for the euro area as a whole. In all countries, researchers were able to follow the price of a product at a particular establishment.

Price records in all countries contained at least the following information: the actual price, a product code, an establishment code, a code indicating product replacement, and the year and the month of the record. By following prices for a given product from the same establishment, price trajectories are observed. The product code for Germany, France, Italy Belgium and Portugal is the PRODCOM code, which is the official classification code of products produced within the European Union, whereas for Spain it is a numeric sub-variety code which prevents identification of the specific product for the researcher.

Monthly quantitative price records, namely individual price trajectories, that is sequences of price quotes for a specific product from a specific establishment, were made available for Germany, France, Spain, Italy, Belgium and Portugal, all together accounting for a weight of around 87% of the euro area PPI. Researchers in these countries had access to nearly the complete set of micro data underlying the computation of the national PPI, with the exception of Italy where only a representative subset of price records referred to 60 products was made available. A complete and detailed description of each national database is provided in country analyses (Table 1).

Table 1 - Coverage of the national databases

Country	*Paper*	*Percentage of PPI basket covered in the national analysis*	*Period covered*
Belgium	Cornille and Dossche (2006)	83	January 2001- January 2005
France	Gautier (2006)	92	January 1994- June 2005
Germany	Stahl (2006)	100	January 1997 - February 2003
Italy	Sabbatini et al. (2005)	44[1]	January 1997- December 2002
Portugal	Dias, Dias and Neves (2004)	Almost 100	January 1995 – December 2000
Spain	Álvarez et al. (2005)	99.4	November 1991 - February 1999

(1) Estimated on the basis of 3-digit weights (see Sabbatini et al., 2005)

For all countries, each individual price record corresponds to a precisely defined product, manufactured by a particular establishment in a particular month and year. The products included in the PPI basket can be classified in 6 different product categories: food products, non-durable non-food products, durable products, intermediate goods, energy and capital goods. Appendix A contains the classification of NACE-3 digit industries into those 6 groups.

Before analysing the characteristics of the price setting behaviour in the euro area, it is useful to recall in which inflation environment this study takes place. The average yearly inflation, as measured by the aggregate producer price index over the period of the respective databases was 1.0% in Germany, 0.7% in France, 1.5% in Italy, 2.1% in Spain, 1.5% in Belgium and 1.7% in Portugal. Hence in all countries this was a low inflation period. However it has to be kept in mind that average inflation hides the fact that PPI inflation is generally quite volatile from month to month.

3. THE CROSS-SECTIONAL AND TIME SERIES PATTERNS OF PRODUCER PRICE CHANGES

This section presents a set of stylised facts on the cross-sectional and time series patterns of producer price changes in the euro area. The main statistic used is the monthly frequency of price changes, whose magnitude is compared across countries and industries. The monthly frequency of price changes can be defined as the share of prices that are changed in a given month. Say 100 establishments provide the prices of bricks of clay in month *t-1* and month *t*. If 20 of the prices differ from *t* to *t-1*, the frequency of price changes of bricks of clay in month *t* is 0.20. Clearly, the frequency of price changes can be calculated at different levels of aggregation across good categories (for individual products such as "bricks of clay", for items belonging to the same category such as "NACE 264, Manufacture of bricks tiles and construction products, in baked clay", for higher aggregate categories such as NACE 26 "Manufacture of other non-metallic mineral products", in the extreme case for all manufactured goods) and across time periods.

A specific problem arises when calculating frequencies at different levels of aggregation: frequencies at higher levels of aggregation are derived by weighting those calculated at lower levels of aggregation. For instance, the frequency of price changes at aggregate NACE 26 is calculated as a weighted average of the frequencies of the subgroups of NACE 26, that is NACE 261, NACE 262, and so on up to NACE 268. Furthermore, the frequency of each of those subgroups, say NACE 264, is a weighted average of the frequencies of the products belonging to the subgroup NACE 264. At the lowest level of aggregation usually no weights are available, so that all products in that subgroup get the same weight. All statistics in this paper are calculated using country specific PPI weights. Country PPI weights differ as countries do not have the same industrial structure; that is some products or product

categories are produced more in some countries than in other countries. In Appendix B we present more formally how the frequency of price changes has been computed.

The frequency of price changes of a particular product or product group provides condensed information on the outcome of price setting. Clearly it has to be interpreted with caution, since the frequency may not be independent of the causes of price changes. If a particular product has a very low frequency of price changes this could be due to the fact that it is not flexible at all (that is it does not react promptly to causes) or that it does not need to be adjusted since the underlying factors driving the price level do not change.

Fact 1 – Producer prices change rather infrequently. The frequency of monthly price changes ranges from 0.15 in Italy to 0.25 in France.

Table 2 provides the (average weighted) frequency of price changes for all goods. We find an average frequency of price changes for the euro area of 21%, higher than the average frequency of price changes of 15% found by Dhyne et al. (2006) for consumer prices. The reference to average frequencies is, however, not a reliable indication of the differences in the degree of price stickiness, as the composition of the CPI and PPI baskets differs considerably. A detailed comparison of frequency differences between consumer and producer goods is given in section 5.

The frequency of Germany, France, Spain, Belgium and Portugal are all lying in a narrow interval between 0.21 and 0.25. The highest frequency occurs in France (0.25), the lowest in Italy (0.15). However, for Italy energy products are excluded, whereas they usually have the highest frequency of price changes; this narrows the above range, implying that the average weighted frequency across euro area countries is very similar. However, the lower frequency of Italy cannot be fully explained by the absence of energy products. In fact, as we discuss later, the frequency of price changes for different product categories tends to be smaller in Italy than in the Euro area (table 3). Moreover, when looking at 19 different 2 digit NACE industries, 16 have a higher frequency in Germany than in Italy, so that it appears that producer prices in Italy are somewhat stickier.

Table 2: Frequency of price changes all goods

	Frequency	*Frequency of price increases*	*Frequency of price decreases*
Belgium	0.24	0.13	0.11
France	0.25	0.14	0.11
Germany	0.22	0.12	0.10
Italy[1]	0.15	0.09	0.07
Portugal	0.23	0.14	0.10
Spain	0.21	0.12	0.09
Euro area[2]	0.21	0.12	0.10

(1) Energy prices are excluded. – (2) The euro area is calculated using the relative weights of total industry producer price index of the euro area (domestic).

Fact 2 – There is a substantial degree of heterogeneity in the frequency of price changes across industries, which can be classified in three broad classes. Price changes are very frequent for energy products, relatively frequent for food and intermediate products and relatively infrequent for capital goods, non-durable non-food and durable products.

Table 3 shows the frequency of price changes according to 6 product categories. From this table it is clear that the frequency of price changes is heterogeneous across and within main industrial groupings and across countries. Energy prices change most frequently in all countries, which is due to oil products in the energy component. The euro area frequency of price changes for energy is 72%. Food prices, with a euro area frequency of 27% as well as intermediate goods, with a euro area frequency of 22 %, also change quite often. On the contrary, capital goods prices (euro area frequency of 9%), non-durable non- food (euro area frequency of 11%) and durable goods prices (euro area frequency of 10%) change least frequently. The fact that energy prices change most frequently is likely due to volatile supply. When looked into more detail it seems that there are frequent price changes for products that are simple and have not undergone a series of transformations. This is consistent with the observation in Bils and Klenow (2004) that prices of raw goods are changed more often than processed goods. This implies that the costs of those products are closely linked to the corresponding raw material price which is presumable set daily on exchanges. A case is, for example, the frequency of price changes of "flour" and "bread": such frequencies are above 40% and equal to 6%, respectively, both in Italy and in Portugal. Other products with

generally high frequency of price changes are, for instance, textile fibers, paper and paper board, veneer sheets, plywood, dairy products, non-ferrous metals, metal wires, sugar, coffee, etc. All these products have undergone little transformation from input to end product. The heterogeneity of price changes across industries seems therefore akin to the heterogeneity across products and product groups found by Dhyne et al. (2006). For instance, in the CPI, energy prices, and unprocessed food have the highest frequency, two categories of products that have undergone little transformation. On the other hand, capital goods, non-durable non-food and durable products generally consist of a whole series of inputs such as raw materials, labour, R&D, etc.

Table 3 – Frequency of price change by product category (1)

	Food	*Non- durable non- food*	*Durable products*	*Intermediate products*	*Energy*	*Capital goods*
Belgium	0.20	0.11	0.14	0.28	0.50	0.13
France	0.32	0.10	0.13	0.23	0.66	0.12
Germany	0.26	0.14	0.10	0.23	0.94	0.10
Italy	0.27	0.10	0.07	0.18	na	0.05
Portugal	0.21	0.05	0.18	0.12	0.66	na
Spain	0.24	0.10	0.10	0.28	0.38	0.08
Euro area	0.27	0.11	0.10	0.22	0.72	0.09

(1) For each component, the euro area figure is computed as the average of the national results, weighted with the national weights of the considered sub-index in the euro area PPI.

The average weighted frequency of price changes masks a lot of heterogeneity across product groups. To document this heterogeneity, the frequency of price changes was calculated at the 2-digit industry level for each country according to the NACE classification (from NACE 15 to NACE 36). The distribution of those 2-digit industry level frequencies, for all countries jointly (unweighted), is represented in Figure 1.[1] The mode of the distribution is around 0.09. The distribution also shows large outliers of high frequencies. The highest frequencies of price change correspond to "Manufacture of refined petroleum products" (NACE 23) (frequencies above 85%) and "Manufacture of basic metals" (NACE 27) (frequencies above 50%).

The distribution is wide for all countries. This is illustrated in Table 4 which reports country specific minimum and maximum two digit industry level frequencies of price changes as well as the country specific standard deviation of the distribution of the two-digit

industry level frequency of price changes; energy products (NACE 23) are excluded from this analysis of Table 4 since in all countries they have the largest frequency of price changes, which can be regarded as an outlier.

Figure 1 : Distribution of 2-digit industry level frequency of price changes.

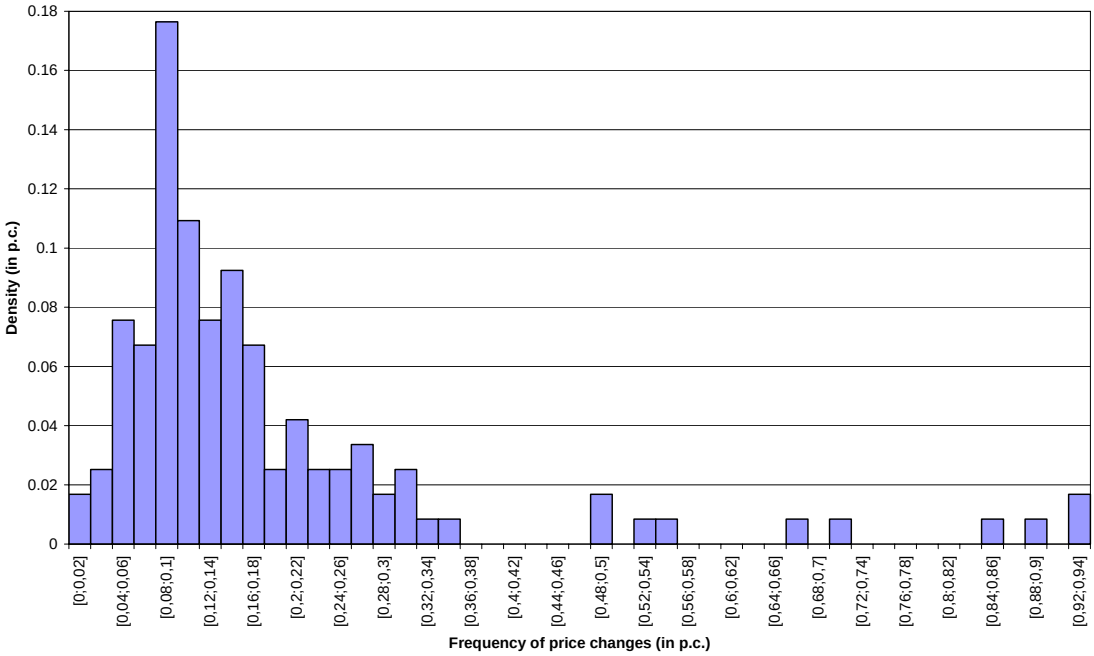


Table 4: Distribution of 2-digit industry level (NACE 15-NACE 36) frequency of price changes (1)

	Minimum Frequency	*Maximum Frequency*	*Standard deviation*
Belgium	0.04	0.72	0.16
France	0.07	0.52	0.10
Germany	0.05	0.49	0.11
Italy	0.01	0.30	0.09
Portugal	0.03	0.24	0.07
Spain	0.08	0.55	0.11

(1) Energy (NACE 23) is excluded from the calculations.

[1] Not all countries were able to calculate a frequency for all 22 2-digit industries.

Fact 3- Countries have a similar ranking of industries in terms of frequency of price changes.

A correlation coefficient of the frequency of price changes at the 2-digit NACE level was calculated for each country-pair (excluding energy products, NACE 23). It is positive in all pairs and has a range from a low of 0.30 between Belgium and Italy to a high of 0.89 between France and Spain. This evidence indicates that industry level factors, such as raw materials cost changes, that play a similar role across countries are likely to affect pricing patterns. The correlations do suggest that the older industrialized Northern European countries – Germany, France and Belgium – are heavily correlated with each other (all correlations are higher than 0.80). Spain is also highly correlated with France and Belgium. This could possibly be due to more similar products or production processes. Although one can conclude that there are country differences, industry differences seem to be the dominating factor in the heterogeneity of frequency of price changes. Also Dhyne et al. (2006) found that heterogeneity across product categories dominated heterogeneity across countries.

Table 5: Correlation of frequency of price changes at the 2-digit industry level (1)

	Belgium	*France*	*Germany*	*Italy*	*Portugal*	*Spain*
Belgium	1	0.81	0.81	0.30	0.47	0.78
France		1	0.84	0.64	0.65	0.89
Germany			1	0.55	0.71	0.57
Italy				1	0.58	0.69
Portugal					1	0.60
Spain						1

(1) The correlation coefficient is calculated on a varying number of industries, e.g. 12 industries for the correlation between Germany and Portugal, versus 19 industries for the correlation between Germany and Italy. Portugal has some 2-digit manufacturing industries in which too few firms operate, so that no PPI price data are collected.

Fact 4 – There is no evidence of strong downward nominal rigidity in the euro area; on average, around 45% of the price changes are price reductions.

Table 2 also provides the frequency of price increases and price decreases. In all countries around 45% of the price changes are price reductions. Carlton (1986) also finds no downward rigidity for producer prices. Interestingly, Dhyne et al. (2006) also report the absence of downward price rigidity for consumer prices in the euro area, where four out of

ten price changes are decreases. This implies for the euro area that downward price rigidity can be rejected on average. The average frequency of price increases in the euro area is at 0.12 a bit higher than the average frequency of price decreases at 0.10. Again the frequency of price increases in Germany, France, Spain, Belgium and Portugal lies in a narrow range of 0.12 to 0.14; in Italy it amounts to 0.09. The frequency of price decreases is almost identical across Germany, France, Spain, Belgium and Portugal (i.e., between 0.09 and 0.11), and a bit lower in Italy at 0.07.

Fact 5 – Price changes, either upwards or downwards, are sizeable compared to the inflation rate prevailing in each country. The distribution of price reductions is roughly similar to that of price increases.

The median price increase in the euro area is 3%. The median price increase ranges from 2% in Germany to 7% in Portugal. The median price decrease in the euro area is 2%. The median price decrease ranges from 2% in Germany and France to 7% in Portugal. In the euro area 50% of price increases are in the range of 1 to 5%, the same range holds for price decreases. Both the distribution of price increases and price decreases are rather wide (see tables 6 and 7). This is true for all countries. The average price increase and average price decrease (not reported in the tables) is 4%. Price increases or decreases over 10% are not rare. This implies that price adjustment costs are likely not convex as they would imply that large price adjustments are costly. In comparison with consumer prices, the average size of a producer price change is relatively low, as the average producer price change (up or down) amounts to 4% compared to 8% and 10% for average consumer price increases or decreases, respectively (Dhyne et al., 2006).

Table 6 –Distribution of price increases

	5pctile	*25pctile*	*median*	*75pctile*	*95pctile*
Belgium	0.00	0.01	0.03	0.06	0.18
France	0.00	0.01	0.03	0.05	0.14
Germany	0.00	0.01	0.02	0.04	0.12
Italy	0.01	0.02	0.03	0.05	0.10
Portugal	0.01	0.03	0.07	0.12	0.23
Spain	0.00	0.01	0.03	0.06	0.15
Euro area	***0.00***	***0.01***	***0.03***	***0.05***	***0.13***

Table 7 –Distribution of price decreases

	5pctile	*25pctile*	*median*	*75pctile*	*95pctile*
Belgium	0.00	0.02	0.04	0.08	0.20
France	0.00	0.01	0.02	0.05	0.15
Germany	0.00	0.01	0.02	0.05	0.15
Italy	0.01	0.02	0.03	0.05	0.11
Portugal	0.01	0.03	0.07	0.12	0.24
Spain	0.00	0.01	0.03	0.06	0.17
Euro area	***0.00***	***0.01***	***0.02***	***0.05***	***0.14***

4. FACTORS DRIVING PRODUCER PRICE CHANGES IN THE EURO AREA

The stylised facts presented in section 3 indicate a marked heterogeneity in the degree of price stickiness across product categories and industries. In this section we examine the contribution of a number of factors in explaining the cross-sectoral and time-series differences in the frequency of price changes. Specifically, the factors analysed are: the cost structure, the level of inflation, the degree of competition, seasonality, the use of attractive pricing, the existence of price regulations, and the incidence of changes in VAT rates. In what follows, for each of the considered factors we first discuss the theoretical arguments supporting the influence of the factor in the degree of price flexibility and, then, we summarise the evidence contained in the IPN national papers.

In these national studies the relative importance of the above factors is assessed by adopting different approaches. Belgium, Germany, and Spain carry out a cross-industry regression analysis. More precisely, sectoral frequencies of price changes are regressed on (at least some of) the above explanatory variables, in order to evaluate each contribution having controlled for the other factors. In addition, the German and Spanish papers also estimate time-series models to assess the contribution of some of the driving factors. In the case of France, a conditional logit model is estimated on individual price quotes to evaluate the contribution of some factors in explaining the frequency of price changes. On the contrary, the analysis for Italy is based on simple correlations; this is due to the fact that the available breakdown for the explanatory variables and the sectoral frequency of price changes (NACE-2 level) is not enough to conduct a regression analysis, due to a lack of enough degrees of freedom.

Table 8 summarises the qualitative importance in the different national studies of the various explanatory factors, analysed in the next subsections, to the differences in the

frequency of price changes. Overall, despite the differences in the databases and in the methodological approaches, results in the national studies are qualitatively homogenous. In the next paragraphs this evidence is analysed more in detail.

Table 8 - Factors affecting the frequency of producer price changes (1)

	BE	FR	DE	IT	PT	SP
Share of labour on costs	Yes	Yes	Yes	Yes	n.a	Yes
Share of intermediate inputs on costs		Yes				
- energy	Yes	n.a.	Yes	Yes	Yes	Yes
- non energy	Yes	n.a.	Yes	Yes	Yes	Yes
Inflation	n.a	Yes	Yes	n.a	n.a	Yes
Competition	Yes	Yes	n.a	n.a	n.a	Yes
Seasonality	Yes	Yes	Yes	Yes	Yes	Yes
Attractive prices	n.a	n.a.	Yes	Yes	n.a	Yes
Regulated prices	n.a	n.a.	n.a	n.a	n.a	Yes
Changes in VAT rates	n.a	Yes	Yes	n.a	n.a	Yes

(1) "Yes" denotes that the factor has an impact on the frequency of price changes; "n.a" indicates that the impact of the factor on the frequency of price changes has not been analyzed.

Factor 1: Cost structure

In this subsection we focus on how the cost structure affects the frequency of price changes. Blanchard (1982) provides some theoretical support to this relationship; in particular, he argues that price setting is influenced by the number of manufacturing stages, with sectors at earlier stages of production (for instance, those selling intermediate goods) being more affected by the high volatility of raw materials prices. More generally, in monopolistic competition models, under quite general conditions, firms choose to charge a price that represents a mark-up over marginal cost.[2] Thus, for firms following mark-up rules the higher is the volatility of input prices, the higher is the frequency of price changes. If input costs are relatively stable, such as wages which change only rarely, prices could also be expected to be stable. On the contrary, if input costs are highly volatile, in particular energy prices, the frequency of price changes should be much higher.

All national studies, except that for Portugal, exploit the cross-sectional differences in the frequency of price changes and in the cost structure to assess how the cost structure contributes to explain the price setting behaviour. Most analyses distinguish between labour costs, non-energy intermediate inputs and energy inputs. From an empirical viewpoint, input-output tables, as well as national accounts, provide valuable information to estimate the structure of the production costs for individual industries. National studies present some

differences in the method through which the cost structure is actually estimated. Moreover, the methodological approach followed in the various analyses to estimate the link between cost structure and frequency of price changes is not always homogeneous (Table 9).

Table 9 – The estimates of the cost structure in the national studies

	Information used to estimate the cost structure	*Level of detail of the information on sectoral cost*	*Breakdown of the cost structure*	*Type of analysis*
Belgium	Input-output tables	NACE-3	• Labour • Non-energy intermediate goods • Energy goods	Cross-section regression analysis
France	Firms' data ; raw materials indices (INSEE)	NACE-3	• Labour share • Non-energy intermediate goods (food ; industry)	• Simple correlations • Conditional logit
Germany	Statistic on the cost structure of firms	NACE-4	• Labour • Non-energy intermediate goods • Energy goods	Cross-section regression analysis
Italy	Input-output tables; national accounts	NACE-2	• Labour • Non-energy intermediate goods • Energy goods	Simple correlations
Spain	Input-output tables	NACE 3	• Labour • Non-energy intermediate goods • Energy goods	Cross-section regression analysis

In spite of the differences in the sources used to estimate sectoral costs and in the methods to calculate correlations, results are similar across countries and confirm our expectation that to most volatile costs correspond higher frequencies of price adjustment. In particular, we find that: (a) a higher share of labour costs indeed corresponds to a lower frequency of price changes (see Figure C.1 in Appendix C); (b) on the contrary, a higher share of non-energy intermediate inputs and of energy goods correspond to a higher frequency of price adjustments (see Figures C.2 and C.3 in Appendix C).

The work for Belgium and Germany also examines the impact of the cost structure on the asymmetry between the frequency of upward and downward price change. For Belgium, there is only evidence in favour of an important role for the share of energy costs in explaining sectoral asymmetry but no significant role for the labour share. For Germany, on the other hand, a higher share of labour costs reduces the frequency of downward price changes more than that of upward price changes.

[2] Fabiani et al. (2006) show that mark-up pricing is the dominant price-setting practice adopted by firms in the euro area.

Factor 2: Inflation

The analysis of the link between the frequency of price adjustment and inflation may offer some evidence on the potential relevance of state-dependent pricing policies. To the extent that this type of policies is prevalent, the frequency of price adjustment should be affected by the existing economic conditions, inflation among them. State-dependent pricing rules are usually incorporated in macroeconomic models through the introduction of a fixed cost of price adjustment (see, for instance, Sheshinski and Weiss, 1977; Caballero and Engel, 1993; Dotsey, King and Wolman, 1999). In these models, the existence of a fixed cost of changing prices implies that firms change their price only when a large enough shock (for instance, in the presence of high inflation rates) occurs. By contrast, if time-dependent strategies are predominant, the frequency of price changes would not react to changes in inflation while these changes would be reflected in the average magnitude of price adjustments.

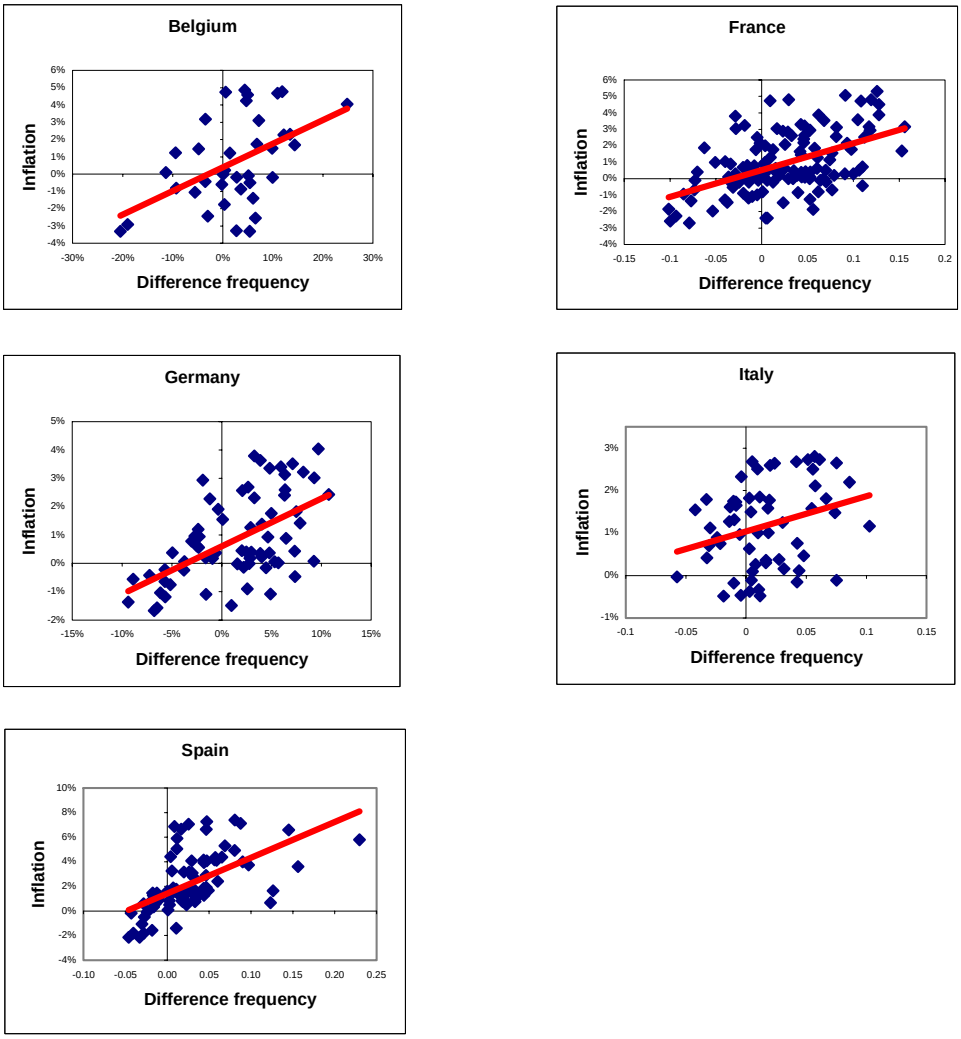
Several euro area country studies document a positive relationship between the level of inflation and the frequency of price increases. Conversely, these studies report a negative relationship between the level of inflation and the frequency of price decreases. Cornille and Dossche (2006) illustrate these results by means of a correlation analysis whereas Álvarez and Hernando (2005) and Stahl (2006) corroborate them by using time series models. Nevertheless, the magnitude of the effect of inflation on the frequency of price adjustment is moderate: a one percentage point increase in inflation raises the frequency of upward price adjustment by 0.7 and 1.1 percentage points in Spain and Germany, respectively. As the average frequency of price increases in both countries is 0.12, the increments in the frequency of price increases represent approximately 6% in Spain (i.e. from 0.12 to 0.127) and 9% (i.e. from 0.12 to 0.131) in Germany of the average value of the frequency of price increases. This effect, although moderate, is larger than that obtained by Dhyne et al. (2006) analysing consumer micro price data for the euro area. These authors find that raising the annual inflation rate for a given product by one percentage point would raise the frequency of price increases by approximately 0.3 percentage points.[3] This link between inflation and the frequency of price adjustment is illustrated in Figure 3 that shows the positive correlation between the level of aggregate inflation and the difference between upward and downward price adjustment frequencies. This correlation is always positive and significant and it ranges from 0.34 in Italy to 0.57 in Spain. This evidence may be interpreted as favourable to the

existence of state dependent pricing in response to aggregate shocks. Alternatively, this evidence suggests that changes over time in the proportion of price increases relative to price decreases seem to be an important driving force behind observed aggregate inflation.

Further, some authors have also explored, using micro consumer price data, the link between accumulated inflation (defined as the growth rate in the sectoral price index since the last price change) and the frequency of price changes (see, for instance, Cecchetti, 1986; Aucremanne and Dhyne, 2005; Fougère et al., 2005). Nonetheless, as Fougère et al. (2005) suggest, this variable admits two possible explanations. On the one hand, it may proxy the inflation in production costs or whole sale prices in the industry. On the other hand, it reflects the evolution of competitors' prices. Under both interpretations, the higher the inflation rate, the higher (lower) the frequency of price increases (decreases).

[3] The estimated effect is also larger than that found by Gagnon (2005) using micro consumer price data for Mexico. He finds that a one percentage point increase in the monthly frequency of price changes is associated with a 0.40-0.45 percentage point increase in the monthly frequency of price changes.

Figure 3 - Inflation and the difference between upward and downward frequency



Furthermore, the price-setting process might be influenced not only by aggregate economic conditions but also by sectoral specific disturbances. To test for this possibility, some of the national studies analyse the link between sectoral inflation rates and the frequency of price adjustment. Gautier (2006) estimates a conditional logit model explaining the price-setting decision (increase, decrease or maintain unchanged). He finds that the probability of observing a price increase (decrease) is positively (negatively) related to the level of sectoral inflation. Similarly, Álvarez et al. (2005) and Stahl (2006), using time series models for the frequencies of price changes, increases and decreases, find that sectoral inflation, measured at the six main product categories level, positively (negatively) affects the frequency of upward (downward) price changes.

Overall, the country studies provide some evidence of state dependency in response to both sectoral and aggregate inflation developments.

Factor 3: Competition

Another factor potentially relevant to explain firms' pricing behaviour is the degree of competition in the market on which the product is sold. The link between market structure and pricing behaviour has received substantial attention in the industrial organisation literature.[4] On the theoretical front, several arguments have been put forward supporting the existence of a direct link between the degree of competition and price flexibility. Thus, it is often argued that firms in competitive markets are more likely to change prices in response to shocks, since the opportunity cost of not adjusting prices to optimal ones is very high (Ginsburgh and Michel, 1988, and Martin, 1993). By contrast, this opportunity cost is smaller for firms enjoying significant market power. Alternatively, Stiglitz (1984) argues that oligopolists may prefer delays in adjusting prices in order to avoid breaking tacit understandings. As for the empirical work, most of the available evidence tends to favour the existence of a positive link between price flexibility and degree of competition,[5] although there are a few exceptions reporting the opposite result.

The empirical analysis of the relationship between the degree of price stickiness and the intensity of market competition faces the difficulty of measuring market competition, a concept whose measurement has been extremely elusive in the empirical literature (Bresnahan, 1999). Standard measures, such as concentration indices or number of firms in the industry, have been often criticised as there are examples of highly concentrated industries with a small number of participants in which competition is very intense (e.g. telecommunications) and, by contrast, there are also industries with a large number of competitors, that maintain market power at the local level (e.g. bars and restaurants). On the other hand, measures of competition in an industry can be directly derived from answers of firms in such industry to questions about their competitive environment. Recently available surveys on price setting behaviour in the euro area (Fabiani et al., 2006) allow the construction of measures of the degree of competition from the responses to different questions in the survey.[6] Obviously, the drawback of this type of measures lies in its

[4] See Carlton (1989) for a survey of theoretical and empirical work on the link between pricing behaviour and market structure, and Álvarez and Hernando (2006) for more recent references analysing this relationship.
[5] This positive link is found, among others, in Carlton (1986), Geroski (1992), Caucutt et al. (1999) or Hall et al. (2000).
[6] For instance, the degree of competition faced by a firm may be inferred from the importance it attaches to changes in competitors' prices in explaining its own price changes (Fabiani et al., 2006). The rationale for this

subjective nature, that is firms may use different criteria in responding survey questionnaires. Table 10 summarises the proxies of the degree of competition used in the PPI national studies to analyse the influence of the intensity of competition on the degree of price flexibility.

Table 10 – The impact of competition on the frequency of price changes in the national studies

	Proxies for the degree of competition	*Data source*	*Level of detail of the information on sectoral cost*	*Type of analysis*
Belgium	Importance attached to competitors' prices; Share of firms using a mark-up rule ;	Survey on pricing behaviour Aucremanne and Druant (2005)	NACE-3	Cross-industry regression analysis
France	Four-firm concentration ratio	INSEE - Firms'data	NACE-4	Conditional logit analysis
Germany	Importance attached to competitors' prices Share of price takers Share of firms with prices that are constantly reduced during the life-cycle of the product	Survey on pricing behaviour Stahl (2005b)	NACE-2,NACE-3	Partial (regression analysis)
Italy	Importance attached to competitors' prices ; Share of firms using a mark-up rule ; Number of competitors	Survey on pricing behaviour Fabiani et al. (2004)	NACE-2	Simple correlation
Spain	Import penetration	Input-output tables	NACE-2	Cross-industry regression analysis
	Importance of demand conditions	Survey on pricing behaviour Álvarez and Hernando (2005)	NACE-3	

Álvarez et al. (2005) and Cornille and Dossche (2006), using a cross-industry regression analysis, find that a higher degree of competition results in more flexible price adjustment. All three papers find that the frequency of price changes depends positively on proxies for the degree of competition taken from surveys on pricing behaviour.[7] In addition, Álvarez et al. (2005) find that the degree of import penetration, which proxies external competition, is positively related to the frequency of price changes. Finally, Sabbatini et al. (2005) report simple correlation coefficients between the frequency of price changes and competition variables obtained from survey data and they observe that a lower degree of competition is associated with a moderately higher frequency of price changes. However,

measure is that it can be expected that the more competitive is the environment faced by a firm, the more its pricing strategy is likely to be affected by the behaviour of its competitors.

[7] More precisely, Cornille and Dossche (2006) use both the average importance attached by firms to their competitors' prices and the fraction of companies that use a mark-up rule. Álvarez et al. (2005) use the average relevance attached by companies to demand conditions, which proxies demand price elasticity. The only

they argue that this result could be due to the quality of the competition indicators at the NACE 2 level, as the survey covered only large firms (more than 50 employees) and the number of firms interviewed for each sector was quite small. In Gautier (2006), the market structure variable is introduced in the model in interaction with other explanatory factors; he finds that the less competitive a market is, the less the shocks are transmitted into prices.

Overall, the results of the country studies tend to support the conclusion that the higher is the degree of competition, the higher is the frequency of price decreases. These results are mostly in line with the evidence based on the analysis of survey data showing that the frequency of price adjustment and the speed of adjustment in the face of demand shocks are positively influenced by the degree of competition (Fabiani et al., 2006; Álvarez and Hernando, 2006).

Factor 5: Seasonality

All national studies investigate whether the frequency of price changes exhibits a seasonal pattern which can be related to various factors. First, it might be due to the presence of implicit or explicit contracts lasting exactly one year and being renewed (formally or informally) in January; this possibility, which would support a time dependent price setting strategy, is formally investigated in survey analysis for a few euro area countries (Álvarez and Hernando, 2005). More generally, the evidence reported in Fabiani et al. (2006) which summarises results for nine euro area countries shows that explicit or implicit contracts in all countries turn out to be one of the most important factors inducing firms to postpone a price change, informally supporting the possibility of having some seasonal patterns in the frequency of price changes. Seasonality might also be linked to a seasonal pattern of price determinants, in particular of wage changes which often take place in January; in this case the presence of a seasonal pattern in price adjustment would not necessarily be interpreted as "time dependent" but would be consistent with a state dependent policy, with pricing responding to cost shocks. The impact of such wage setting can only be identified if not all contracts start at the same time. This is for instance observed in western Germany, in the so called "metal-working industries". For these industries, Stahl (2005a) analyses how various factors alter the probability of a price increase or reduction in a certain month. He finds that dummy variables capturing the collective wage negotiation process even controlling for

variable with a statistically significant impact on the frequency of price changes is the share of firms with prices that constantly decline during the life-cycle of the product.

seasonality with monthly dummies have a statistically significant impact on price increases but not on price reductions.[8]

Although seasonality in price setting may partially be explained by seasonality in other factors, seasonality turns out to be an important feature underlying the time profile of the (unconditional) frequency of price changes in all national studies. In particular, for the euro area as a whole the frequency shows a peak in January (0.32 against an average in the remaining months of 0.20). This feature of price setting is present in all countries. It is particularly pronounced in Belgium, where the average frequency in January is 0.54 whereas the average frequency in other months is around 0.22, and in France (0.39 compared to an average 0.23 in the remaining months). By contrast, the frequency of adjustment tends to be smaller over the summer months, particularly in August, and in December.

Table 11 – Frequency of price changes in the various months

	Belgium	*France*	*Germany*	*Italy*	*Portugal*	*Spain*	*Euro area*
January	0.54	0.39	0.31	0.23	0.29	0.34	0.32
February	0.21	0.25	0.23	0.18	0.21	0.25	0.22
March	0.21	0.24	0.22	0.16	0.23	0.22	0.21
April	0.24	0.25	0.24	0.16	0.24	0.22	0.22
May	0.23	0.22	0.24	0.13	0.21	0.20	0.20
June	0.20	0.21	0.21	0.13	0.23	0.21	0.19
July	0.20	0.26	0.24	0.12	0.22	0.18	0.21
August	0.20	0.19	0.20	0.15	0.21	0.16	0.18
September	0.24	0.23	0.21	0.16	0.23	0.19	0.20
October	0.28	0.24	0.25	0.13	0.26	0.21	0.22
November	0.22	0.21	0.21	0.12	0.24	0.20	0.19
December	0.13	0.21	0.20	0.13	0.22	0.18	0.18
All	0.24	0.25	0.22	0.15	0.23	0.21	0.21
All except January	0.22	0.23	0.22	0.14	0.23	0.20	0.20

Factor 6: Attractive pricing

It has been widely documented that certain digits are more likely than others to appear as rightmost digit of prices. For instance, prices ending in 0, 5 or 9 are considerably more frequent in practice than a uniform distribution would imply. This fact is the result of different objectives of the price setters such as making transactions easier or resulting in psychologically attractive prices for customers. Although this type of pricing strategy is more likely to be used by firms selling their products to consumers, it could also be relevant in the

[8] In a more recent analysis over a longer period the dummies capturing the wage negotiation process turned out to be significant only for the period between 1980 and 1996 whereas from 1996 until 2005 they were insignificant.

case of producer prices. In fact, Sabbatini et al. (2005), Álvarez et al. (2005), and Stahl (2006), using alternative definitions of attractive prices, report that the share of attractive prices is 43%, 31% and 19% in samples of Italian, Spanish and German producer prices, respectively.[9] It is also worth noting that our producer prices are, in most cases, transaction prices, contrary to what is standard in micro consumer price databases, which typically include list prices. In some cases, this transaction price is the outcome of a bargaining process and it can be argued that it may be too costly to bargain on the last digit(s). Basu (1997) shows for example that prices ending in 9 have an economic interpretation in which consumers are rational; this is an equilibrium where each firm can not change the situation.

In terms of the degree of price flexibility, the use of attractive pricing strategies can be seen as a rigidity in the price setting process. In the face of a certain disturbance, firms may decide to delay their price adjustments until new shocks induce a change to a new attractive price. This pricing policy would result in a lower frequency of price adjustment and larger magnitudes of price changes. Evidence for Spain (Álvarez et al., 2005) supports this hypothesis: the frequency of price changes for products priced in attractive terms is 0.16, whereas this frequency is 0.24 for the rest of the products. Analogously, the average price change for a firm setting attractive prices is 6.2% whereas it is 4.6% for the rest of the firms. Moreover, Álvarez et al. (2005) and Stahl (2006) estimate cross-industry regression models for the frequency of price changes and find that the fraction of prices set in attractive terms has a negative impact on that frequency.

Factor 7: Other sources

Lünnemann and Mathä (2005) using HICP sub-indices for the individual EU-15 countries, as well as for the EU-15 and the euro area aggregates, find that those sectors being subject to price regulation exhibit larger degrees of nominal price rigidities. As Dexter et al. (2002) argue, this higher price stickiness of sectors where the public sector is involved in the price-setting process, might be related to the institutional process required to adjust prices, which could also imply the intervention of a rate review agency. On the same vein, Blinder et al. (1998), analysing survey data for U.S. firms, suggest that hierarchical delays due to bureaucracy can cause prices to respond slowly and erratically to market forces. Also on the basis of survey data, Fabiani et al. (2006) report that firms in France, Italy and Spain whose prices are regulated are characterised by a lower probability of displaying a fast price reaction

[9] It has to be stressed that the figures are not comparable across countries since the definitions of attractive prices are different.

in the face of costs shocks. In this line, among the country studies analysing PPI data, Álvarez et al. (2005) find that sectors with a high fraction of firms whose prices are set by the government display a low frequency of price adjustment.

Finally, Álvarez et al. (2005) and Stahl (2005a), using a time series analysis, and Gautier (2006), estimating conditional logit models, find that changes in VAT rates lead to temporary increases in the frequency of price changes, particularly in the frequency of price increases. As German, French and Spanish PPI price records excluded invoiced VAT, this result suggest that firms take advantage of the need to change their final prices (including VAT) to carry out additional revisions. This finding corroborates the evidence reported in Dhyne et al. (2006) for consumer prices. Another explanation is that the change in producer prices reflects the only partial pass through of VAT changes by retailers. In Germany, for example, for non-durable non-food consumer products, price increases were less frequent and price reductions more frequent. The average size of the price changes was not affected. So these producers shared part of the tax burden.

5. A COMPARISON BETWEEN CONSUMER AND PRODUCER PRICES

This section compares producer prices with consumer prices, in particular, addressing the question of which prices are the more flexible. The answer can be provided with reference to three different levels of comparison: (i) comparing the entire baskets of CPI and PPI, (ii) comparing sub-baskets of CPI and PPI, (iii) finally comparing individual products in CPI to similar products in PPI. Each comparison has its own merits and caveats that are discussed below.

(i) Comparison based on the entire CPI and PPI baskets

When the entire baskets of CPI and PPI are compared, producer prices turn out to be more flexible than consumer prices. In all countries considered, it turns out that the frequency of price changes is higher for the PPI than for the CPI. Large differences can be found in Germany (22% versus 11%) and Belgium (24% versus 14%), smaller ones in France (25% versus 19%) and Portugal (23% versus 21%; see also Table 13). For the euro area, the frequency of price changes amounts to 21% for producer prices compared to 15% for consumer prices (Dhyne et al., 2006). However, in interpreting this fact one has to keep in mind the statistical differences between the two indices, which are summarised below:

- composition of the baskets: (a) services are not included in the PPI. As documented in various empirical analyses (Dhyne et al., 2006; Fabiani et al., 2006) services prices exhibit a much lower frequency of price change compared to goods; *ceteris paribus* the reference to aggregate indicators would lead to detect a higher degree of stickiness for consumer than for producer prices; (b) producer prices include non-energy intermediate goods and capital goods. In particular, prices for the first component are quite volatile, closely mirroring the evolution of raw material quotations on international markets and the movements of the exchange rate; (c) the CPI includes unprocessed food, whereas PPI does not (with the exception of meat); (d) the weights assigned to energy prices are typically much higher in the PPI than in the CPI basket;
- type of price: (a) PPI refers to prices of only domestically produced goods, whereas the CPI also includes the imported ones; (b) producer prices are net of indirect taxes, whereas consumer prices include them. The actual impact of this difference on the comparison is indeed country specific, depending on how many changes in the excise duties occurred in the considered time horizon. For the countries for which both producer and consumer micro prices have been analysed, the impact of this factor on the estimate of the frequency of consumer price changes over a time horizon covering approximately the second half of the nineties and the first years on this century was not particularly relevant.

Besides the differences documented above, other sources of biases are in principle related to the methodological differences in the calculation of the frequency of price changes for consumer and producer prices, in relation to: (a) the time horizon (reflecting the availability of data over a different period of time); (b) the treatment of censoring; (c) weighting. In practice, on the basis of the information reported in Table 12, in principle only the differences in the time horizon can impact on the analysis of the results. In particular, for most countries the time horizons adopted for the computation of the various statistics slightly differ, with the only exception of Spain.[10] Concerning the treatment of censoring, only in the case of Italy the comparison is based on statistics computed under different assumptions, namely "no censoring" for producer prices and "intermediate censoring" for consumer prices; these correspond to the "best guess" on the frequency of price adjustment in Italy, for reasons

[10] In Italy, instead, for both consumer and producer price data, in order to avoid the contamination of the results due to the unusual behaviour recorded during the euro cash changeover, the results are restricted to the period ending in December 2001, though the beginning of the period differ for the two indices.

extensively discussed in Fabiani et al. (2006). Finally, concerning weighting all countries reported weighted statistics on the frequency of price changes for PPI and CPI.

Table 12– Main characteristics of the national statistics on the frequency of price changes

Country	*Time horizon*		*Censoring (1)*		*Weighting (2)*	
	PPI	**CPI**	**PPI**	**CPI**	**PPI**	**CPI**
Belgium	Jan .2001-Jan. 2005	Jan 1996-Feb 2003	No censoring	No censoring	Weighted statistics	Weighted statistics
France	Jan. 1994- June 2005	July 1994- Feb. 2003	No censoring	No censoring	Weighted statistics	Weighted statistics
Germany	Jan. 1997- Dec. 2002	Jan.1998- Dec.2003	No censoring	No censoring	Weighted statistics	Weighted statistics
Italy	Jan. 1997-Dec. 2001	Jan. 1996-Dec. 2001	No censoring	Intermediate censoring (3)	Weighted statistics	Weighted statistics
Portugal	Jan. 1995 – Jan. 2001	Jan 1997 – Jan 2001	No censoring	No censoring	Weighted statistics	Weighted statistics
Spain	Jan. 1993 – Jan. 1999 (4)	Jan. 1993 – Jan. 1999 (4)	No censoring	No censoring	Weighted statistics	Weighted statistics

(1) "No censoring" denotes that all price spells are used to compute the statistics; "Censoring" indicates that the censored spells (the first and the last) are disregarded. - (2) Weighting refers to how the aggregate statistics on the frequency of price changes for CPI and PPI, respectively, are computed. - (3) See Fabiani et al. (2006) for details on the reasons underlying the differences in treatment of censoring between CPI and PPI. - (4) For Spain, the comparison between the frequency of price changes of consumer and producer prices has been conducted using a common seasonally balanced sample period running from January 1993 to January 1999 (see Álvarez et al., 2005). In the original CPI database the sample period covered from January 1993 to December 2001 and in the whole PPI database it went from November 1991 to February 1999.

(ii) Comparison of sub-baskets of CPI and PPI

The main difficulty in interpreting a comparison of frequency of price changes based on the entire CPI and PPI basket is related to the different composition of the baskets. Such a comparison does not reveal whether groups of similar products in CPI and PPI have different price flexibility. Groups of similar products in CPI and PPI can be most easily found in two sub-components of CPI and PPI, namely processed food and non-food non-energy consumer goods.

A comparison of those two sub-baskets is reported in Table 13 which shows that producer prices tend to be more flexible (higher frequency of price changes) than consumer prices; this result in general holds for all countries and for both sub-component, as well as for the overall sample. An exception is prices of non-food non-energy goods in France. This exception can however be explained by the different way product replacements (which are frequent for consumer goods like furniture or clothes) are treated. They are considered as price changes in the French CPI study but not in the PPI study. For the euro area as a whole processed food are almost twice as flexible at the production stage than at the retailing one

(the frequency of price changes is 0.27 and 0.13, respectively); differences for non-food non-energy consumer prices are more moderate (0.09 and 0.12).

Table 13 – Comparison between consumer and producer prices: frequency of price changes

	Processed food		*Non-food non-energy consumer goods*		*All items (total sample)*	
	Consumer prices	Producer prices	Consumer prices	Producer prices	Consumer prices	Producer prices
Germany						
Frequency of price changes	0.10	0.26	0.07	0.15	0.11	0.22
France						
Frequency of price changes	0.18	0.32	0.16	0.11	0.19	0.25
Italy (1)						
Frequency of price changes	0.09	0.27	0.06	0.09	0.11	0.15
Spain						
Frequency of price changes	0.18	0.24	0.07	0.10	0.15	0.21
Belgium						
Frequency of price changes	0.14	0.2	0.07	0.12	0.14	0.24
Portugal						
Frequency of price changes	0.25	0.21	0.14	0.09	0.21	0.23
Euro area (2)						
Frequency of price changes	0.13	0.27	0.09	0.12	0.14	0.21

(1) Energy prices are excluded. - (2) Euro area figures are computed as the average of the national results, weighted with country weights available for the considered sub-indices. For the PPI, country weights for non-durable consumer goods have been used as a proxy for "processed food" and weights for "durables consumer goods" for non-food non-energy consumer goods. Note that the figures for the Euro area can be different from those reported in Dhyne et al. (2006) for the CPI due to the different countries considered.

As far as asymmetries in price movements are concerned, for all countries increases tend to be more frequent than decreases (Table 14), for both producer and consumer prices, though the differences are not so large for all the sub-components and are in line with results based on the overall basket.

Table 14 – Comparison between consumer and producer prices: asymmetries in the frequency of price changes

	Processed food		*Non-food non-energy consumer goods*		*All items (total sample)*	
	Consumer prices	Producer prices	Consumer prices	Producer prices	Consumer prices	Producer prices
Germany						
Frequency of price increases	0.05	0.14	0.04	0.09	0.06	0.12
Frequency of price decreases	0.05	0.12	0.03	0.07	0.05	0.1
France (1)						
Frequency of price increases	0.1	0.17	0.06	0.07	0.1	0.14
Frequency of price decreases	0.07	0.14	0.05	0.04	0.06	0.11
Italy (2)						
Frequency of price increases	0.07	0.13	0.05	0.07	0.07	0.08
Frequency of price decreases	0.04	0.13	0.03	0.04	0.04	0.07
Spain						
Frequency of price increases	0.1	0.13	0.05	0.07	0.09	0.12
Frequency of price decreases	0.07	0.1	0.02	0.03	0.06	0.09
Belgium						
Frequency of price increases	0.08	0.11	0.04	0.07	0.08	0.13
Frequency of price decreases	0.05	0.09	0.03	0.05	0.06	0.11
Portugal						
Frequency of price increases	0.14	0.12	0.08	0.06	0.13	0.14
Frequency of price decreases	0.11	0.09	0.06	0.03	0.08	0.10
Euro area (3)						
Frequency of price increases	0.08	0.14	0.05	0.08	0.08	0.12
Frequency of price decreases	0.06	0.12	0.03	0.05	0.05	0.09

(1) For France the frequency of consumer price increases and consumer price decreases sum up to the frequency of consumer price change minus the frequency of product replacement. (2) Euro area figures are computed as the average of the national results, weighted with country weights available for the considered sub-indices. For the PPI, country weights for non.-durable consumer goods have been used as a proxy for "processed food" and weights for "durables consumer goods" for non-food non-energy consumer goods. Note that the figures for the Euro area can be different from those reported in Dhyne et al. (2006) for the CPI due to the different countries considered.. (3) Energy prices are excluded.

More substantial differences between PPI and CPI hold for the amount of the actual percentage change (Table 15). In general, price changes, both upwards and downwards, are larger for consumer prices than for producer prices. For the euro area as a whole, the size of consumer price changes for processed food amounts to around 8% (both upwards and downwards) compared to around 4% for the corresponding producer price changes; for the non-food non-energy component, differences are even more pronounced, above 10% and around 4% (both upwards and downwards), respectively for consumer and producer price changes. It is also worth remarking that while producer price changes of both processed food and non-food non-energy goods are quite similar in all countries for both increases and decreases, lying in a range between -5% and 6%, for consumer prices euro area aggregates mask a substantial heterogeneity in results both across countries and components. In particular, in France and Germany non-food non-energy consumer goods exhibit a

pronounced asymmetry, resulting in larger decreases in Germany (-14.2% compared to 9.6%) and larger increases in France (16.6% compared to -13.8%).

Table 15 – Comparison between consumer and producer prices: percentage price changes

	Processed food		*Non-food non-energy consumer goods*		*Total sample*	
	Consumer prices	Producer prices	Consumer prices	Producer prices	Consumer prices	Producer prices
Germany						
Average price increase	10.3	3.5	9.6	2.9	8.7	3.4
Average price decrease	-9.8	-3.1	-14.2	-3.5	-11.1	-3.1
France						
Average price increase	6.9	3.7	16.6	4.0	10.8	4.1
Average price decrease	-7.4	-3.3	-13.8	-4.3	-10.0	-3.9
Italy (1)						
Average price increase	7.0	4.4	7.0	3.7	7.5	4.2
Average price decrease	-6.0	-4.5	-7.0	-3.5	-8.4	-4.2
Spain						
Average price increase	7.0	5.9	6.1	4.5	8.2	4.9
Average price decrease	-8.2	-5.3	-8.6	-4.4	-10.3	-4.7
Belgium						
Average price increase	7.0	5.0	7.0	4.0	8.0	6.0
Average price decrease	-8.0	-5.0	-7.0	-4.0	-8.0	-6.0
Portugal						
Average price increase	6.6	6.8	11	4.9	10.1	6.7
Average price decrease	-6.9	-7.5	-13.6	-7.4	-11	-7.7
Euro area (2)						
Average price increase	8.1	4.2	10.1	3.6	8.9	4.1
Average price decrease	-8.0	-3.9	-11.3	-3.8	-10.0	-4.0

(1) Energy prices are excluded. - (2) Euro area figures are computed as the average of the national results, weighted with country weights available for the considered sub-indices. For the PPI, country weights for non.-durable consumer goods have been used as a proxy for "processed food" and weights for "durables consumer goods" for non-food non-energy consumer goods. Note that the figures for the Euro area can be different from those reported in Dhyne et al. (2006) for the CPI due to the different countries considered.

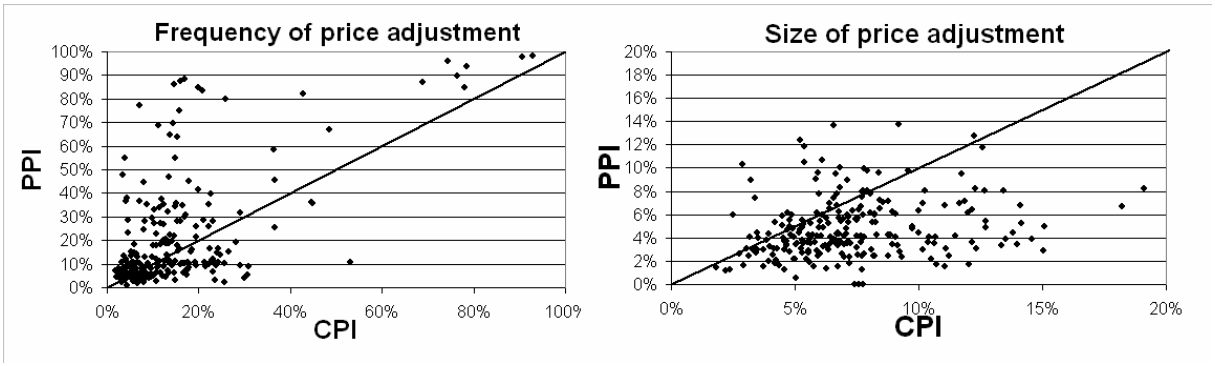
(iii) Comparison of individual items in CPI and PPI

So far the comparison has been carried out with reference to sub-indices. Actually, this analysis can also be conducted by matching individual products that are both represented in the consumer and producer price index. However, such matching is complicated by the fact that CPI items are classified according to the COICOP classification while for the PPI items this is the PRODCOM classification. There are no direct correspondence tables available so that finding matching products is more or less a manual exercise (for the exact way the pairs were selected in each country we refer to Appendix D).

All six participating countries carried out this type of exercise at the national level. In Figure 4 we pool the matched observations for all countries. We have 240 pairs of products

that are both present in the CPI and in the PPI. We use those 240 paired observations on frequency and size of price adjustment to perform a Wilcoxon signed-rank test to check if the frequency and size of price adjustment is significantly different for the PPI than for the CPI. The results of the test confirm those previously reported and based on aggregate comparable indices that producer prices tend to change more often than consumer prices (significance at the 1% level), and the average price change is smaller for producer prices than for consumer prices (significance at the 1% level). The results for the pooled data are also found separately for Belgium, France, Germany, Italy and Spain, although not for Portugal. The same conclusions remain valid if we look at price increases or decreases separately.

Figure 4: Frequency and size of price changes PPI versus CPI (1)



(1) The 240 Euro area CPI/PPI comparison points result from pooling pairs across six countries (Belgium (82), Germany (14), Spain (16), France (52), Italy (14), Portugal (62)).

The bottom line is that the three different levels of comparison suggest the same result: producer prices are more flexible than consumer prices and the size of their changes is smaller than for consumer prices. This result remains valid if comparable items are considered (food and non-food non-energy goods). These results are important for calibrating general equilibrium models with an input-output structure where intermediate goods are used in production like for instance Basu (1995) or Bergin and Feenstra (2000). These models predict a higher rigidity for final goods than for intermediate goods. As Gordon (1990) suggests, this is partly due to the law of large numbers that cancels out idiosyncratic shocks for final goods, incorporating large numbers of different purchased materials. However, this cannot explain why the size of price changes is higher for consumer prices than for producer prices.

6. CONCLUSIONS

In this paper we brought together and presented new findings on the frequency of producer price changes in the euro area. The stylised facts that can be derived for producer prices resemble those for consumer prices. The defining characteristics of producer price changes and consumer price changes are quite similar. Heterogeneity across products, infrequency of price changes in general, absence of downward rigidity, and magnitudes of changes that are a multiple larger than inflation have been found here and are found by Dhyne et al. (2006) as well.

The analysis of consumer and producer price with official data used to construct CPI or PPI has limitations. The reasons behind the price changes are not observed. Neither can the price changes be linked to variables at the establishment level. Explaining those changes can therefore only be based on more aggregate information. Also, questions like "how long do prices remain constant for a given customer" remain unanswered as only prices are observed not the customers.

A central finding is the higher flexibility of prices at the PPI versus the CPI level. Although, comparisons are difficult due to the fact that identical goods cannot be observed at both levels, the analysis indicates that retail level seems to add an additional level of stickiness to prices above the producer level. This finding is likely important for the modelling of sticky prices in macro models.

The evidence in this paper also begs further questions that we have to leave unanswered at this stage. For instance, what is the relative role of the different factors on causing firms to change prices? Does this role change over time? Further research using the large datasets will be an ongoing business for many years to come.

APPENDIX A

NACE 3-digit industries in 6 Groups

I. 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

II. 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.

III. 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

IV. 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
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

V. 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

VI. 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

Appendix B

Calculation of the frequency of price changes

Most of the analysis in this paper uses the *frequency of price changes*, defined as the proportion of prices that change in the transition between period *t-1* and *t* among those observed in both periods. For each country the frequency is first calculated at the product level, i.e. this is for the lowest level of aggregation possible. Frequencies are then calculated for group of products by given each product equal weight. Frequencies for higher levels of aggregation are calculated by taking weighted averages of frequencies of lower levels of aggregation, where the weights are the official weights of the PPI index.

Hence, for the statistics on the frequency of price changes in this paper the following formulas have been used for all countries. We define the following binary variables for a price p{ijt} of a product j sold by establishment i at month t. Let, OBS{ijt}=1 if p{ijt} and p{ijt-1} are observed and OBS{ijt}=0 otherwise. Let CHANGE{ijt}=1 if $p\{ijt\} \neq p\{ijt\text{-}1\}$ (and both are observed) and 0 otherwise. Let T be the period of investigation and J the number of establishments.

The frequency of price changes for product i is then $FREQ(i) = \dfrac{\sum_{t}^{T}\sum_{j}^{J} CHANGE\{ijt\}}{\sum_{t}^{T}\sum_{j}^{J} \mathrm{OBS}\{ijt\}}$

If N products belong to a group of products (e.g. industry NACE 4 digit) and there are no PPI weights available for the products within the group. Each product gets the same weight 1/N and the frequency of price changes for that group is calculated as the simple average of the frequencies of the products belonging to that group.

The frequency of price changes within a category of products is:

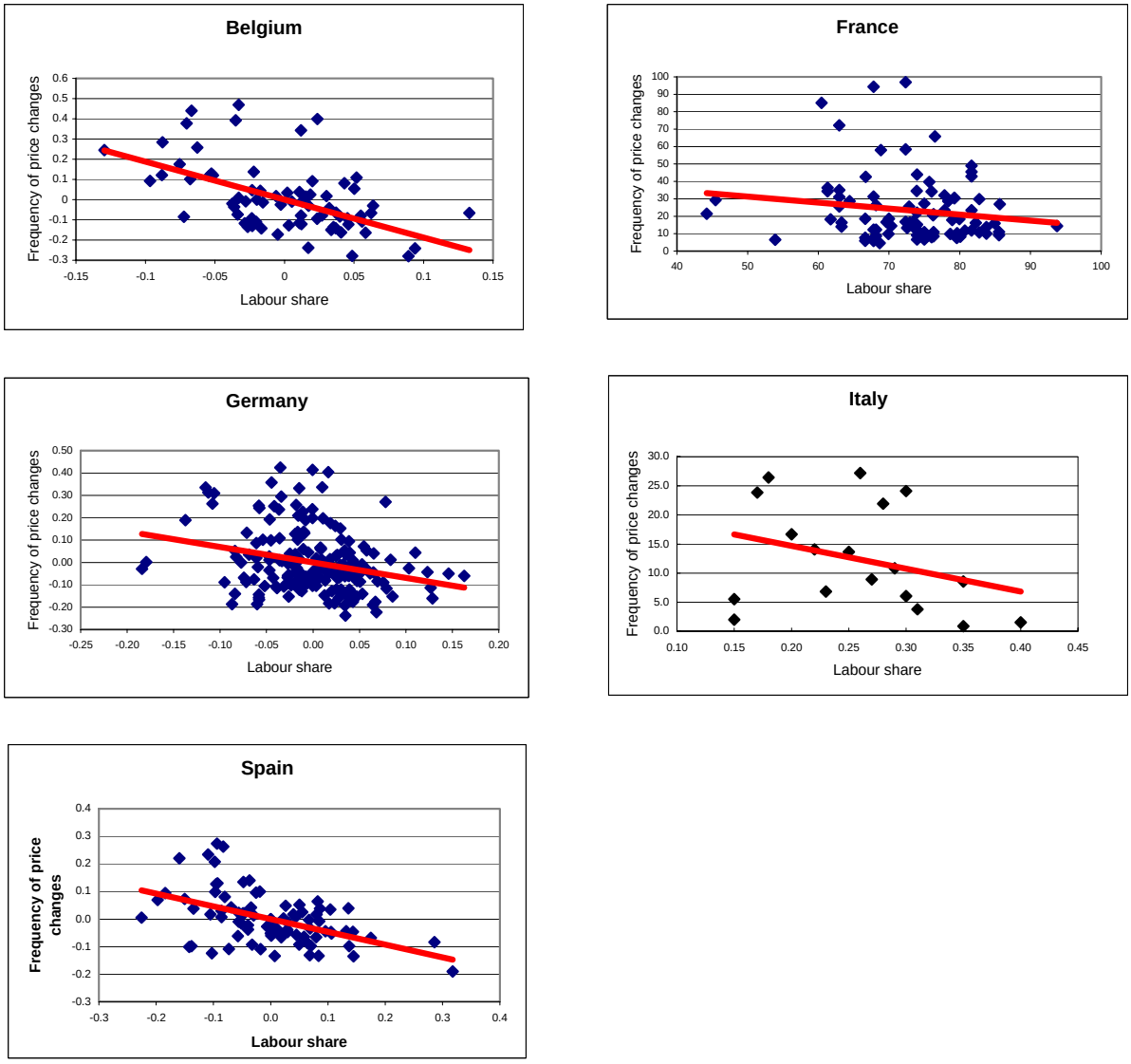
$$FREQ(group) = \sum_{i}^{N} \frac{1}{N} \frac{\sum_{t}^{T}\sum_{j}^{J} CHANGE\{ijt\}}{\sum_{t}^{T}\sum_{j}^{J} \mathrm{OBS}\{ijt\}}$$

The frequency of higher levels is calculated by using weighted averages.

$$FREQ(industry) = \sum_{g}^{G} w(g) \sum_{i}^{N} \frac{1}{N} \frac{\sum_{t}^{T}\sum_{j}^{J} CHANGE\{ijt\}}{\sum_{t}^{T}\sum_{j}^{J} \mathrm{OBS}\{ijt\}}$$

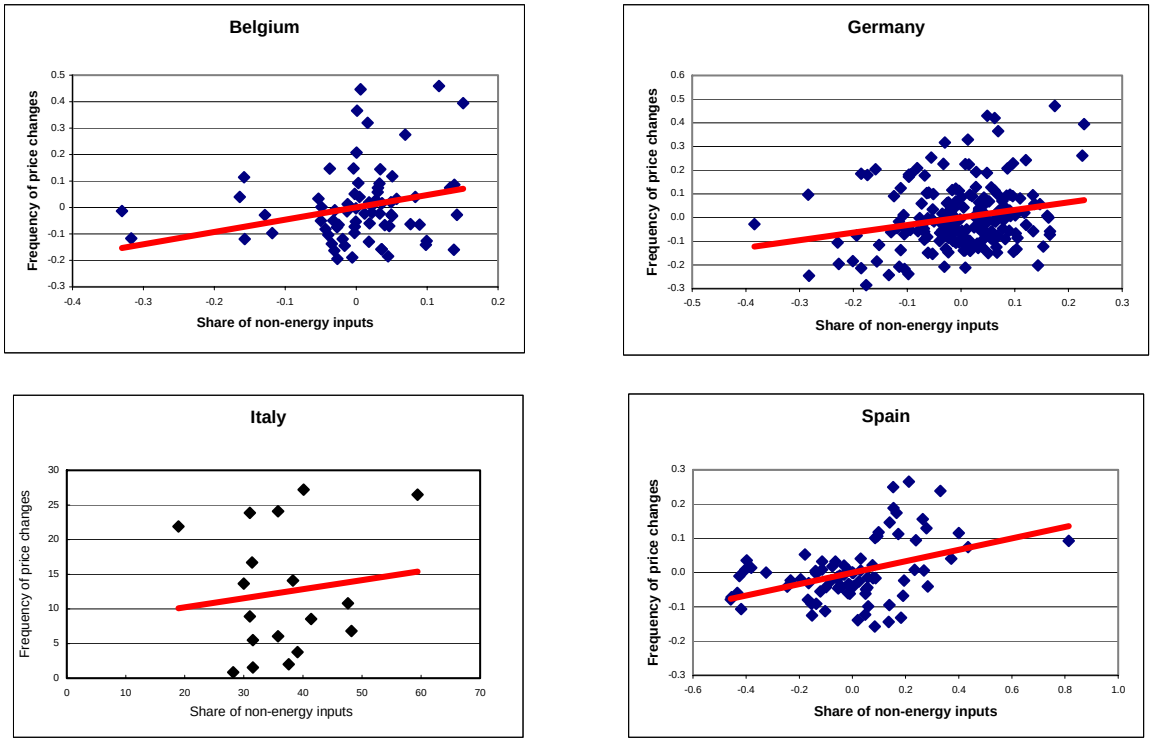
APPENDIX C

Figure C.1 - Frequency of price changes versus the labour share



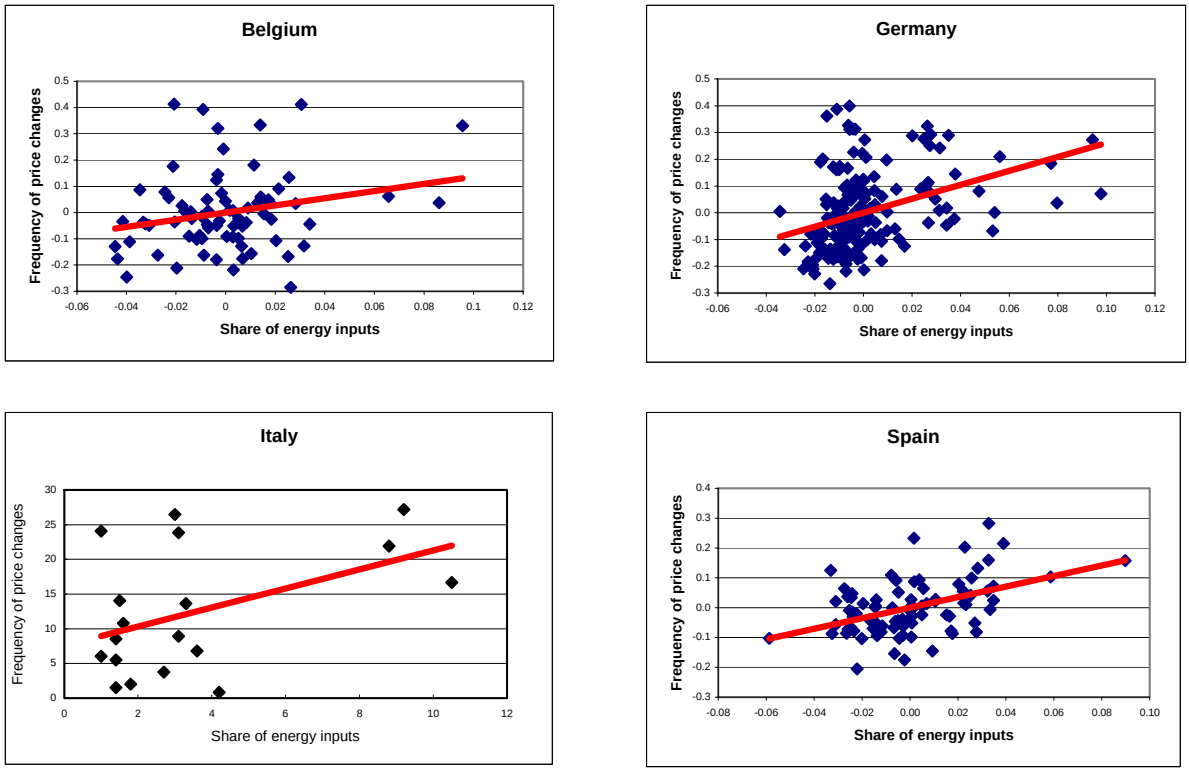
Notes: For Belgium, Germany and Spain figures of frequency and labour share are adjusted for other determinants of the frequency of price changes (see Cornille and Dossche, 2006, Stahl, 2006, and Álvarez et al., 2005).

Figure C.2 - Frequency of price changes versus the share of non-energy inputs



Notes: For Belgium, Germany and Spain figures of frequency and labour share are adjusted for other determinants of the frequency of price changes (see Cornille and Dossche, 2006, Stahl, 2006, and Álvarez et al., 2005).

Figure C.3 - Frequency of price changes versus the share of energy inputs



Notes: For Belgium, Germany and Spain figures of frequency and labour share are adjusted for other determinants of the frequency of price changes (see Cornille and Dossche, 2006, and Stahl, 2006, and Álvarez et al., 2005).

Appendix D

In Table D1 we present, for each country, the list of CPI items, for which a comparable item was found in the PPI. As an example, we present a typical matching of CPI items and PPI items for France.

Table D1 – Individual items considered in the national comparison between PPI and CPI

Belgium (a):chips potatoes frozen, PU soft mattress, peas (tinned),slatted base, low-fat white cheese, Eurosuper (RON 95),ice cream, diesel for cars, corn oil, gasoline (+ 2000 litres), coffee beans or ground coffee, LPG (fuel for cars), Spaghetti, cod fillet (frozen), smoked salmon, Beef meat ,four fruits jam, Sausages , dairy butter, Tinned fish ,Whipped cream, Frozen vegetables ,baking flour, Tinned fruits, rice in kitchen bags, Margarine , whisky, Dairy products ,Gin (minimum 32 degrees), Breads, Liqueur (i), Sweet biscuits,Vermouth (l), Other bakery products, lager, Sauces, tobacco (50 g), Mineral waters, men socks, Cigarettes, pullover (ladies), Bed linen, Raincoat, minimum 30% wool, Toilet linen and kitchen linen, underwear size 51, Fabric for curtains, Lycra tights, pullover (men), underwired bra, Leather clothes , panties mini/midi-medium, Women's or girls' suits and ensembles, men shoes, Women's town footwear, Toiletpaper, Washing preparations and cleaning preparations, tampon, Prepared unrecorded media for sound recording or similar recording, diapers, Printers, loose sheet notebook, Fax machine, acrylate painting, cheese, cement, fruit juice, electric radiator, Porc, natural gas convector, Tinned vegetables, dry battery, Chocolate, fluorescent light, Lemonade, halogen desklamp, Cosmetics, kitchen element 200x50, Crockery and Tableware, modern bedroom furniture, Lamp/bulb

Germany: Milk, Sugar, frozen Spinach, Mineral water, Bottled beer Coffee ,Toothpaste, Electricity Gas, Regular fuel, Heating oil, Steel radial tyre

Italy: Chicken, Milk, Sugar; Frozen peas , Mineral water; Coffee; Beer ,T-shirts, Sport footwear, Soap, Manufacture of luggage, Tapes, Foot Balls, Leathers for shoes

Portugal (b): Bread and cereals (6), Meat (5), Fish and seafood (4), Milk, cheese and eggs (4), Oils and fats(4), Vegetables (2), Sugar, jam, honey, chocolate and confectionery (4), Food products n.e.c. (1), Coffee, tea and Cocoa (1), Mineral waters, soft drinks, fruit and vegetable juices (3), Wine (1), Beer (1), Tobacco (1), Clothing materials (1),Garments (3),Other articles of clothing and clothing accessories (1), Furniture and furnishings (1), Carpets and other floor coverings (1), Household textiles (1), Major household appliances (3), Glassware, tableware and household utensils (3), Major tools and equipment for the house and garden (1), Non-durable household goods (2),Pharmaceutical products (2); Motor cycles (1), Bicycles (1), Fuels and lubricants for personal transport equipment (1), Games, toys and small musical instruments (1), Stationery and drawing materials (1), Other appliances, articles and products for personal care (1), Jewellery, clocks and watches (2), Other personal effects (1)

Spain(c): Meat and meat products, Vegetable and animal oils and fats, Dairy products, Other food products, Beverages, Made-up textile articles except apparel, Footwear, Outwear, Pharmaceuticals, medicinal chemicals and botanical products, Soap and detergents, Domestic appliances; Television and radio receivers, sound and video recording; Photographic equipment, Furniture, Games and toys, Jewellery and imitation jewellery

France	
CPI	PPI
Pastry - cook products	Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes
Cereals	Manufacture of grain mill products
Meat of poultry	Production and preserving of poultry meat
Other preserved or processed meat and meat-based preparations	Production of meat and poultry meat products
Preserved, frozen, dried or smoked seafood and seafood-based preparations	Processing and preserving of fish and fish products
Edible oils and margarines	Manufacture of refined oils and fats + Manufacture of margarine and similar edible fats
Frozen, dried fruits or "appertized" fruits	Processing and preserving of fruit and vegetables n.e.c.
Frozen, dried or preserved vegetables and other vegetable-based preparations	Processing and preserving of potatoes + Processing and preserving of fruit and vegetables n.e.c.
Edible ices, ice creams and sorbets	Manufacture of ice cream
Condiments and sauces	Manufacture of condiments and seasonings
Processed baby food and dietary preparations	Manufacture of homogenized food preparations and dietetic food
Other food products n.e.c.	Manufacture of other food products n.e.c.
Mineral waters and spring waters	Production of mineral waters and soft drinks
Sodas, juices and syrops	Manufacture of fruit and vegetable juice +Production of mineral waters and soft drinks
Aperitifs	Manufacture of other non-distilled fermented beverages
Brandy and liqueurs	Manufacture of distilled potable alcoholic beverages
Beers	Manufacture of beer
Clothing materials	Textile weaving
Other articles of clothing and clothes accessories	Manufacture of other wearing apparel and accessories n.e.c.
Water supply	Collection, purification and distribution of water
Kitchen and bathroom furnitures	Manufacture of other kitchen furniture
Armchairs and sofas	Manufacture of chairs and seats
Carpets and other floor coverings	Manufacture of carpets and rugs
Bedlinen and bedding	Manufacture of made-up textile articles, except apparel + Manufacture of mattresses
Other household textiles	Manufacture of made-up textile articles, except apparel
Other major household appliances	Manufacture of non-electric domestic appliances
Household articles of porcelain or earthenware and glassware	Manufacture of hollow glass + Manufacture of ceramic household and ornamental articles
Tools and other equipments for house and garden	Manufacture of tools
Parapharmaceutical products	Manufacture of pharmaceutical preparations
Motor cycles and bicycles	Manufacture of motorcycles + Manufacture of bicycles
Photographic and cinematographic equipment and optical instruments	Manufacture of optical instruments and photographic equipment
Games, toys hobbies	Manufacture of games and toys
Equipments for sport, camping and open-air recreation	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers + Manufacture of sports goods
Seedling and seeds	Manufacture of fertilizers and nitrogen compounds
Other paper-based articles	Manufacture of paper stationery
Perfumes and beauty products	Manufacture of perfumes and toilet preparations
Jewelry, clocks and watches	Manufacture of jewellery and related articles n.e.c
Leather working and travel goods	Manufacture of luggage, handbags and the like, saddlery and harness
Bread + Pastry products	Manufacture of bread; manufacture of fresh pastry goods and cakes
Meat of beef animals+ Meat of veal animals + Meat of lamb and horse + Meat of pork and cooked pork meats	Production and preserving of meat
Milks and fresh creams + Yoghurts and milk-based desserts + Cheeses + Butters	Operation of dairies and cheese making
Sugar-based products + Chocolate-based products	Manufacture of cocoa; chocolate and sugar confectionery
Coffees + Teas and infusions	Processing of tea and coffee
Wines + Champagne, other sparkling wines and ciders	Manufacture of wines
Garments for men + women + children	Manufacture of other outerwear
Underwear for men + women + children	Manufacture of underwear
Town footwear + Other footwear including repair	Manufacture of footwear
Materials for the maintenance and repair of the dwelling + Domestic soaps and cleaning products for routine household maintenance	Manufacture of soap and detergents, cleaning and polishing preparations
Bedroom furnitures +Living room furnitures	Manufacture of other furniture

Equipments for the reception, recording and reproduction of pictures and sound + Recording media for pictures and sound	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods

(a) For the majority of products one can find relatively close correspondence. But in other cases some aggregation of products is required: Three situations occurred: i) different PPI products match one CPI product. ii) different CPI products match one PPI product. iii) different CPI products match different PPI products. (b) The matching of consumer goods was made by matching Producer goods at the NACE12 digits level into comparable Consumer goods at the 4 digits level, In this list, we are presenting only the list of Consumer goods at the 3 digits level that are represented in our matched samples. The numbers in parenthesis that appear in front of each good correspond to the number of Consumer goods at the 4 digits level included in each one of the categories. Overall, in the matched samples, there exist 65 different consumer goods categories represented. (c) The pairs of comparable items have been matched at the most detailed available level: the 4-digit classification of the CPI items (subclass) and the 3-digit NACE codes for the PPI items. See Álvarez et al. (2005) for additional details.

References

Álvarez, L.J., Burriel P. and I. Hernando, 2005: "Price Setting Behaviour in Spain. Evidence from Micro PPI Data", *ECB Working paper* 522.

Álvarez L.J. and I. Hernando, 2005: "The price setting behaviour of Spanish firms: evidence from survey data", *ECB Working paper* 538.

Álvarez, L.J., and I. Hernando, 2006: "Competition and price adjustment in the Euro Area", forthcoming in Fabiani S., Loupias C., Martins F. and R. Sabbatini (eds.), *Pricing Decisions in the Euro Area: How Firms Set Prices and Why*, Oxford University Press.

Aucremanne L. and E. Dhyne, 2005: "Time-Dependent versus State-Dependent Pricing: A Panel Data Approach to the Determinants of Belgian Consumer Price Changes", ECB Working Paper 462.

Aucremanne, L. and M. Druant , 2005: "Price-setting behaviour in Belgium: what can be learned from an ad hoc survey?", *ECB Working paper* 448.

Basu S., 1995: "Intermediate Goods and Business Cycles: Implications for Productivity and welfare", *American Economic Review*, 85: 512-531

Basu S., 1997: "Why are so many goods priced to end in nine? And why this practice hurts the producers?", *Economics Letters*, 54: 41-44

Bergen M., Ritson M, Dutta S., Levy D. and M. Zbaracki , 2003: "Shattering the myth of costless price changes, *European Management Journal,* 21(6): 663-669.

Bergin P. and R. Feenstra, 2000: Staggered Price Setting, Translog Preferences and Endogenous Persistence, *Journal of Monetary Economics*, 45: 657-680.

Bils, M. and P. Klenow, 2004: "Some Evidence on the Importance of Sticky Prices", *Journal of Political Economy* 112(5): 947-985

Blanchard, O.J., 1982: "Price asynchronisation and price level inertia", *NBER Working paper* No. 900.

Blinder, A.S., Elie R. D., Canetti, D.E. Lebow and J.B. Rudd, 1998: *Asking about prices: A new approach to understand price stickiness*. New York: Russel Sage Foundation.

Bresnahan, T.F., 1989: "Empirical studies of industries with market power". In Schmalensee R. and R. Willig (eds.), *Handbook of Industrial Economics*. Amsterdam: North-Holland.

Caballero, R. and E. Engel, 1993: "Microeconomic rigidities and aggregate price dynamics", *European Economic Review*, 37 (4): 697-711.

Carlton, D., 1986: "The rigidity of prices", *American Economic Review*, 76: 637-658.

Carlton, D., 1989: "The theory and facts about how markets clear". In Schmalensee R. and R. Willig (eds.), *Handbook of Industrial Economics*. Amsterdam: North-Holland.

Caucutt, E., Ghosh, M. and C. Kelton, 1999: "Durability versus concentration as an explanation for price inflexibility", *Review of Industrial Organization*, 14: 27-50.

Cecchetti, S., 1986: "The frequency of price adjustment: a study of the newsstand prices of magazines", *Journal of Econometrics*, 31: 255-274.

Cornille, D. and M. Dossche, 2006: "The patterns and determinants of price setting in the Belgian industry", *ECB Working Paper* No 618.

Dexter, A., Levi M. and B. Nault 2002: "Sticky Prices: The Impact of Regulation", *Journal of Monetary Economics*, 49(4): 797-821.

Dhyne, E., Álvarez L.J., Le Bihan H., Veronese G., Dias D., Hoffmann J., Jonker N., Lünnemann P., Rumler F. , and Vilmunen J., 2006: "Price Changes in the Euro Area and the United States: Some Stylised Facts from Individual Consumer Price Data". *Journal of Economic Perspectives* 20 (2): 171-192.

Dias, M., Dias D. and P. Neves, 2004: "Stylised features of price setting behaviour in Portugal: 1992-2001", *ECB Working Paper* No. 332.

Dotsey, M., King, R. and A. Wolman, 1999: "State-dependent pricing and the general equilibrium dynamics of money and output", *Quarterly Journal of Economics*, 114: 655-690.

Eurostat, 2002: *Methodology of short-term business statistics: Interpretation and guidelines.*

Fabiani S., Gattulli A. and R. Sabbatini, 2004: "The pricing behaviour of Italian firms: new survey evidence on price stickiness", *ECB Working Paper* No. 333.

Fabiani, S., Druant D., Hernando I., Kwapil C., Landau B., Loupias C., Martins F., Mathä T., Sabbatini R. and A. Stokman, 2006: "What firms' surveys tell us about price-setting in the euro area", *International Journal of Central Banking,* 2 (3): 3-47.

Fougère, D., Sevestre, P. and H. Le Bihan, 2005: "Heterogeneity in consumer price stickiness: a microeconometric investigation", ECB Working Paper No 536.

Gagnon, E. E., 2005: "Price setting and inflation: evidence from the Tequila crisis", Northwestern University, mimeo.

Gautier, E. 2006: "The behaviour of producer prices: some evidence from the French PPI data", *ECB Working Paper*, No 699.

Geroski, P., 1992: "Price dynamics in UK manufacturing: a microeconomic view", *Economica* 59: 403-419.

Ginsburgh, V. and P. Michel, 1988: "Adjustment costs, concentration, and price behaviour", *Journal of Industrial Economics* 36: 477-481.

Gordon R., 1990, "What is New-Keynesian Economics?", *Journal of Economic Literature*, 28: 1115-1171.

Hall, S., Walsh M. and A. Yates, 2000: How Do UK Companies Set Prices", *Oxford Economic Papers* 52: 425-446.

Kashyap, A., 1995: "Sticky prices: new evidence from retail catalogs", *Quarterly Journal of Economics*, 110 (1): 245-274.

Lünnemann, P. and T. Mathä , 2005: "Regulated and services' prices and inflation persistence", *ECB Working Paper* No. 466.

Martin, C., 1993: "Price adjustment and market structure", *Economics Letters* 41: 139-143.

Sabbatini R., Fabiani S., Gatulli A. and G. Veronese, 2005: "Producer price behaviour in Italy: Evidence from micro PPI data", Banca d'Italia, *mimeo*.

Sheshinski, E. S. and Y. Weiss, 1977: "Inflation and Costs of Price Adjustment", *Review of Economic Studies* 44: 287-303.

Stahl, H., 2005a: "Time-dependent or state-dependent price setting? Micro-evidence from German metal-working industries", *ECB Working Paper* No. 534

Stahl H., 2005b: "Price setting in German manufacturing: new evidence from new survey data", *ECB Working Paper* No. 561.

Stahl, H., 2006: "Producer price adjustment at the micro level: evidence from individual price records underlying the German PPI", Deutsche Bundesbank, *mimeo*.

Stigler, G. and J. Kindahl, 1970: The Behavior of Industrial Prices, NBER General Series, No. 90, New York: Columbia University Press.

Stiglitz, J.E., 1984: "Price rigidities and market structure", *American Economic Review* 74: 350-355.

Yun T., 1996: "Nominal price rigidity, money supply endogeneity, and business cycles", *Journal of Monetary Economics* 37*:* 345-370.

Zbaracki M., Ritson M, Levy D., Dutta S. and M. Bergen, 2004: "Managerial and customer costs of price adjustment: direct evidence from industrial markets", *Review of Economics and Statistics,* 86(2): 514-533.

European Central Bank Working Paper Series

For a complete list of Working Papers published by the ECB, please visit the ECB's website (http://www.ecb.int)

691 "The yield curve as a predictor and emerging economies" by A. Mehl, November 2006.

692 "Bayesian inference in cointegrated VAR models: with applications to the demand for euro area M3" by A. Warne, November 2006.

693 "Evaluating China's integration in world trade with a gravity model based benchmark" by M. Bussière and B. Schnatz, November 2006.

694 "Optimal currency shares in international reserves: the impact of the euro and the prospects for the dollar" by E. Papaioannou, R. Portes and G. Siourounis, November 2006.

695 "Geography or skills: What explains Fed watchers' forecast accuracy of US monetary policy?" by H. Berger, M. Ehrmann and M. Fratzscher, November 2006.

696 "What is global excess liquidity, and does it matter?" by R. Rüffer and L. Stracca, November 2006.

697 "How wages change: micro evidence from the International Wage Flexibility Project" by W. T. Dickens, L. Götte, E. L. Groshen, S. Holden, J. Messina, M. E. Schweitzer, J. Turunen, and M. E. Ward, November 2006.

698 "Optimal monetary policy rules with labor market frictions" by E. Faia, November 2006.

699 "The behaviour of producer prices: some evidence from the French PPI micro data" by E. Gautier, December 2006.

700 "Forecasting using a large number of predictors: Is Bayesian regression a valid alternative to principal components?" by C. De Mol, D. Giannone and L. Reichlin, December 2006.

701 "Is there a single frontier in a single European banking market?" by J. W. B. Bos and H. Schmiedel, December 2006.

702 "Comparing financial systems: a structural analysis" by S. Champonnois, December 2006.

703 "Comovements in volatility in the euro money market" by N. Cassola and C. Morana, December 2006.

704 "Are money and consumption additively separable in the euro area? A non-parametric approach" by B. E. Jones and L. Stracca, December 2006.

705 "What does a technology shock do? A VAR analysis with model-based sign restrictions" by L. Dedola and S. Neri, December 2006.

706 "What drives investors' behaviour in different FX market segments? A VAR-based return decomposition analysis" by O. Castrén, C. Osbat and M. Sydow, December 2006.

707 "Ramsey monetary policy with labour market frictions" by E. Faia, January 2007.

708 "Regional housing market spillovers in the US: lessons from regional divergences in a common monetary policy setting" by I. Vansteenkiste, January 2007.

709 "Quantifying and sustaining welfare gains from monetary commitment" by P. Levine, P. McAdam and J. Pearlman, January 2007.

710 "Pricing of settlement link services and mergers of central securities depositories" by J. Tapking, January 2007.

711 "What "hides" behind sovereign debt ratings?" by A. Afonso, P. Gomes and P. Rother, January 2007.

712 "Opening the black box: structural factor models with large cross-sections" by M. Forni, D. Giannone, M. Lippi and L. Reichlin, January 2007.

713 "Balance of payment crises in emerging markets: How early were the "early" warning signals?" by M. Bussière, January 2007.

714 "The dynamics of bank spreads and financial structure" by R. Gropp, C. Kok Sørensen and J.-D. Lichtenberger, January 2007.

715 "Emerging Asia's growth and integration: How autonomous are business cycles?" by R. Rüffer, M. Sánchez and J.-G. Shen, January 2007.

716 "Adjusting to the euro" by G. Fagan and V. Gaspar, January 2007.

717 "Discretion rather than rules? When is discretionary policy-making better than the timeless perspective?" by S. Sauer, January 2007.

718 "Drift and breaks in labor productivity" by L. Benati, January 2007.

719 "US imbalances: the role of technology and policy" by R. Bems, L. Dedola and F. Smets, January 2007.

720 "Real price wage rigidities in a model with matching frictions" by K. Kuester, February 2007.

721 "Are survey-based inflation expectations in the euro area informative?" by R. Mestre, February 2007.

722 "Shocks and frictions in US business cycles: a Bayesian DSGE approach" by F. Smets and R. Wouters, February 2007.

723 "Asset allocation by penalized least squares" by S. Manganelli, February 2007.

724 "The transmission of emerging market shocks to global equity markets" by L. Cuadro Sáez, M. Fratzscher and C. Thimann, February 2007.

725 "Inflation forecasts, monetary policy and unemployment dynamics: evidence from the US and the euro area" by C. Altavilla and M. Ciccarelli, February 2007.

726 "Using intraday data to gauge financial market responses to Fed and ECB monetary policy decisions" by M. Andersson, February 2007.

727 "Price setting in the euro area: some stylised facts from individual producer price data", by P. Vermeulen, D. Dias, M. Dossche, E. Gautier, I. Hernando, R. Sabbatini and H. Stahl, February 2007.

ISSN 1561081-0