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Asymmetries in the price setting behavior of Firms: evidence from a panel of Italian firms

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Abstract

In this paper, we analyze firms' pricing behavior using a full informative micro dataset that accounts for a large part of Italian firms. In our view, "the black boxes" to examine are the relations between price setting, market structure and spatial disparities. A first goal of the research is to investigate the link between asymmetries in price changes and spatial dependence. Besides, we compare the price dynamics among sectors, namely manufacturing vs. service. It is irrefutable that prices stickiness is linked to good market rigidities. Consequently, these issues have extremely important policy implications; for instance, the Monetary Authority considers the macro price indexes to determine the right policy to stabilize the economy and to improve social welfare. However, the Central Bank does not distinguish the likely aggregation bias source from the cross sector-region-country heterogeneities. On the other hand, the propagation mechanism of an adverse monetary policy impulse, following a cost-push shock, may induce considerable mortality for firms' survival, expressed by the entry/exit balance. Overall, the purpose of this paper is to provide an analysis of survey data that allows us to collect important aspects for Economic Policy analysis, which could not be drawn from analysis with "mesoeconomic" or aggregate data.

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1. Introduction

The economic debate on the asymmetric effects of monetary policy has a long history. Keynes and Pigou debated whether monetary policy would have less effect on output during a rigorous recession than in a growth period. Friedman (1967) compared monetary restriction against positive monetary innovation[1]. Nevertheless, the new micro-founded macroeconomic models (e.g. DSGE) are the background theory commonly followed by policy-makers; however, they do not include in the micro-foundation any asymmetric behavior that empirical studies have found. For instance, an empirical regularity shown by literature denotes that prices are downwardly rigid and upwardly flexible, and that positive monetary innovation is more effective than monetary tightening. Moreover, price variation upwards is more intensive and frequent than downwards. Consequently, the three main macroeconomic building blocks of demand (IS curve for New Keynesian models), supply (e.g. the Phillips curve) and the social loss function might neglect the right way of counteracting inflation or deflation[2].

A lot of empirical evidence in favor of asymmetrical responses of output to monetary shocks are present at macro level[3]. For example, Ball and Mankiw (1994) investigated the implication of asymmetric price adjustments for AD-AS. They provide evidence that in a high inflation regime, prices are more elastic to positive shocks than to negative impulses, and that output is more responsive to negative shocks than to positive innovations. On the other hand, these asymmetries disappear when macro data (inflation) is close to zero. Cukierman and Muscatelli (2008) provided empirical evidence that those asymmetries in the monetary policy regime cause a non-linearity in the Taylor rules for the UK and the US[4]. Moreover, wide literature reviews on time series models have been supplied by Frey and Manera (2006), Clarida and Gertler (1997) and Mishkin and Posen (1997), expressing a similar view for inflation targeters. Other price asymmetry studies have been extensively conducted in the energy supply sectors[5].

In view of the fact that the macroeconomic functions, e.g. supply and inflation persistence, have an important role in the monetary policy effects on welfare, recent empirical research has rejuvenated interest in the idea that output responds asymmetrically to monetary shocks. For instance, according to Buckle and Carlson (1998) the effects of higher inflation on output asymmetries come mainly from cost and demand increases and to a lesser (and statistically insignificant) extent from cost and demand decreases.

On the other hand, from a social point of view, asymmetric policy preference could be favored. For example, it is evident that a positive output-gap is more desirable than a negative output-gap, or alternatively, thinking

[1] More recently Caballero et al. (1992), Sims (1992) and Morgan (1993), among many others.

[2] Barro and Gordon (1983) assume a standard symmetric reaction function for positive and adverse shocks.

[3] Tobin (1972) first introduced the price asymmetric idea, more recently Ball and Mankiw (1994) among many others.

[4] Cukierman and Muscatelli (2008) find that Taylor rules are concave both in the output and inflation gaps during periods of recession. On the contrary, when a central bank wants to build its reputation, during a period of inflation stabilization the policy maker implements a convex reaction function.

[5] Frey et al. (2007) investigated asymmetric price transmission in commodity markets and Galeotti et al. (2003) show asymmetries in the gasoline market through a vector Autoregression model.

that inflation should be preferred to unemployment. For these reasons, the Monetary Authority could be less risk averse if it is not completely politically independent.

Even if microeconomic literature discusses the implication of asymmetric price adjustment, for Italy no study relates the role of asymmetries in firm pricing behavior with panel data information. However, the previous empirical works partly consider the spatial heterogeneity impact of a common monetary policy shock; with the consequence, that monetary policy target may not be optimal because of the disparities among regional areas, in particular for the underdeveloped regions such as the "Mezzogiorno". In this regard, Aoki (2001) analyzes the heterogeneity implication for monetary policy within a two-sector model (a flexible-price and a sticky-price industry), but neglecting the inflation persistence issue. He finds that the optimal monetary rule should target the inflation rate in the sticky-price sector, rather than targeting aggregate inflation.

At the microeconomic level, Fabiani et al. (2005) find that firms' reaction function differs between costs push or demand shocks. In particular, prices change more when costs or demand go up than inflation shocks occur. They show that prices respond to asymmetric sign direction; according these authors, prices are less flexible upwards than downwards in response to demand shocks.

Furthermore, Fabiani et al. (2005), Blinder et al. (1998) and Rotemberg et al. (1997) provide three main reasons for staggered price adjustment: explicit contracts, tacit collusive agreements and time nature of shocks.

In addition, Kwapil et al. (2005) observe that Austrian firms react asymmetrically to cost and demand shocks; they point out that prices are more sticky downwards than upwards in the face of cost shocks, as more firms react more quickly to cost-push shocks than to decreasing cost shocks. On the other hand, in the case of large demand shocks, they find that prices are more sticky upwards than downwards, because more firms react to declining demand than to increasing demand. Moreover, Martins (2005) discovers also some source of asymmetric among labor or capital intensive share, he shows that labor-intensive sectors, in particular for services[6], denote higher degree of price persistence.

From a micro-foundation of price determination, the presence of asymmetries and persistence in the inflation path leads us to investigate the possible causes and consequences via a Micro data analysis for the Italian economy. Our analysis investigates asymmetric adjustment prices, testing whether magnitude differs for price decreases and price increases. Overall, the present paper introduces innovations in various directions. (a) Firstly, it aims to provide new insight, focusing on the main factors (such as firm size, spatial localization, and sector) that follow firm and price dynamics. (b) It seeks to propose new evidence on asymmetric firm price setting responses to monetary policy impulses. (c) Furthermore, as the Central Bank may overlook heterogeneity both at Sectoral and geographical levels, we assume that monetary innovations may cause a very different impact for the backward regions in particular; consequently, we evaluate the significance of regional and Sectoral dummy variables under several econometric specifications.

On the basis of the above insights, we consider that an interesting and original contribution to literature can be supplied through an empirical study that examines some aspects previously neglected by literature.

[6] Martins (2005) finds that service sectors, in general, is associated with lower frequencies of price changes.

Firstly, we investigate the pricing behavior of small firms and we expect to find heterogeneities across sectors, which are themselves determined by disparities across market and cost structure. Then, we expect that price increases occur more often than decreases. In other words, downward rigidities for prices are an expected outcome. Afterwards, we estimate several multinomial models to check whether the sign of price changes depend on the industries, the location, the dimension and the nature of the firm (multinational/versus local and so on). We suppose that another empirical regularity would be founded on the connection between price stickiness and firm dimension, thinking that in the retail product sector slightly higher priced corner shops change prices less frequently than hypermarkets. In essence, the combinatorial structure of these problems raises a different set of issues: in our view, the first question to be addressed is: How does monetary policy affect the price decisions of Italian firms? Moreover, does a spatial dependence exist within pricing dynamics? Furthermore, does an asymmetric price dynamic pattern exist? What are the monetary policy consequences for a heterogeneous price stickiness agent? Is there evidence of these three heterogeneous macro regions? A second and perhaps more important reason why we would expect spatial dependence is that the spatial dimension of economic activity may truly be an important aspect of a firm's behavior-modeling problem.

Our model differentiates from other analyses, thanks to the different nature of the dataset adopted for the econometric specifications. In fact, Ascari and Vaona (2010) apply a time series analysis at a fine level of territorial disaggregation; their analysis does not adopt a longitudinal firm survey dataset. Although, their model found that backward regions have an inflation persistence that is 40% higher than in the Northern regions, the authors do not find evidence of geographical aggregation bias. They justify this conclusion with the structure of the macro inflation index that weights city and region to account for heterogeneity.

Our analysis discerns from the Ascari and Vaona (2010) model, even if it considers the same issue of regional disparities and asymmetric pricing strategy by firms, by applying a different econometric analysis based on more disaggregated data. In fact, the previous empirical analysis does not consider the possible bias caused by territorial aggregation that washes out the spatial heterogeneity in price setters and therefore neglects these important aspects. Thus, our analysis differentiates in terms of methodological approach from previous empirical works, since it is the first to adopt a survey and full informative dataset at single firm level. Secondly, the longitudinal survey allows us to consider the intrinsic diversity across either sectors or geographical areas. At the same time, this study should produce robust findings across several Microeconometric-specifications, in view of the fact that sample bias has been attenuated, thanks to the high quality and very complete database supplied by the Research Department of the Bank of Italy.

The paper is structured as follows. In section 2, we lay out the econometric specification. Section 3 presents the evidence. Finally, Section 4 concludes and presents suggestions for policy-makers.

2. Data

The Italian productive system is an interesting case study for several reasons. Indeed, we have a historic problem of three very different degrees of development. The North of Italy is one of most advanced regions of the world. While, on the contrary, we have the South, where some regions[7] are still in objective 1, even though Italy receives the second largest amount of structural funds (21 million Euros) among objective 1 member states of the European Union. After the first program, only one region escaped from objective 1. Furthermore, Italian industries are still concentrated in the North. Consequently, the backward part of Italy should have a greater degree of inflation persistence in this area, since the underdeveloped areas probably denote imperfectly competitive industries that often do not change when costs or demand change.

As stressed in the introduction, our study conducts the price dynamic through a longitudinal study on Italian firms. It is incontrovertible that the longitudinal surveys are better than time series or cross-section ones because they are able to control the individual heterogeneity (see Hsiao, 2004 for other benefits). Furthermore, panel data allow us to identify and estimate the effect of complex issues of a firm's specific behavior. However, Panel dataset availability is very rare, for multiple reasons, e.g. for time costs, difficulty in collecting data for long time, for privacy reasons and so on. Fortunately, in recent times, a lot of panel data has been created for research proposes, thanks to the Bank of Italy allowing us to conduct inference on *"Business Outlook Survey of Industrial and Service Firms*"; an important and original dataset for Italian firms[8], both as regards its content and its size.

The empirical investigation has been conducted with two main data sets. The first analysis uses the whole panel data[9] with the magnitude of price variations. The second study adopts the price changes in frequency that consists in one-time surveys (cross section data type) collected by the Bank of Italy in 2003.

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[7] According to the EU, Objective 1 areas are geographical areas with a per capita gross domestic product (GDP) lower than 75% of the Community average. The regions are Campania, Apulia, Basilicata, Calabria, Sicily and Sardinia while Molise has transitional support.

[8] The data is very high quality; indeed sample composition is constructed by the Research Department of the Bank of Italy, which collects the data directly to represent the whole Italian productivity system in terms of its composition by firm size, sector and geographical location.

Furthermore, the sample structure is consistent across time within the same firm to be monitored during the sample period. See http://www.bancaditalia.it/statistiche/indcamp/indimpser/boll_stat/sb41_07/en_Suppl_41_07.pdf the Methodological Notes (Appendix A) describe the composition of the sample and the universe, the sampling design, the collection of data and the estimation and weighting procedures. The Research team of the Bank of Italy treated outliers through selective editing techniques (see Lee et al. 1995). They also provide information about response behavior and data quality.

[9] For the full dataset, STATA uses estimation algorithms and takes care of the unbalanced nature of the dataset. In particular, we use WLS model option for the between model, and a GLS.

We consider the data[10] for price dynamics from 1989 to 2008 (covering several complete business cycles: the recessions in 1991, 1993, 2001, 2008 and the expansion in the other sample periods) at annual frequency.

The database contains firm-specific information on the frequency and size of price revisions.

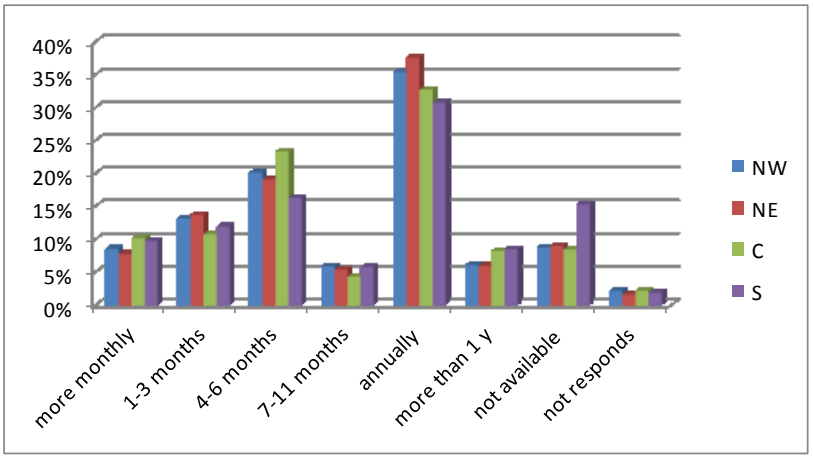
With regard to frequency, in 2003 the firms were asked the following question: "How frequently does your firm typically modify selling prices?" There were possible responses: "Several times a month", "Every month", "Every three months", "Every six months" and "Once a year or less frequently". The survey collected the information on price review strategies by interviewing about 2062 firms, across both service and industry sectors.

In more detail, the dependent variable "PQ2" reflects price variations in Italian industry. Firms are measured by a set of dummy variables: "Sed" captures the heterogeneity across sectors. To capture the regional effects, we insert the regional dummy Areag4, indicating the firms' regional location.

The frequency of price changes gives a measure of nominal rigidities that constitutes an important ingredient in the calibration of standard DSGE models with staggered adjustment mechanisms, commonly adopted for monetary policy analysis.

For the size of price changes in one year, we use the following annual panel provided by the Bank of Italy; a total of 6000 firms were included in the study. In table 1 reported in the appendix, the variables used are described in detail. In more detail, figure 1 shows the number of price reviews across regions:

Figure 1. Price review across macro regions

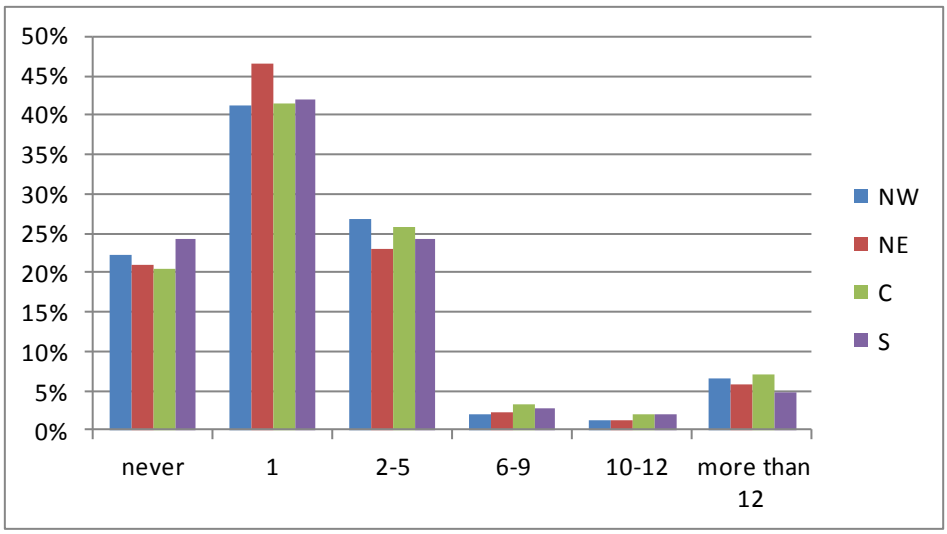


It shows that firms review price on average once a year. Overall, firms in the south change prices less frequently. Moreover, according to the survey, firms review very frequently or rarely their

[10] The sampling design is stratified with a single stage. The sample units were chosen randomly. The weighting process with post-stratification adjustment. The panel survey structuring allows data consistency across time within the same firm to be monitored.

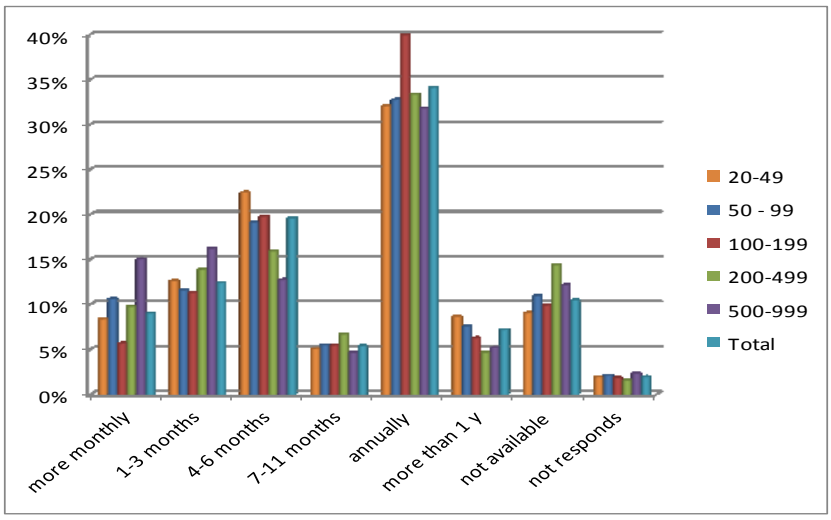
prices. As for the analysis on price review, the evidence on price changes in a year reveals analog results. Indeed, figure 2 displays the number of changes in price setting.

Figure 2. Price changes across regional areas



According to the figure, about 20% of the industries do not move prices for one year. The timing of price adjustments reveals itself to be a significant geographical variability with a difference of about 5% between the North and South. Moreover, figure 3 draws attention to the price pattern and firm dimension. As expected, it shows that price stickiness arises with firms' dimensions.

Figure 3. Frequency of price review in one year across firm dimension (numbers of employees)



The disaggregation by sector reveals a substantially higher dispersion in the frequency of price adjustment across sectors than across regions. Manufacturing, engineering, transport and real estate businesses adjust prices much less often than those in the remaining industries, while transport is the sector with the highest fraction of firms reporting no greater pattern in price revisions.

Figure 4. Number of price changes across sectors

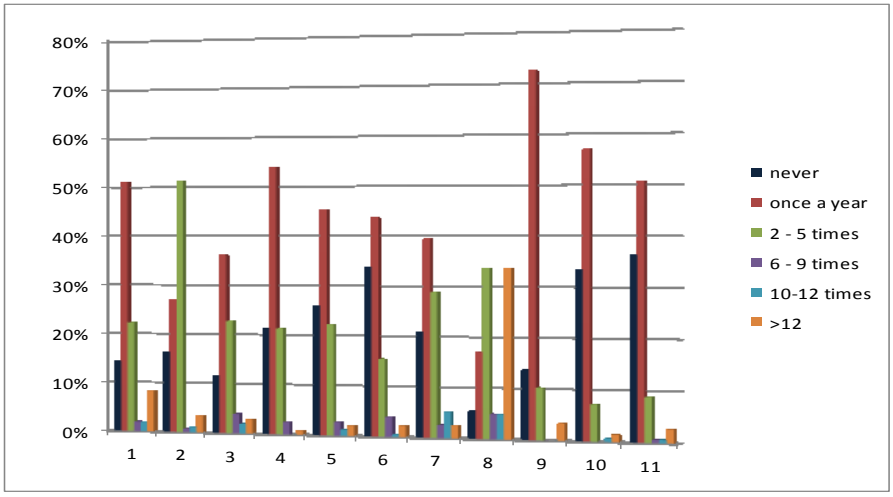


Figure 4 shows that prices set by hotels and restaurants and business service firms tend to remain unchanged on average for just less than one year, whereas those set in trade services seem to be more flexible, with a larger number of price revisions in one year.

Furthermore, the degree of price stickiness varies both within and across markets in the industry. Among the non-financial service sectors, the real estate and transport industries are the stickiest businesses.

2.1 Symmetric variation?

The survey does not directly collect signs of price variation. Therefore, we have estimated the symmetry evidence, by extrapoleting the sign of the price variation from the variable "V 220A", which contains information on the magnitude of price changes.

Figure 5. Asymmetries price changes by regions

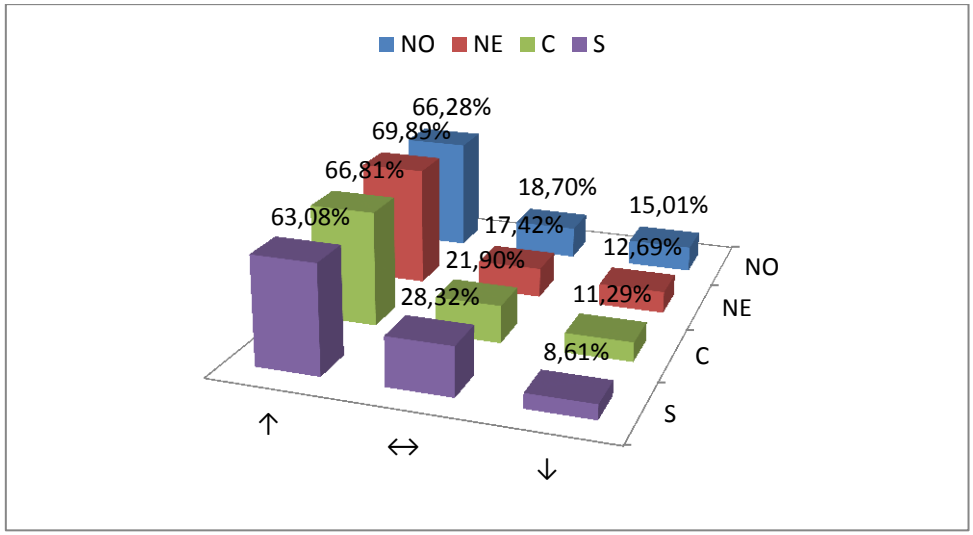
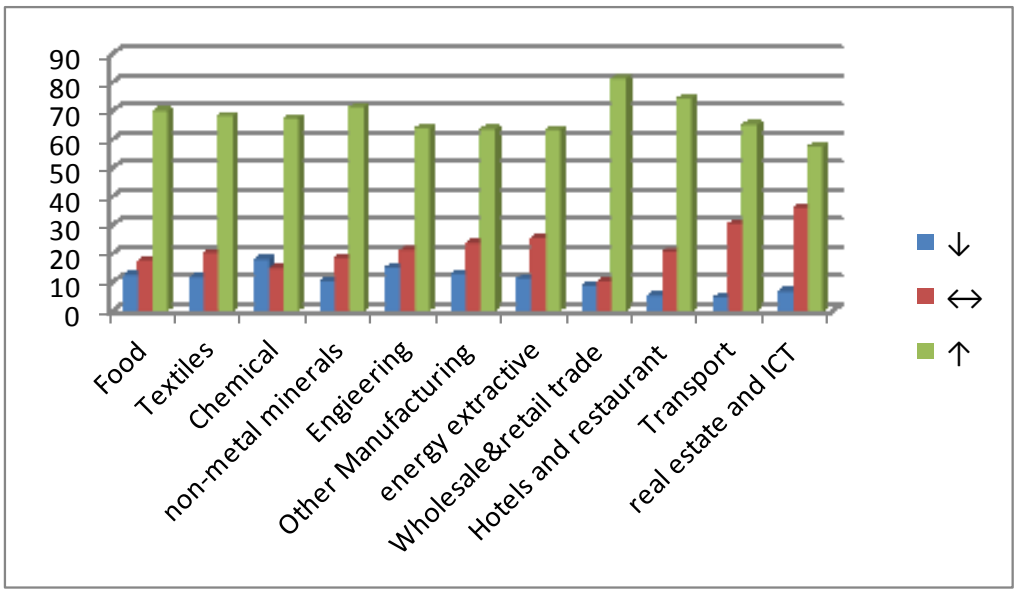


Figure 5 highlights the symmetries among macro-regions. It shows that price cuts are more frequent in the Northwestern regions, where they are more or less twice higher than in the South, and fairly

similar dynamics are present across the center and Northern regions. The Northwestern area has the lowest downward rigidities, as well as being the location with least price stability. This result can be explained by extra strong competitors' prices or an alternative explanation, such as situations of declining demand for firms with a high export share.

Figure 6. Prices variation across sectors



Besides, figure 6 shows that for small books of products there is less asymmetric variation. On average, prices go down for the chemical and engineering sectors. This is not the case for the service sectors, where price reductions are lower than in the manufacturing industries (half of those experienced in manufacturing industries). In particular, the largest difference is displayed by the "wholesale and retail trade" business. These findings are interpretable with downward wage rigidities. Hence, highly labor-intensive sectors probably have more asymmetries in sign variation. On average, price growth is more frequent and smaller in magnitude than negative variation. The results probably denote those prices are the result of supply-side movement and much less due to demand shift. We will expect labor-intensive industries to express higher downward price rigidities, as a typical consequence of the fact that both nominal and real wages are downwardly sticky [11]

3. Econometric approach: Model of pricing dynamics

As stressed in the introduction, in order to assess the numerous aspects of pricing behavior by a single firm in Italy, we conduct an empirical analysis that refers to a panel model that evaluates price stickiness across firms with different characteristics and across economic sectors. The

[11] Wage setting, especially in Italy, is indexed to expected inflation. This rule might be a source of distortions and can advent a vicious circle.

empirical model relates the rate of price variation to a set of explanatory variables, which include firms' territorial location, and variables measuring competition.

3.1 The equation of interest for the magnitude of price changes, the econometric specification

Overall, the analysis sets a panel model with a set of dummy variables that represent firms' characteristics in order to identify the idiosyncratic behavior of firms.

The equation of interest is the following:

$$P_{it} = \beta_0 + \beta_1 G_i + \beta_2 W_i + \beta_3 V_i + \beta_4 Q_{it} + \beta_5 Z_i + U_i + \varepsilon_{it} \qquad (1)$$

Where P_{it} is the proportion of price variation in firm *i* at year t. G_i is a dummy equal to 1 if the company belongs to a group. W_i represents the firm dimensional dummy, V_i stands for sector dummy, and U_i captures the firm fixed effects. Q_{it} is a regressor that accounts for the export share on sales. Furthermore, Z_i includes the macro regional dummy and ε_{it} is the stochastic error term. Positive coefficients associated with these variables are interpreted as greater price variation. During the specification setup, we also test the elasticity with respect to two other possible explanatory variables: the firm's age and the EBIT result. However, we find that neither of these regressors is statistically significant across all empirical models.

Overall, our inference has been conducted with several specifications, including the firm fixed effects to account for firm specific time invariant features. Besides, we also estimate the same model for several sample periods, to check the stability of the estimated coefficients, e.g. after the Euro changeover.

The results are shown in tables 7, where the dependent variable V220A is the size of price variation. The model has been estimated with n-1 dummies. It catches the regional disparities using the firms located in the Northeast of Italy as control group. Therefore, the other estimated regional dummies have to be considered as a distance with respect to the benchmark value. Furthermore, the other control groups are the firms that operate in Real estate (or the Manufacturing industries) and the smallest firms (fewer than 50 workers).

All the estimated models denote the presence of large disparities among geographical areas. All regional dummies are statistically significant at the 1% level, confirming the importance of economic environment in the price setting strategy. However, the sign is sensitive across the empirical models. Indeed, the estimated coefficients are very different, highlighting the existence of unobserved individual factors correlated with the explanatory variables causing biases in the level estimates.

The Fixed effect shows, as expected, a negative impact of the probability of larger price changes for firms located in the South. . On the contrary, the OLS Between and Maximum Likelihood gee pa reveals a positive impact in the price changes over one year. Firms' size influences the pattern of price adjustment, which is likely to happen more intensively in larger firms than in small ones (the omitted category in the regression is that of small firms with 20 to 49 employees). Firms that belong to a group reveal more price stability, they presents parameters (such as financial behavior, productivity and profitability) typical of larger firms. The estimated coefficients to capture the disparities across industries reveal that the cross-sectoral differences matter. In this case, we use two different omitted categories; firstly, the real estate service sector (different from transport, wholesale and retail trade), and then manufacturing businesses.

Non-processed food, tobacco and beverage sectors and energy prices are scarcely persistent, whereas service and industrial goods prices are highly persistent. Finally, the fixed effect specification shows that for firms operating in the non-metal mineral industry and manufacturing sectors, prices tend to be adjusted higher than in non- financial services.

4. Concluding remarks

There is an active literature on the study of price rigidity. This paper contributes to this literature by studying this issue using high quality data on price dynamics by estimating the impact of several factors on the degree of price stickiness. Summarizing, in this study, we have conducted an empirical analysis with individual micro-data; we have estimated the microeconomic supply function of Italian industries. We have used a matched panel dataset, which we think provides accurate information on price setting by firms and the dynamic patterns for inflation. A series of concluding remarks can be drawn from our finding:

Firstly, our paper provides new micro-founded evidence for models of price staggering that have become very popular in New Keynesian DSGE models. In particular, our findings, which are robust across several alternate empirical specifications, suggest that industrial sectors are less sticky than service sectors at all. This may be due to lack of restriction, such as menu cost and cost variation agility. The export share on sales is never significant and it has no effects. This outcome implies that there is no evidence of pricing to market strategies. Moreover, the estimated coefficient for firm dimension is negative. Hence, more dimensions imply more persistence and less variation. Overall, for price intensive and monetary effects, prices were shown to be stickier in the South than in the North.

Another main conclusion is that firms located in the South present stronger price variations than the rest of Italy. In part, this may due to the lack of competition. Furthermore, we provide large

disparities in the sign of variation among both geographical location and sectors. This asymmetric behavior may provide new insight. Indeed, this model predicts large variation in size. The large variation may be due to menu costs faced by firms. The presence of *non-Ricardian* agents that implement a sort of Rule of thumb in the price setting might cause heterogeneity in the pricing behavior strategy adopted by firms.

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Appendix

Table 1. Variable definitions and descriptive statistics

Variable	Description	Value	Mean
V220A	% average price goods variation	-80 -100	2.53
PQ1	Number of price review	1-9	-
PQ2	Number of price change	0-5	-
AREAG4	Geographic area Dummy North-East, North-West, Center, South	1-4	-
SETTOR	Sector dummy	1-11	
SS1	Food and Tobacco products	4.184	-
SS2	Textile, Clothing, Leather and footwear	5.928	-
SS3	Cook, rubber, chemical and plastic	4.199	-
SS4	Non metallic mineral product	2.768	-
SS5	Manufacturing	14.445	-
SS6	Other manufacturing industries	3.812	-
SS7	Other industries	605	-
SS8	Wholesale and retail commerce	2.258	-
SS9	Hotels and restaurants	404	-
SS10	Transports and e communications	1.266	-
SS11	Real estate and Informatics, etc.(K)	1.367	-
CLDIMET-V24	0 = 20-49 ; 1 = 50–99; 2 = 100–199; 3 = 200–499; 4 = 500–999 5 =1.000 workers or more	0-5	-
V284	Year of foundation	1400-2008	1969
V521	The firm belongs to a group	0-1	-
A6	Export share on sale	1-4	-
V558	% turnover changes if firm raises prices by 10%	-100 100	-37.71

Table 2. Sample Geographical distribution of the sample

AG	FREQ.	PERCENT
NORTH-EAST	13.368	32.42%
NORTHWEST	8.812	21.37%
CENTER	8.277	20.07%
SOUTH	10.779	26.14%
TOTAL	41.236	100%

(1) North-West=Piemonte, Valle d'Aosta, Lombardia e Liguria. – (2) North-East=Veneto, Trentino Alto-Adige, Friuli Venezia Giulia e Emilia Romagna. – (3) Centre=Toscana, Umbria, Marche e Lazio. – (4) South-and Island=Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia e Sardegna.

Table 3. Sectoral distribution of the sample

industry classification	Freq.	Percent
SS1 Food products, beverage and Tobacco	4,184	10.15
SS2 Textiles and clothing	5,928	14.38
SS3 Coke, Chemical industries,	4,199	10.18
SS4 Non-metallic mineral products	2,768	6.71
SS5 Engineering industries Manufacturing	14,445	35.03
SS6 Other manufacturing industries	3,812	9.24
SS7 Other industries(energy extractive)	605	1.47
SS8 Wholesale and retail trade	2,258	5.48
SS9 Hotels and restaurants	404	0.98
SS10 Transport and communications	1,266	3.07
SS11 Real estate and informatics	1,367	3.32

Table 4 price changes by sign

(n =6973)	Overall		Between		Within
sig	Freq.	Percent	Freq.	Percent	Percent
-1	3918	**13.01**	1840	**26.39**	**31.69**
0	5908	**19.62**	3060	**43.88**	**34.49**
1	20279	**67.36**	5900	**84.61**	**72.3**
Total	30105	100.00	10800	154.88	54.67

Table 5. sign of price changes across sector

Sector/price variation	↓	↔	↑
Food	12.42	17.7	69.88
Textiles	11.64	20.18	68.19
Chemical	17.87	14.85	67.28
Non-metal minerals	10.28	18.49	71.24
Engineering	15.03	21.25	63.72
Other Manufacturing	12.9	23.6	63.5
Energy extractive	11.26	25.49	63.24
Wholesale& retail trade	8.6	10.12	81.28
Hotels and restaurant	5.23	20.56	74.22
Transport and communication	4.56	30.36	65.08
Real estate and ICT	6.68	35.99	57.33

Table 6. Price variation within regional distinction

northeast	**Overall**		**Between**		**Within**
sig	**Freq.**	**Percent**	**Freq.**	**Percent**	**Percent**
↓	1602	17.54	628	36.30	32.21
0	1452	15.89	711	41.10	28.18
↑	6081	66.57	1509	87.23	69.79
Total	9135	100.00	2848	164.62	51.12
			(n = 1730)		
Northwest	**Overall**		**Between**		**Within**
sig	**Freq.**	**Percent**	**Freq.**	**Percent**	**Percent**
↓	841	12.04	415	27.47	30.20
0	1180	16.89	592	39.18	30.29
↑	4966	71.07	1329	87.95	74.85
Total	6987	100.00	2336	154.60	55.62
			(n = 1511)		
Center	**Overall**		**Between**		**Within**
sig	**Freq.**	**Percent**	**Freq.**	**Percent**	**Percent**
↓	721	11.56	359	24.42	32.23
0	1272	20.40	644	43.81	36.28
↑	4243	68.04	1237	84.15	74.14
Total	6236	100.00	2240	152.38	56.54
			(n = 1470)		
South	**Overall**		**Between**		**Within**
sig	**Freq.**	**Percent**	**Freq.**	**Percent**	**Percent**
↓	754	9.73	443	19.42	32.17
0	2004	25.87	1115	48.88	43.99
↑	4989	64.40	1840	80.67	71.60
Total	7747	100.00	3398	148.97	57.40

Table 7. Panel estimation for price size variation

Variable	OLS cluster	FE	be wls	MLE	Gee pa
ad2	0.506**	1.9127**	0.5079**	0.5335**	0.4112**
	(0.12)	(0.78)	(0.13)	(0.13)	(0.12)
ad3	0.667**	12.518**	0.6614**	0.69799**	0.4755**
	(0.13)	(3.52)	(0.13)	(0.14)	(0.13)
ad4	1.0941**	-1.791**	1.064**	1.11355	0.8676**
	(0.14)	(0.75)	(0.13)	(0.13)	(0.14)
sed1	-0.3391	-4.047	-0.3619	-0.2607	0.003
	(0.29)	(3.32)	(0.48)	(0.46)	(0.29)
sed2	0.0704	-0.1407	0.0917	0.0972	0.0887
	(0.35)	(0.66)	(0.52)	(0.49)	(0.34)
sed3	-0.8596**	1.2*	-0.8644	-0.793	-0.7621**
	(029)	(0.26)	(0.52)	(0.49)	(0.28)
sed4	-0.4421	4.833**	-0.4414	-0.4216	0.0574
	(0.28)	(1.41)	(0.48)	(0.46)	(0.29)
sed5	0.0668	2.218**	0.075	0.1931	0.5412*
	(0.3)	(1.07)	(0.48)	(0.47)	(0.3)
sed6	0.2356	1.708**	0.2435	0.2886	0.6283**
	(0.29)	(0.29)	(0.49)	(0.47)	(0.29)
sed7	-0.2157	2.518**	-0.1855	-0.11	0.2395
	(0.27)	(0.77)	(0.47)	(0.45)	(0.27)
sed8	0.8059**	2.317**	-0.8302*	-0.6722	-0.3855
	(0.28)	(0.92)	(0.48)	(0.46)	(0.28)
sed9	0.3512	-0.1983**	0.3857	0.3743	0.5254
	(0.4)	(1.10)	(0.57)	(0.55)	(0.4)
sed10	-0.077	0.411	-0.0841	0.0038	-0.0494
	(0.29)	(1.41)	(0.5)	(0.47)	(0.29)
did2	-0.3536**	0.212	-0.3485**	-0.4093**	0.0847
	(0.13)	(0.44)	(0.13)	(0.12)	(0.13)
did3	-0.5847**	0.258	-0.6319**	-0.6212**	-0.112
	(0.58)	(0.43)	(0.14)	(0.13)	(0.14)
did4	-0.5758**	0.259	-0.5569**	-0.6444**	-0.08
	(0.13)	(0.42)	(0.15)	(0.14)	(0.14)
did5	-0.9909**	0.0472	-1.1061**	-0.03**	-0.4565**
	(0.20)	(0.36)	(0.22)	(0.12)	(0.19)
group	-0.363**	-0.0697	-0.4493**	-0.3452**	-0.2809**
	(0.09)	(0.23)	(0.10)	(0.09)	(0.97)
age	-0.0019	0.0039	-0.0029	-0.0012	0.0271
	(0.001)	(0.00)	(0.00)	(0.00)	(0.00)