Inflation forecasts from the Bank of Italy-Sole 24 Ore survey of expectations of inflation and growth

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1. Introduction

Measures of inflation, and expectations thereof, are a typical concern of central banks. These parameters of the economy enter all types of loss function used by these institutions. The inflation rate is closely monitored as the main concern of monetary policy and in some cases explicitly targeted. All flavours of the Phillips curve include the inflation rate and expectations thereof, measured at different time lags. An accurate knowledge of inflation expectations among economic agents and the way they are formed is crucial to check, among other goals, if inflation expectations are properly anchored.

Inflation expectations can be made observable in different ways. A review of the main indicators used to measure inflation expectations in the euro area can be found in European Central Bank (2006). The break-even inflation rate calculated from prices of inflation-indexed assets can be considered an indirect measure, providing very high frequency data; but market-specific noise often prevents the correct individuation of the expectation component. But research is highly divisive also about usefulness of direct measures coming from survey data, as pointed out, for example, by Kershoff and Smit (2002) and Stekler (2002). Conclusions often rely heavily on the assumptions made and show no consistency over time. Serious criticisms from various authors include lack of correct (or bluntly distorted) incentives at work when formulating a figure (or a direction) during the interview and excessively different information sets available to the respondents, factors which could, among other effects, prevent the assessment of rationality of expectations. A review of uses of survey data in forecasting is found in Pesaran and Weale (2006).

Nonetheless, it seems that resorting to survey data is unavoidable when the moment comes for a reality check. Thus, from the survey conducted by the Michigan Survey Research Center since 1966 to the many local and global surveys where inflation expectations are collected, directly asking agents about future inflation has become common practice. Although sentiments cannot be ignored (as they directly influence consumption decisions), to query consumers on the projected quantitative inflation rate may be deceptive: recent studies pointed out the dangers of significant distortionary effects of perceptions, depending on factors (like frequency of purchase) at work particularly during regime changes (Del Giovane, Fabiani and Sabbatini, 2008).

Businesses or experts may also be queried within regular surveys. Examples are the Consensus Forecasts or the Survey of Professional Forecasters, where an independent private body collates forecasts made available by a poll of major banks and financial operators in a simple unweighted average. These sources are widely used by financial operators and central banks. Surveying inflation expectations on a sample of industrial businesses is not particularly widespread practice. Indeed, senior managers in prominent firms are often part of experts panels, for example for computing the Purchasing Manager

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Index (PMI); yet those are not always randomly selected (as they are deemed "subject matter experts"); sample size is normally very small and information collected is mainly qualitative. A random sample survey of businesses aimed at collecting information on projected inflation and the course of own prices is conducted in few countries. Colombia and Hungary run inflation expectation surveys on firms similar to that of the Bank of Italy (BIS, 2009). The National Bank of New Zealand, a private bank, conducts monthly a survey of the macroeconomic climate (National Bank Business Outlook, NBBO) where a sample of 1,500 firms, chosen from among this bank's clients, is asked about forecasts of general inflation and own prices. South Africa also surveys a panel of firms, taken from a convenience non-probability sample, for inflation expectations. The European Commission collects data on inflation and own price changes expectations of firms in qualitative form through national research bodies like Ifo in Germany and ISAE in Italy.

Uses of survey expectations are not limited to, nor centered on, their forecasting power. As stated, they bear interest in themselves as they provide information on the way they are formed. Nonetheless, their predictive content may be of use in models that include also other forecasting sources.

This paper illustrates the 10-year results of the quarterly Bank of Italy survey of expectations of inflation and growth. Section 2 contains a description of the survey and the data available. Section 3 describes the main statistical features of the aggregate estimates and contains an assessment of their forecasting performance, also in comparison with a widely used series such as Consensus Forecasts and a couple of mechanical benchmarks. The predicting content of forecasts from some subgroups in the sample is also investigated. Section 4 concludes, putting forward further work.

2. The survey

The Survey of Expectations of Inflation and Growth (SEIG henceforth) is conducted in partnership with the Italian daily financial newspaper "Il Sole 24 Ore". A letter, signed by senior executives of both the Bank and the newspaper, is sent to the selected firms as an invitation to participate in the survey. "Il Sole 24 Ore" has the right to publish and comment on the main results with priority over any other media. This entails the advantage of sharing the cost of the field, which is conducted by a firm specialized in economic polls. Methods and sample design are developed, and estimates are produced within the Sample Surveys Unit of the Economic and Financial Statistics directorate of the Research department. The results of the surveys are published by the Bank among its statistical publications and made available on the Bank's website[2].

This initiative started in December 1999, as a reprise of a former initiative set forth by the Bank of Italy and the late economic weekly "Mondo Economico" dating back to 1952, the results and implications of which are extensively reviewed in Visco (1984). While the latter was a biannual opinion poll, the 1999 edition is quarterly and based on a random sample. The sample size is about 500, chosen among the universe of industrial and service firms with 50+ employees, stratified by size of workforce, sector of economic activity and geographical location. Tables 1 & 2 provide some basic information on the sample design and participation in the survey. By design, firms with at least 1,000 employees are over-represented in the sample. Service firms also include some banks. Since the very first wave, interviews have been mainly conducted on a web interface (well over 90 per cent). In principle, the same

[2] http://www.bancaditalia.it/statistiche/indcamp/indaspe;internal&action=_setlanguage.action?LANGUAGE=en.

firms are constantly re-contacted in order to achieve a panel dimension. Panel average size is around 30 per cent of the sample.

The field is kept open in the first weeks of the last month of each quarter (namely March, June, September and December). Its duration, originally four calendar weeks, was reduced to three in year 2007, when the Bank of Italy Economic Bulletin became quarterly, in order to allow a comment of the results in that report.

A quantitative assessment of general inflation, in the form of a forecast of the 12-month inflation rate one year ahead, has been asked for since the beginning of the survey. In order to channel respondents' answers towards plausible figures, an anchor is proposed in the questionnaire, in the form of the latest definitive (hence referred to two months earlier) official HICP (Harmonized Index of Consumer Prices) figure, for both Italy and the euro area. To realize a uniform informational framework, interviews are started just after the announcement of the latest provisional HICP figure referred to the preceding month. During the field, the definitive figure of the same index is published, but the impact of this is irrelevant, as revisions to the provisional index are normally very limited. Answers to these questions are summarized and published in a sample weighted mean. Starting in June 2009, a question on the projected 12-month inflation rate at end of the next 24 months was added.

The questionnaire also contains a quantitative question on expectations of own prices, in the form of a 12-month change one year ahead. Starting in 2003, a retrospective question (on past 12 months) was also inserted. These answers are published as sample weighted means, in which the weights take into account not only the design but also the size of the firms in terms of workforce (as a proxy of turnover). Own prices may record significant changes, either firm-specific or sector-specific, so that some outliers may be detected in the database. Estimates are protected from the related undesirable effects through winsorization (i.e. values outside the 5-95 percentile interval of the distribution are set equal to the respective thresholds prior to computation). The magnitude of the robust estimates is, anyway, comparable: this indicates a low influence of the outliers overall.

Standard errors of the estimates have constantly been quite low: on average, 0.04 percentage points for inflation forecasts; 0.33 percentage points for predicted own price changes (0.21 when considering winsorized estimates); 0.53 percentage points for declared realized own price changes (0.32 when considering winsorized estimates).

A qualitative question is posed about direction and intensity of the impact of some factors (such as demand, competition and cost components) on own prices developments. The questionnaire also includes qualitative assessments on the general economic situation, an outlook of business and employment conditions and relevant factors thereto, an assessment on investment conditions in the past three months and other topics that may be of interest in the short term.

The questions on general inflation are the only mandatory items in the questionnaire, although data are ordinarily inspected for missing values and records with a high proportion of missing responses are discarded. Typically, information on own prices is not provided by all firms participating in the survey, although the item non-response rate remains acceptable (below 10 per cent on the average of all 42 waves).

3. The aggregate estimates as forecasts

This section is devoted to describing the performance of the macro forecast estimates (IT12 henceforth) aggregated from the SEIG since the beginning of the survey in December 1999 up to the wave of March 2010, by means of standard forecast performance evaluation tools like those recommended by Theil (1961, 1966). Such descriptive tools appear adequate

to describe the behaviour of forecasts where the number of observations for which a comparison with realizations is possible (38) is relatively low.

The comparison will be conducted with respect to Consensus Forecasts[3] (the other main source for which quarterly quantitative survey data for Italy are available – CONS henceforth). Surveys collecting expectations in qualitative form, hence requiring a further model to envisage the latent quantities, will not be considered here. Two mechanical benchmarks will also be compared: the naive forecast (NAIVE), obtained by simply shifting the realized values 12 months forward, and a non-trivial autoregressive model (ARP) recursively estimated on the aggregate official data, to simulate the conduct of a forecaster willing to use baseline econometric tools[4].

As stated, accuracy is not the only relevant feature of survey forecasts; it is considered here as an objective starting point for further analysis. Figure 1 shows a classical Theil's prediction-realization diagram for the main series we wish to compare. Most of the observations cluster around the line of exact forecast for values between 2 and 3 per cent; the slope appears negative overall. This behaviour, although clearly linked to the dependency of the forecasts on past values, is also related to difficulty in forecasting. A more consistent pattern can be revealed by excluding outliers, detected according to an appropriate definition: points whose forecast error exceeds a certain quantile of the distribution of the errors of the naive forecast[5]. Figure 2 shows the positive slopes revealed by considering a threshold at the 85th percentile[6].

An extensive array of literature has clearly shown that inflation expectations – especially those collected in surveys – tend to be heavily influenced by past realizations. SEIG results are no exception; by no means, anyway, can this apparent behaviour automatically void the forecast content of the estimates. Figure 3 shows the trend of the time series over time. Both IT12 and CONS appear clearly influenced by past realizations; while CONS is less volatile and regularly underestimates inflation[7], IT12 appears more in line with the average level of inflation observed in the period. The time series being rather short, this comparison should be interpreted with caution; but the discontinuity due to the advent of the single currency would have suggested prudence, even if the series had contained more data from the past.

Let l be the time lag (or lead), measured in quarters, between the forecast and the time where the forecast is to be referred to. Thus, a forecast is formulated at $l = -4$ and targeted to inflation realized at $l = 0$. Figure 4 shows the cross-correlation curve for the SEIG, Consensus Forecasts and the naive forecast. Correlation with realized inflation ($l = 0$) is relatively weak and negative for all three forecasts. On the contrary, correlation is positive and strong with respect to official data disseminated at the moment of the interview ($l = -4$).

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[3] Consensus Forecasts is a survey conducted by Consensus Economics, a private body, which involves a convenience non-probabilistic sample of professional forecasters from financial institutions. For Italy, the individual estimates of some 15 bodies are aggregated in a simple unweighted mean.

[4] These estimates are obtained by applying the SAS FORECAST procedure to monthly official HICP data for Italy, starting from January 1997 and up to the same quarter where firms were interviewed, in order to obtain, for each quarter, an out-of-sample forecast 12 months ahead. The SAS FORECAST is an automated forecasting procedure that combines time trend regression with an autoregressive model, using a stepwise method to select the lags of the autoregressive process.

[5] A special definition of "outlier" is key to the robustification process here; using the quantiles of each own distribution instead would have reflected only the mechanical effect of removing points far away from the diagonal.

[6] This quantile is also higher than correspondent quantiles of the remaining distributions.

[7] This could also be related to the fact that Consensus Forecasts participants know that they will be allowed to update (revise) their forecast (on the same point in time) in the subsequent month or quarter.

Comparable results are obtained by running a simple OLS regression of IT12 on realizations and lagged values thereof, which shows that only the coefficient at $l = -4$ is significant. This shows clearly that expectations rely heavily on the information available at the moment of the interview. Not surprisingly, the same behaviour is shared by CONS and, by construction, by the naive forecast. On the other hand, Figure 4 shows for IT12 a strong and positive correlation with inflation realized about 9 quarters ahead of the moment where the forecasts were formulated. This would suggest a better forecasting capability of IT12 on this time horizon.

The tools we use to assess the forecast accuracy of the series under scrutiny are the Root Mean Square Forecast Error (RMSFE) and Theil's U statistic. The former is the root mean quadratic distance between forecast and realizations; the latter measures the RMSFE of the given forecast as a quota of the RMSFE of the naive forecast, considered as the "least informed forecast", yet not necessarily the easiest to beat. Estimates having a U statistic less than 1 should exhibit some forecasting content. Both CONS and IT12 forecasts show this property, with distinct features. In the period considered, CONS has constantly tended to underestimate inflation, so that the forecast error has been mostly positive. As a result, the overall RMSFE of the IT12 forecast has been steadily lower than that of CONS until recently. These results are shown in Figure 5, depicting the trend of Theil's U of the series over the subsequent forecasting exercises[8].

It would also be possible to check if qualitative unbiased information is contained in firms' forecasts. This can be done by checking out whether the forecasts are able to detect direction-of-change and turning points. The latter are detected in over 60 per cent of total cases[9] but there is no clear superiority of any forecast in this comparison; detection of direction-of-change is seldom satisfactory for any estimates.

The SEIG survey allows us to check if there are groups of firms whose forecasting capability is relatively more accurate, by using different aggregations of microdata. A simple comparison can be done between forecasts as expressed by different groups of firms according to design stratification variables. Results are shown in Table 4. Economic sector of activity and geographical area do not appear as relevant factors, whereas firm size clearly matters: firms with at least 1,000 employees show a better forecasting power than any other group (its performance over time is depicted by series IT12_CLD_3 in Figure 5); estimates from small firms, on the contrary, are shown to regularly overshoot with respect to those of bigger firms (Figure 6). OLS show a strong positive correlation between forecasting accuracy and firm size. It may also be of interest to note that the small subsample of banks that can be isolated within the SEIG also exhibit a better-than-average forecasting performance.

A test (Giacomini and White, 2006)[10] can be run on the aggregate estimates to check if their out-of-sample predictive power is significantly different. Results in Table 5 suggest that the series aggregated on bigger firms (IT12_CLD_3) exhibits a higher predictive power than IT12.

Since firm price changes should eventually affect overall inflation, some suggest that survey forecasts of own price changes, although possibly biased as such, should contain some information on future inflation. An apparent feature of SEIG own price changes (both

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[8] The first values of the series have no statistical significance, being based on a handful of time points. The reader should focus on the right half of the graph.

[9] For the definitions of turning point and of direction-of-change see Theil (1961, 1966). To avoid spurious matches due to the chosen accuracy (1 decimal digit) for forecasts and realizations, the former have been added 0.05 when on LHS, subtracted 0.05 when on RHS of a "<" inequality, and vice-versa.

[10] This test is based on a comparison between the series of errors of the two forecasts at stake, the null hypothesis being of equal predictive power.

declared realizations and forecasts) is that they are very often lower than realized inflation and lower than forecasts for general inflation. This is true of the aggregates (Figure 7) but also of microdata, with almost 70% of firms overall showing the same behaviour individually. Although there could be many explanations for this, a plausible starting point for further analysis could be the hypothesis of a form of social desirability (interviewed firms would not want to be blamed for general inflation). Nevertheless, a preliminary analysis shows that the cross-correlation between projected own price changes and actual inflation is positive for leads between 4 and 6 quarters, which would indicate some forecast content on general inflation 24 to 30 months ahead. This will be the subject of further research.

4. Conclusion and further work

This paper describes the main features of the aggregate forecasts of Italian inflation (as measured by the harmonized index of consumer prices (HICP) computed by Eurostat) collected within the Survey of Expectations of Inflation and Growth (SEIG) run by the Bank of Italy. Evidence to date shows that the forecasting power of SEIG estimates, measured by Theil's U statistic, is broadly comparable to Consensus Forecasts, a commonly used source of quantitative inflation forecasts, over the same time horizon (12 months ahead), although both forecasts are heavily influenced by data available at the time of the interview. A better performance within the SEIG, also confirmed by a test suggested by Giacomini and White (2006), is shown by forecast estimates aggregated on bigger firms only.

The number of observations over time is relatively low as yet, and the expectations collected show some limitations, mainly, the absence of revised estimates on the same time horizon, which is, on the contrary, available for Consensus Forecasts. Yet there seems to be no reason to exclude SEIG data from serious consideration. The panel dimension allows for the possibility of microeconomic analysis on expectation formation; clusters of "best forecasters", possibly homogeneous with respect to some economic features, could be detected. A composite HICP forecast could be constructed, integrating SEIG estimates with other sources: it is graphically apparent, for example, that a simple linear interpolation of IT12 and CONS would have easily constituted, in the period under study, a forecast more accurate than the two single estimates. In this case, a composite index could exploit the distinct skills of two "forecasters", i.e. IT12 being more accurate in low volatility and CONS being more accurate in high volatility. Quantitative data on firms' own price changes could allow us to study the link between these measures and production prices on one hand, and general inflation on the other.

Possible developments of the SEIG survey are currently being debated within the team. Improvements proposed include a split sample test to verify the sources of the correlation between current inflation data and the forecasts provided; and asking participants for a whole forecasting curve (e.g. 3-6-9-12 months ahead…), which would provide a useful third panel dimension, as suggested in Davies and Lahiri (1995).

Tables and figures

Table 1

Composition of sample and sampling universe

Number of firms, percentages; March 2010

	Sample size (a)	Universe of firms[1] (b)	Sample coverage rate (a / b) * 100
Size class			
50-199 employees	199	17,490	1.1
200-999 employees	164	3,513	4.7
1,000+ employees	110	500	22.0
Sector			
Industry	283	11,727	2.4
Services	190	9,776	1.9
Geographical area			
North-West	183	8,484	2.2
North-East	153	6,134	2.5
Centre	82	3,774	2.2
South and Islands	55	3,111	1.8
Total	**473**	**21,503**	**2.2**

(1) Source: Italian National Institute of Statistics (Istat) (2007).

Table 2

Response rates and data collection via the Internet

Number of firms, per cent; March 2010

	Firms contacted	Response rate[1]	Data collected via the Internet[2]
Size class			
50-199 employees	576	33.9	95.4
200-999 employees	298	53.7	95.0
1,000+ employees	122	84.4	99.0
Sector			
Industry	558	47.3	96.2
Services	438	44.3	95.9
Geographical area			
North-West	394	43.9	98.3
North-East	301	50.2	96.7
Centre	166	51.2	91.8
South and Islands	135	36.3	93.9
Total	**996**	**46.0**	**96.1**

(1) Percentage of companies contacted that were interviewed. (2) Percentage of firms interviewed that completed the questionnaire via the Internet.

Figure 1

HICP forecasts and realizations, 2000q4-2010q1

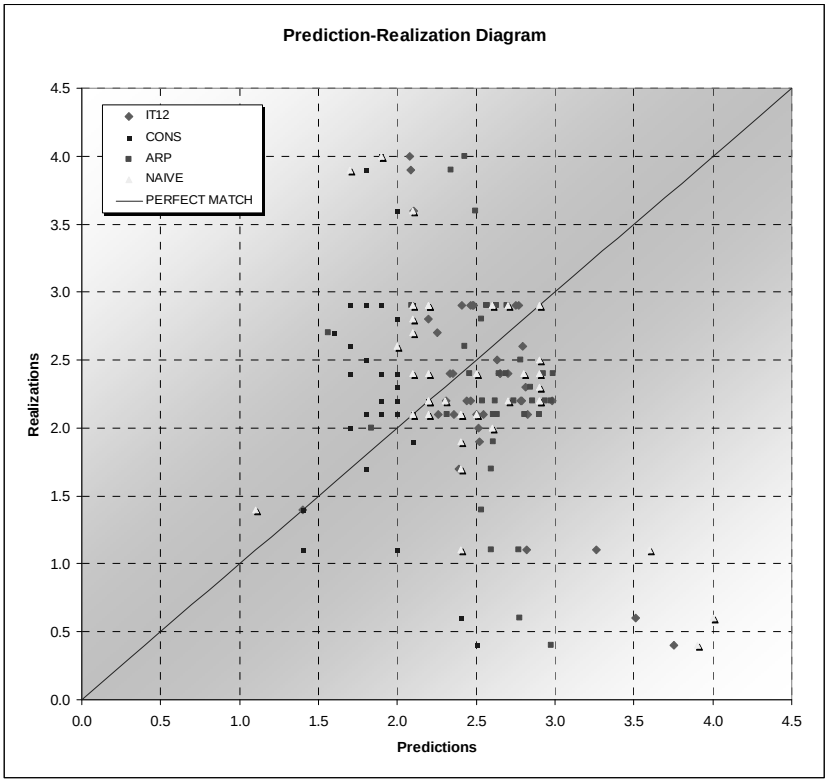

Figure 2

HICP forecasts and realizations, 2000q4-2010q1 (robust diagram)

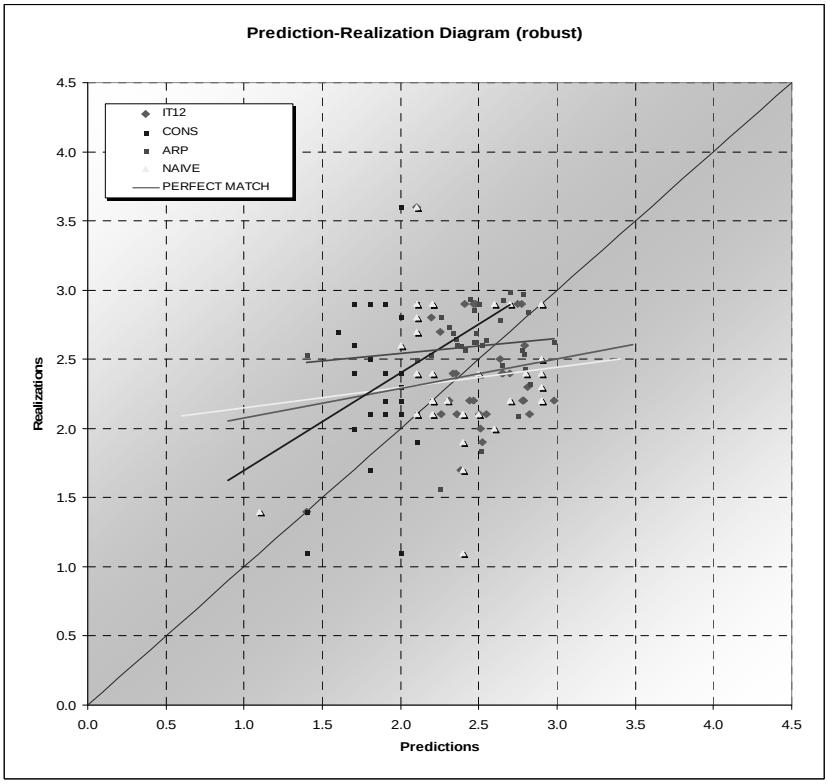

Figure 3

Quarterly inflation forecasts of HICP and realizations over time

Per cent

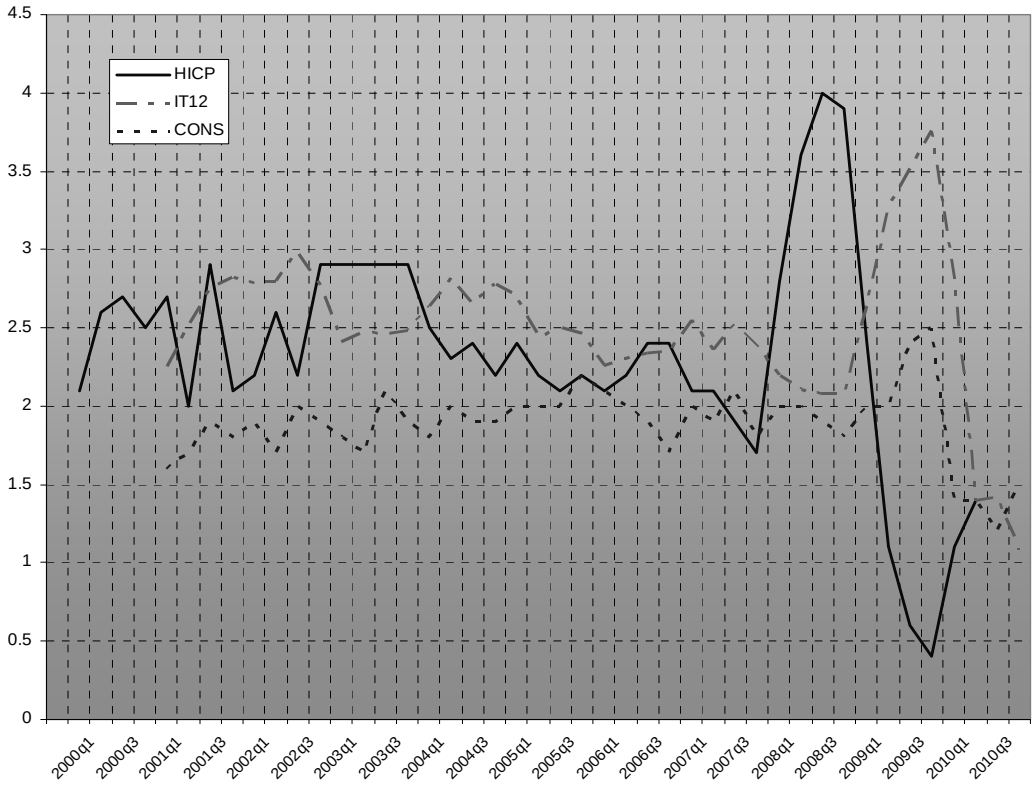

Figure 4

Cross-correlation between forecasts and realizations at different time lags

Pearson's ρ

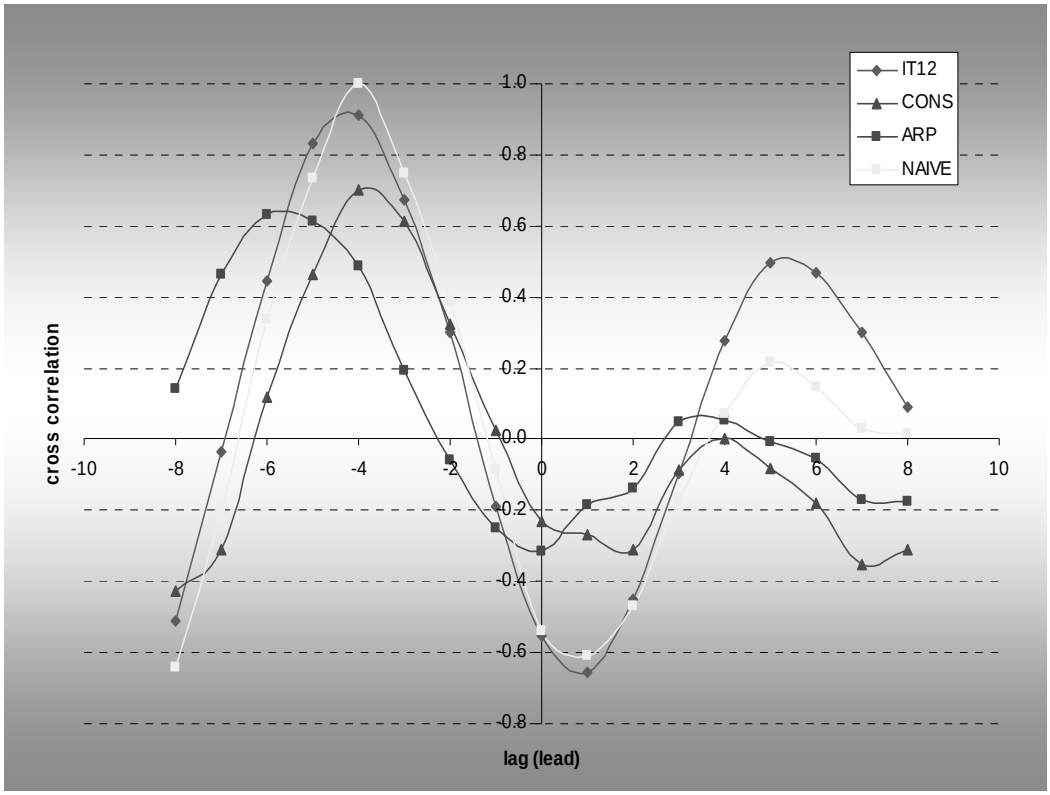

Figure 5

RMSFE of forecasts relative to the naive forecast (Theil's U) over the forecasting exercises

% units of RMSFE of the naïve forecast

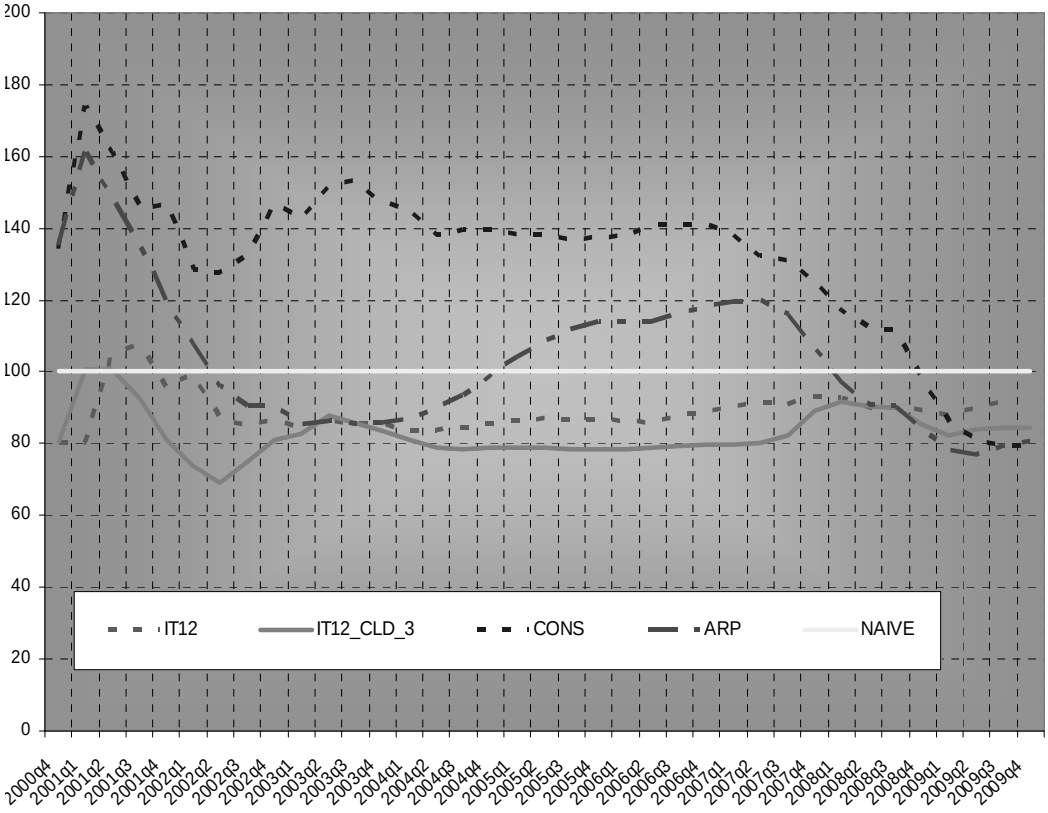

Figure 6

Inflation forecasts, by firms' size class

Per cent

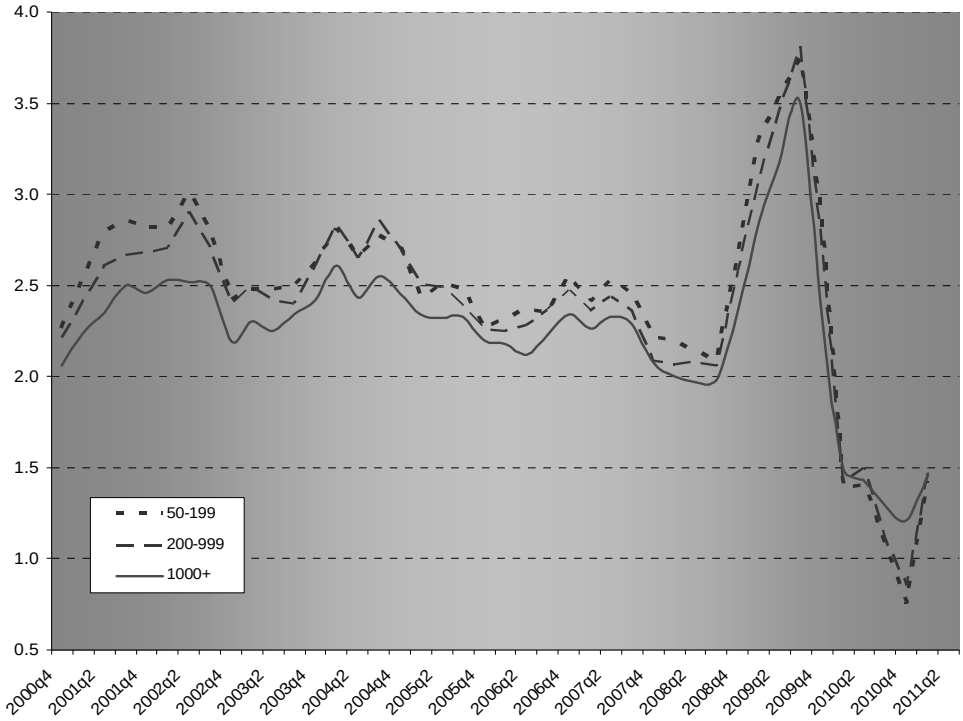

Table 3

RMSFE and Theil's U of HICP forecasts for Italy(1)

	IT12	CONS	ARP	NAIVE
RMSFE(2)	1.07	0.97	0.93	1.15
Theil's U(3)	0.92	0.79	0.81	1.00

(1) Based on 38 observations (2000q4 to 2010q1). (2) Percentage points. (3) RMSFE of the forecasts as a percentage of RMSFE of the naive forecast.

Table 4

RMSFE and Theil's U of HICP forecasts for Italy: estimates from subgroups[1]

	Size class			Geographical area				Sector				Total	Naive
	50-199	200-999	1,000+	North-West	North-East	Centre	South/ Islands	Indus-try	Services	Banks	Non-banks		
RMSFE[2]	1.07	1.05	0.98	1.08	0.98	1.05	1.10	1.08	1.06	0.98	1.07	1.07	1.15
Theil's U[3]	0.92	0.91	0.84	0.93	0.84	0.91	0.95	0.93	0.91	0.84	0.92	0.92	1.00

(1) Based on 38 observations (2000q4 to 2010q1). (2) Percentage points. (3) RMSFE of the SEIG aggregate forecast as a percentage of RMSFE of the naive forecast.

Figure 7

Own prices and general inflation: expectations and realizations

Per cent

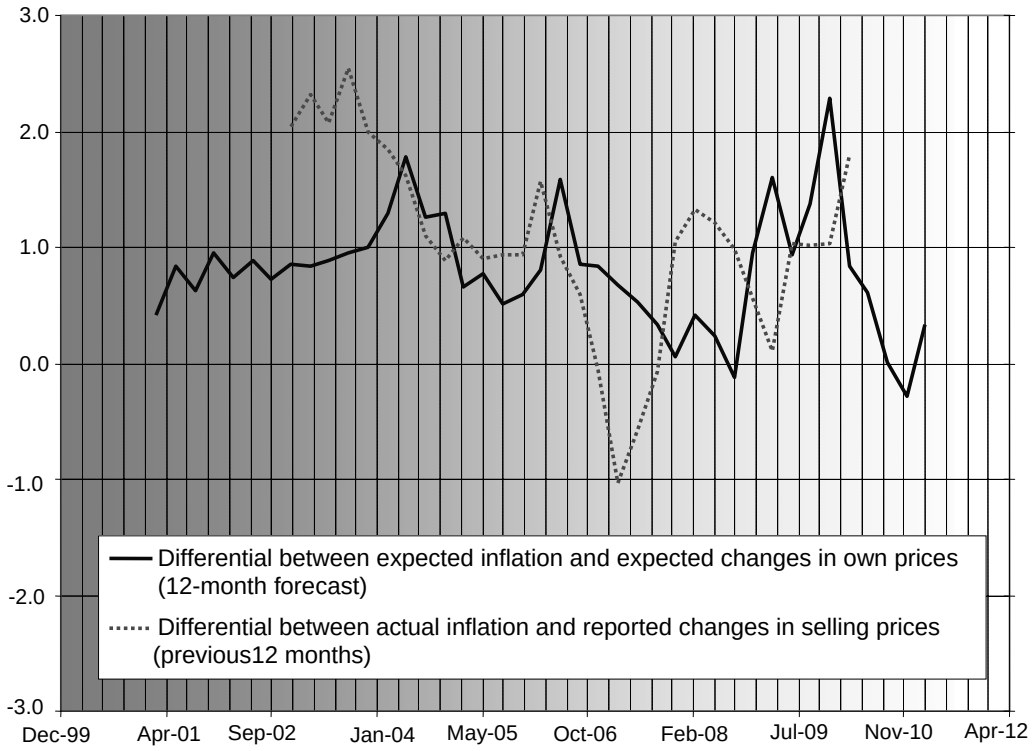

Table 5

Giacomini-White test of conditional predictive power[1]

IT12 compared to	IT12_CLD_3	CONS	ARP	NAIVE
GW	3.364*	1.057	1.785	3.458*
p-value[2]	(0.066)$^{+}$	(0.304)	(0.182)	(0.063)$^{-}$

(1) Based on 38 observations (2000q4 to 2010q1). – Null hypothesis of equal predictive power rejected at the confidence level of : *** 1%, ** 5%, * 10%. – (2) Plus sign: IT12 is outperformed (higher RMSFE) by the comparison series; minus sign: IT12 outperforms (lower RMSFE) the comparison series.

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