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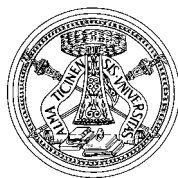
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**Quaderni di Dipartimento**

**Regional Patterns of Inflation Persistence in Italy**

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# **Regional Patterns of Inflation Persistence in Italy**

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## **Abstract**

Regional patterns of inflation persistence have received attention only at a very coarse level of territorial disaggregation, that of EMU member states. However economic disparities within EMU member states are an equally important policy issue. This paper considers a country with a large regional divide, i.e., Italy, at a fine level of territorial disaggregation (NUTS3). Our results show that economically backward regions display greater inflation persistence. Moreover, we show that higher persistence is linked to a lower degree of competitiveness in the retail sector.

## **1. Introduction**

The implication of sectoral and regional differences in inflation persistence for the functioning of monetary policy have recently attracted considerable attention. However, the analysis of inflation persistence across different regions is rather limited as it stops at a very coarse level, that of EMU member states (Altissimo et al., 2006, Benigno and Lopez-Salido, 2006, and Lünnemann and Mathä, 2004). This limitation should not be understated, as wide regional disparities exist within EMU member states, and a common monetary policy should take them into account. The present study would like to bridge this gap by analyzing regional patterns of inflation persistence at a fine level of territorial dis-aggregation in Italy (NUTS 3 regions<sup>1</sup>).

The Italian regional divide is a well known problem, with Northern Italy being the most developed part of the country followed by the Centre and then by the South and Islands, also called “Mezzogiorno” (Brunello et al. 2001). Furthermore, the “Mezzogiorno” ghost has been evoked in trying to understand regional disparities within other European countries, notably Germany (Sinn and Westermann, 2001). Therefore, Italy appears to be an ideal laboratory where studying how inflation persistence may interact with regional disparities.

The rest of this paper is structured as follows. In the next section, we will deal with our estimates of inflation persistence. Then, we will illustrate its link with the local degree of competitiveness of the retail sector.

## **2. Estimating Persistence at the Regional Level: Data, Methods and Results**

The Italian Statistical Office (ISTAT) has a long tradition in collecting data about prices in the main cities of NUTS3 regions. In this contribution we consider the data for the Consumer Price Index (CPI) from 1996Q1 to 2006Q3 at quarterly frequency for 71 out of 103 Italian provinces. The period under scrutiny is very similar to that studied by Lünnemann and Mathä (2004).

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<sup>1</sup> NUTS is the French acronym for Nomenclature of Territorial Units for Statistics used by Eurostat. In this nomenclature NUTS1 refers to European Community Regions and NUTS2 to Basic Administrative Units, with NUTS3 reflecting smaller spatial units most similar to counties in the US.

For each provincial index we estimate a univariate autoregressive process with a constant, and quarterly dummies to account for seasonality. We choose the optimal lag length resorting to the Schwarz criterion, starting from a maximum lag length of 4. The selected optimal lag length was always equal to one. Different measures of persistence have been offered in the literature, but for the AR(1) model they are all connected (Andrews and Chen, 1994). As in Lünemann and Mathä (2004), we stick to the simplest one: the sum of the coefficients of the lags of the inflation rate ( $\rho$ )

After estimating the model for the whole sample, we test - by means of Wald tests robust to heteroskedasticity - the restrictions of  $\rho$  being equal to zero or one, and for the presence of a structural break in the intercept and in  $\rho$ . For the last two tests, we take as possible reference years the EMU kick-off (1999Q1) and the introduction of Euro banknotes and coins (2002Q1). We also test for a structural break in the variance by means of an F test. Finally, we perform a poolability test to check whether the different estimates obtained for each province are statistically different. It is worth stressing that one of the advantages of the sum of the autoregressive coefficient compared to other measures of persistence is that its confidence interval is very easy to compute (Andrews and Chen, 1994). Thus, the poolability test is rather straightforward.

In general, we find a very low level of persistence: across different provinces  $\rho$  has an average of 0.20 and a standard deviation of 0.11. Table 1 shows the results of the specification tests. It is evident that structural breaks do not appear to play a major role in our sample. These results are similar to those of Lünemann and Mathä (2004) and consistent with those of Angeloni et al. (2006), who find a structural break in the inflation process in EMU member states in the mid-90s and a low, stable degree of inflation persistence thereafter. Given the low level of persistence, resorting to more sophisticated methods to avoid bias or unreliable inference does not seem necessary (Andrews and Chen, 1994 and Hansen, 1999).

To further explore the impact of possible structural breaks on  $\rho$ , we estimate its kernel density function for the complete, pre-break and post-break estimates. Figure 1 shows that structural breaks do not appear to have sizeable effects on the regional distribution of inflation persistence in our data. Indeed, a Li test for equality between the regional distribution of  $\rho$ , before and after the structural break, could never reject the null returning a p-value of respectively 0.21 and 0.29 for the 1999 and the 2002 cases.

Finally, the poolability test is strongly rejected. Regional disparities in inflation persistence are quite remarkable. On average  $\rho$  is 11% higher in the Centre than in the North and 33% higher in the South and Islands than in the North (where its average is equal to 0.18). Furthermore, inflation persistence is much more dispersed in the South and Islands and in the Centre than in the North. The standard deviation of  $\rho$  is equal to 0.08 in the North, 0.12 in Centre and 0.13 in the South. Therefore, inflation persistence appears to be greater in the lagging part of the country, which also displays a smaller degree of economic integration.

### ***3. Regional Inflation Persistence and the Retail Sector: Data, Methods and Results.***

In order to shed further light on the possible sources of this geographical pattern, we investigate the connection between regional inflation persistence and the structure of the retail sector. Recent empirical contributions have compared the persistence properties of consumer and producer price indexes in Italy (Veronese et al., 2004; Sabbatini et al., 2004). These works show that the rate of change of the consumer price index displays more persistence than the producer price index, pointing to the retail sector as the place where most of persistence originates.

The retail sector is often regulated at the local level and Italy makes no exception (Boylaud and Nicoletti, 2001). Furthermore, recent reforms, though originally aiming at liberalizing the sector, actually increased the regulatory power of local authorities, which often used it to inhibit competition, limiting the entry of large stores (Schivardi and Viviano, 2006).

The entry of large stores would generally be beneficial for competition. If the effect of market regulation were, however, to protect small shops, boosting their share in the total number of firms belonging to the sector, local monopoly power would tend to increase. This would induce higher inflation persistence through two channels. First, Leith and Mulley (2003) show that firms in a less competitive environment tend to adjust prices less frequently and are less likely to do so in a forward-looking manner. Second, the recent New Keynesian literature suggests that inflation persistence requires the existence of “rule of thumbs” among price setters (Galí and Gertler, 1999, and.

Altissimo et al., 2006). Intuitively, small shops are good candidates for “rule of thumb” price-setters, because they are unlikely to have the ability to forecast future inflation.

We want, therefore, to check if there is a link between inflation persistence and the share of retail firms with no more than two employees, the “mom-and-pop stores” (Boylaud and Nicoletti, 2001). This indicator is available from the 2001 census. The average value of this variable is 81% and it has a standard deviation of 0.04. The South of Italy has a higher incidence of small shops than the North, where large stores gained ground in recent decades (Argiolas and Ventura, 2002).

We regress the measure of inflation persistence obtained above on the “mom-and-pop stores”. First, we explore our dataset by means of a nonparametric estimator. As showed in Fig. 3 the relationship between inflation persistence and the share of small shops appears to be nonlinear and concave: very similar to an exponential function. Second, we use a nonlinear least squares estimator to fit an exponential model to the data, obtaining the following result:

$$\rho = -1.18 + e^{0.03 * (\% \text{ of "mom- and - pop stores"})} \quad (1)$$

(0.00)                      (0.02)

where p-values are reported in parentheses. The estimated relationship has, therefore, the expected positive sign, revealing that inflation persistence is positively affected by the degree of monopoly power in the retail sector, as suggested by the New Keynesian theoretical literature.

We tried different initialization for the values of the parameters and results are stable. Moreover, as showed in Table 2 the residuals of this model are very well behaved. Their normality could not be rejected by a battery of tests, as well as the fact that they have zero mean. A RESET test, obtained adding to the right hand side of (1) the square of the fitted values of the model (Davidson and MacKinnon, 1999), could not detect the presence of omitted variables. Finally, a test for spatial correlation could not reject the absence of spatial correlation in the residuals.

#### **4. Conclusions**

In this contribution we assessed the issue if there exist statistically significant differences in inflation persistence at the regional level in a country with sizeable regional disparities like Italy. Our results point to the fact that economically backward regions also have greater inflation persistence. With this result in mind, it is not surprising that the unemployment rate increased more in the South than in the North during the deflation of the nineties, as more persistence in inflation means a larger sacrifice ratio (Brunello et al., 2001). In accordance with recent theoretical contributions, our results stress the need for monetary policy to take into consideration regional disparities in inflation persistence. Finally, another important result of our analysis is that different levels of inflation persistence are associated with different local degrees of competitiveness in the retail sector.

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**Table 1 - Model specification tests - based on regional inflation time series at quarterly frequency<sup>°</sup>**

<b>Wald test on the autoregressive coefficient to be equal to zero<sup>†</sup></b>	<b>0.34</b>	<b>Wald test on a structural change in the intercept (2002Q1)<sup>‡</sup></b>	<b>0.89</b>
<b>Wald test on the autoregressive coefficient to be equal to one<sup>†</sup></b>	<b>0.00</b>	<b>One sided F-test on a structural change in the standard deviation of inflation (1999Q1)<sup>‡</sup></b>	<b>0.89</b>
<b>Wald test on a structural change in the autoregressive coefficient (1999Q1)<sup>‡</sup></b>	<b>0.86</b>	<b>One sided F-test on a structural change in the standard deviation of inflation (2002Q1)<sup>‡</sup></b>	<b>0.87</b>
<b>Wald test on a structural change in the autoregressive coefficient (2002Q1)<sup>‡</sup></b>	<b>0.89</b>	<b>Wald test of poolability of all the provinces (restricted sample) - p-value<sup>*</sup></b>	<b>0.00</b>
<b>Wald test on a structural change in the intercept (1999Q1)<sup>‡</sup></b>	<b>0.90</b>	<b>Total number of series</b>	<b>71</b>

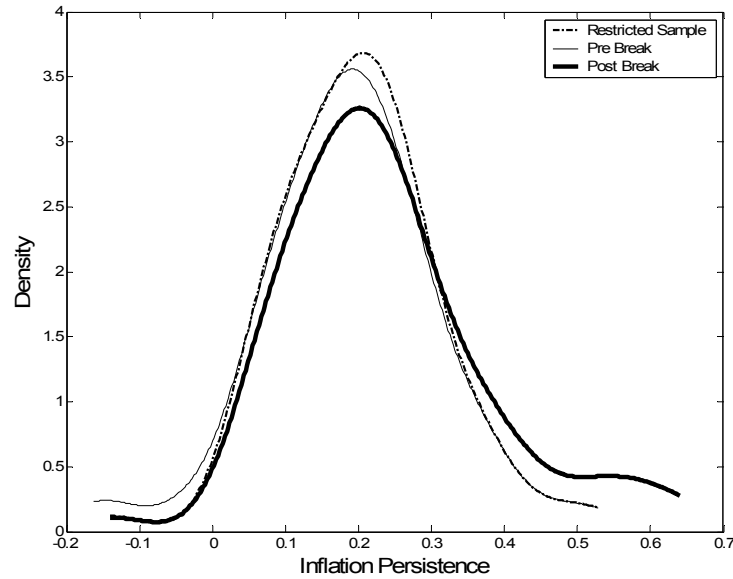
<sup>°</sup>: all the tests are based on heteroskedasticity consistent standard errors.

<sup>†</sup>: frequency of accepting the null at the 5% level, in percent of the total number of time series analysed.

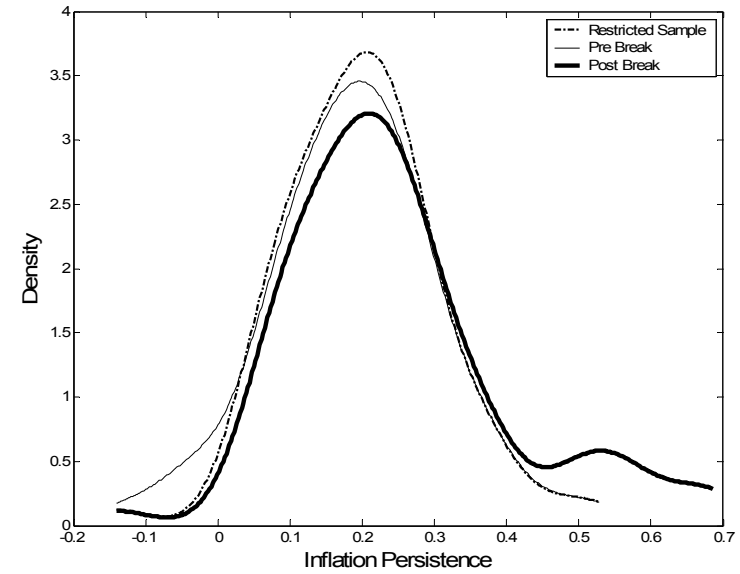
<sup>‡</sup>: frequency of accepting the null of no break at the 5% level, in percent of the total number of time series analysed.

<sup>\*</sup>: the test is distributed as a chi squared with 70 degrees of freedom. The null is that all the provinces can be pooled, namely that each province has the autoregressive coefficient equal to that of Turin, the main city of the Piemonte region in the North-West of Italy.

**Figure 1 – Regional Distribution of Inflation Persistence – General Consumer Price Index**



**Break in 1999Q1**



**Break in 2002Q1**

Note: kernel density estimators with Silverman's optimal smoothing bandwidth. The inflation persistence measure is the coefficient of an AR(1) process estimated for each Italian province included in the sample. For the reasons underlying the choice of this measure see the body of the paper.

**Table 2 - Tests on the residuals of Model (1)**

Normality tests	
Shapiro - Francia (p-value) <sup>o</sup>	0.35
Shapiro - Wilk (p-value) <sup>o</sup>	0.69
Skeweness - Kurtosis (p-value) <sup>o</sup>	0.35
RESET test for omitted variables (p-value) <sup>†</sup>	0.97
Test for zero mean residuals (p-value) <sup>††</sup>	1
Test for spatial correlation <sup>††o</sup>	1.16
Observations	71

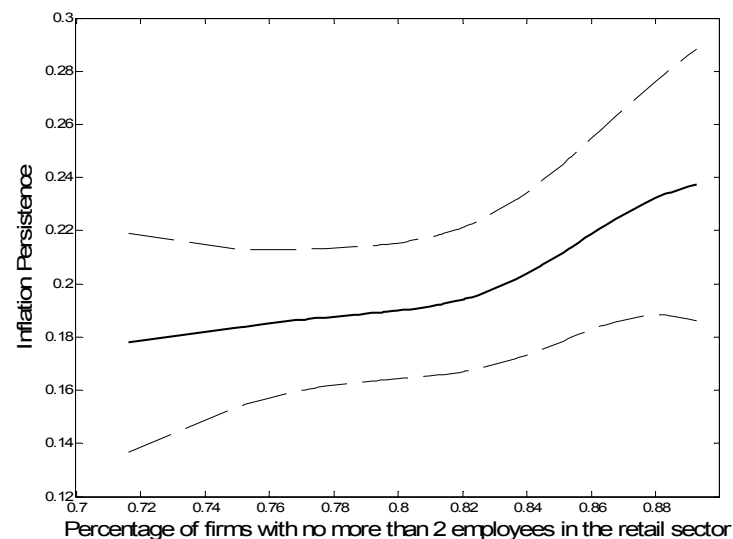
o: the null is that residuals have a normal distribution.

†: the null is absence of omitted variables. We report the p-value of the parameter of squared fitted values inserted in (1) to implement the RESET test.

††: the null is that residuals have a zero mean.

††o: the test for spatial correlation is the Moran's I statistic which is distributed as  $N(0,1)$  and whose 5% critical value is 1.96. The null is absence of spatial correlation. For an introduction to this test see Anselin (1988).

**Figure 2 – Nonparametric estimator of the relationship between regional inflation persistence and the percentage of firms with no more than 2 employees in the retail sector**



Note: for this picture we resorted to a gaussian kernel estimator with a bandwidth of 0.03. Resorting to Silverman's optimal smoothing bandwidth (equal in this case to 0.02) would not alter the results.