Do Households Anchor their Inflation Expectations? Evidence from a Quantitative Survey on Italian Consumers

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Motivation - 1

Households' expectations are included in most models explaining aggregate outcomes, such as business cycle and inflation dynamics

However, how households form their expectations is less studied and understood

Recent influential papers have introduced different approaches to expectations formation, including:

- Rational inattentive behaviors (Reis, 2006a; 2006b)
- Sticky information expectations (Mankiw and Reis, 2002; 2007)
- Epidemiological expectations (Carroll, 2003; 2006)
- Anchored expectations (Bernanke, 2007; Levin et al 2004; Blanchflower and Mac Coille, 2009)

Motivation - 2

In this paper, we will use a new dataset to bring together two of these recent important strands of research:

- 'anchoring' and Central Banks inflation targeting
- 'sticky information / epidemiological expectations'

The research questions we try to answer are the following:

- To whom do households anchor when forming their inflation expectations?
- Do they, in the long run, anchor on professional forecasters or on the central bank targets? → *cost of acquiring information*
- Are these anchors mutually exclusives? → *hedge the bets under uncertainty*

The Model (component one)

Bridges the gap between anchoring and sticky / epidemiological information models by nesting sticky information and anchoring models in both the short and the long run dynamics.

Simple **excess sensitivity model**, where changes in households inflation expectations $E_t^h(\pi_{t+1})$ depend on changes in both their own perceptions $\pi_t^{P,h}$ and the known rate of inflation π_t

(1) $$\Delta E_t^h(\pi_{t+1}) = \alpha + \beta' \Delta \pi_t + \beta'' \Delta \pi_t^{P,h} + \varepsilon_t$$

Two major drawbacks of model (1):

- disregards level relationships (long-run anchoring)
- does not allows for the role of professional forecasts

The Model (component two)

The **epidemiological model** can be depicted as follows:

$$(2) \quad E_t^h(\pi_{t+1}) = \lambda E_t^F(\pi_{t+1}) + (1-\lambda)E_{t-1}^h(\pi_t) + \varepsilon_t$$

Level-relationship dynamics: partial adjustment (PA) mechanism with respect to the professional forecasts $E_t^F(\pi_{t+1})$

- The PA mechanism can be generalized in an error correction specification (EC), where short and long run dynamics are not restricted to share the same speed of adjustment λ

- Combining equation (1) and (2) in EC form and adding the possibility of anchoring on a Central Bank target π^T we obtain the error correction representation of households' expectations

Our Model

$$\Delta E_t^h(\pi_{t+1}) = \lambda_{11}\Delta E_t^F(\pi_{t+1}) + \lambda_{12}\Delta\pi_t^{P,h} + \lambda_{13}\Delta\pi_{t-1}$$
$$+ \lambda_2[E_{t-1}^h(\pi_t) - \phi_1 E_{t-1}^F(\pi_t) - \phi_2\pi_{t-1}^{P,h} - \phi_3\pi_{t-2} - \phi_4\pi^T] + \varepsilon_t$$

Dynamics:

- The λ_{1i} parameters measure **short run** fluctuations to changes in:
  - professional forecasts (i = 1);
  - perceived inflation (i = 2)
  - actually known inflation (i = 3)

- The λ_2 parameter measures the speed of adjustment towards the **long run** level relationship

$$\Delta E_t^h(\pi_{t+1}) = \lambda_{11}\Delta E_t^F(\pi_{t+1}) + \lambda_{12}\Delta\pi_t^{P,h} + \lambda_{13}\Delta\pi_{t-1}$$
$$+ \lambda_2[E_{t-1}^h(\pi_t) - \phi_1 E_{t-1}^F(\pi_t) - \phi_2\pi_{t-1}^{P,h} - \phi_3\pi_{t-2} - \phi_4\pi^T] + \varepsilon_t$$

Long run:

- The four ϕ_i parameters measure the relative weights in setting the long run households expectations for:
  - professional forecasts (i = 1)
  - perceived inflation (i = 2)
  - actual inflation rate (i = 3)
  - inflation target (i = 4)

Restrictions:

- A number of restrictions may be empirically tested:
  - if $\lambda_2 = 0$, relations in levels may be excluded and the excess sensitivity model is data-congruent
  - if $\lambda_{12} = \lambda_{13} = 0$; $\phi_2 = \phi_3 = \phi_4 = 0$; $\lambda_{11} + \lambda_2 = 0$; $\phi_1 = 1$ the pure-epidemiological model is data-congruent

Data for $E_t^h(\pi_{t+1})$ $\pi_t^{P,h}$ $E_t^F(\pi_{t+1})$ π_t

ISAE source: individual **inflation expectations** and **perceptions** over the next and past 12 months since Feb 2003, in the framework of the harmonized EU project. 83 waves from Feb 2003 to Dec 2009; repeated cross-sections (no individuals over time)

Professional forecasts for Italy are obtained pooling inflation forecasts of different national and international institutes

Actual inflation rate: y-o-y or annualized m-o-m CPI monthly growth rate

The empirical strategy

Three alternative levels of aggregation may be used in the analysis:

1) individual data
2) single time series (monthly averages of individual answers)
3) group-specific time series (individual survey characteristics, such as gender, age, education, employment)

The data may be accordingly analyzed with different econometric instruments:

1) as repeated cross-sections (N*T ≅ 120,000)
2) as single time series (T = 83 months)
3) as a pseudo-panel (T = 83; N = 7, 8 or 10)

The results:
Repeated cross–sections analysis

We can assess whether individual characteristics are correlated with inflation expectations by OLS estimating dummy variables models where individual expectations are explained by characteristics and time.

About 120,000 individual observations

Most of category deviations from the reference group are significant (as usually found in this literature)
Largest differences: Self employed or aged more 64 years (-1%)
Low educated people (+1%)
Women have higher expectations than men

For the complete picture see Table 1

What about if we add perceived and consensus inflation (and interactions?) See Table 2

The results: time series analysis - 1

Missing element in repeated cross-section models: dynamics

Solution: aggregation of survey data at the country level and considering a first order ARDL model, where *h* = *M*

Five main outcomes:

- a long run level-relationship between households' inflation expectations and consensus forecasts
- speed of adjustment: 30% of the gap is closed in the first month
- actual and perceived inflation do not play a long-run role
- the long-run target effect shows high variability
- explains more than 35% of inflation expectations variability

$$\Delta E_t^M(\pi_{t+1}) = \lambda_{11}\Delta E_t^F(\pi_{t+1}) + \lambda_{12}\Delta \pi_t^{P,M}$$

$$+ \lambda_2[E_{t-1}^M(\pi_t) - \phi_1 E_{t-1}^F(\pi_t) - \phi_4 \pi^T] + \varepsilon_t$$

The results: time series analysis - 2

In the long run households' forecasts are tied to the level-relationship:

$$E^{M}(\pi^{*}) = \phi_1 E^{F}(\pi^{*}) + \phi_4 \pi^{T}$$

If consensus forecast is represented by AR(*p*), it collapses to the long run solution:

$$E^{F}(\pi^{*}) = \frac{\beta_0}{1 - \sum_{k=1}^{p} \beta_k} \approx 1.8 / 2.2\%$$

Results point to a 5.1 / 6.4 range for households' expected inflation, a figure well above the ECB target.

The need for pseudo-panels

Cross section and time series have shown some interesting results:

- inflation expectations are significantly heterogeneous across socio-demographic groups
- at the aggregate level they adjust in the short run to the consensus and perceived inflation, being driven by consensus alone in the longer term

Drawbacks:

Cross sections estimates are biased by the lack of the time dimension
Time series can be biased due to heterogeneity emerging from data

Solution:

To repeat the analysis using pseudo panels with alternative grouping rules (see Table 4)

The pesudo panel model

The panel-heterogeneous specification of the model is:

$$\Delta E_t^h(\pi_{t+1}) = \lambda_{11}^h \Delta E_t^F(\pi_{t+1}) + \lambda_{12}^h \Delta \pi_t^{P,h} + \lambda_{13}^h \Delta \pi_{t-1}$$
$$+ \lambda_2^h [E_{t-1}^h(\pi_t) - \phi_1^h E_{t-1}^F(\pi_t) - \phi_2^h \pi_{t-1}^{P,h} - \phi_3^h \pi_{t-2} - \phi_4^h \pi^T] + \varepsilon_t^h$$

After non rejected restrictions, pooled mean group (PMG) estimation, see Pesaran et al. (1999) of the model:

$$\Delta E_t^h(\pi_{t+1}) = \lambda_{11}^h \Delta E_t^F(\pi_{t+1}) + \lambda_{12}^h \Delta \pi_t^{P,h}$$
$$+ \lambda_2^h [E_{t-1}^h(\pi_t) - \phi_1^h E_{t-1}^F(\pi_t) - \phi_4^h \pi^T] + \varepsilon_t^h$$

The results: pesudo panel analysis - 1

$$\Delta E_t^h(\pi_{t+1}) = \lambda_{11}^h \Delta E_t^F(\pi_{t+1}) + \lambda_{12}^h \Delta \pi_t^{P,h}$$

$$+ \lambda_2^h [E_{t-1}^h(\pi_t) - \phi_1^h E_{t-1}^F(\pi_t) - \phi_4^h \pi^T] + \varepsilon_t^h$$

Inflation expectations show in the short-run sensitivity to:

- changes in consensus forecasts
- perception of current inflation rates.

A level relationship do exists with heterogeneous speeds and heterogeneous long run inflation expectations (different intercepts)

Households anchor their inflation expectations only on consensus forecasts – no role for current inflation is found in the analysis

Long run solutions for inflation expectations are much higher than the ECB target, even tough consensus forecasts approximate the target

The results: pesudo panel analysis - 2

Absorption rates (minus the speed of adjustment) are higher:

- the higher the level of education
- for the workers vs. non-workers
- for self employed vs. dependent workers
- for those aged 50-64
- for males vs. females

Similarly, long run inflation expectations:

- tend to decrease the higher the level of education
- for men vs. women (the distance among men and women decreases with age and level of education

The amplitude of the interval of estimation for long run expectations is similar across groups (long run solutions being always above ECB target)

Extension to non-linearity

Possible non linear relationships between current inflation (excluded above), expectations, and professional forecasts, by following the future direction (**momentum**) of the latter through:

$$gap_t = \frac{E_t^F(\pi_{t+1}) - \pi_{t-1}}{se_t^F(\pi_{t+1})}$$

Idea: households react differently if professional forecasts are above/below the current level of inflation (different parameters for positive and negative gaps).

Results: positive momentum are associated with:

- an higher long run reactivity to professional forecasts
- higher absorption rates (which is maximum for female blue collar workers), i.e. higher speed of adjustment
- nonlinear effects (long-run vanishing) lower steady state households' expected inflation, but still above ECB target

Conclusions - 1

Cross section, time series and pseudo panels depict a coherent picture on how households form their inflation expectations.

In the **short run** agents adjust to changes in professional forecasts and perceptions, but not to actual inflation

A **long run** level relationship among expectations and professional forecasts is always found, but the latter proxy ECB targets, while households do not (their expected inflation in the l.r. is higher).

Both long run solution for inflation expectations and the speed of adjustment to it **differ across socio-demographic groups**:

- speed of adjustment is growing with age, level of education, being higher for men
- similarly, long run solutions are lower for men with higher education and self employed; the gender gap is decreasing with age

Conclusions - 2

Future inflation direction (**momentum**) exerts asymmetric effects on households' inflation expectations (households are more concerned by rising inflation)

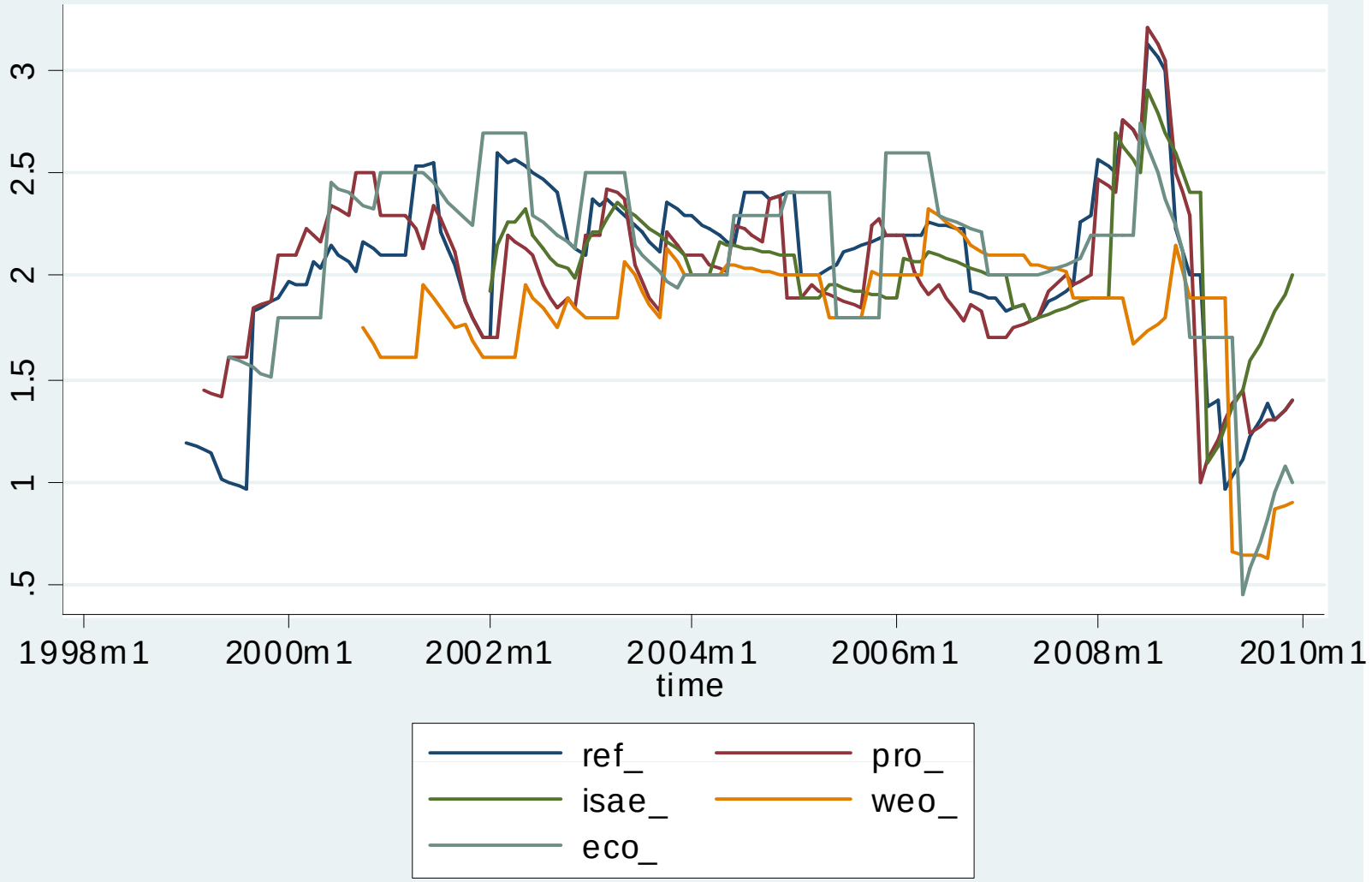
Long run solutions of households inflation expectations are always above the ECB target, a result questioning its credibility

For Italy, it is possible that households are not sufficiently aware of the target, given that this tool was not exploited before EMU

Further research is advisable, by extending our analysis to other Euro Area countries with a different tradition in the conduct of monetary policy

Thank you for your Attention

The Dataset: Professional Forecasts



Repeated cross–sections analysis: Table 1, part 1

	# obs. (1)	% share (2)	mean (3)	std. dev. (4)	% points deviation from reference group [a, b] (5) [c]	(6) [d]
Employment						
- self-employed	10288	8.9	4.6	10.8	-1.036 ***	-1.004 ***
- white collar	29687	25.6	5.6	12.2		
- blue collar	11684	10.1	6.6	13.8	0.557 ***	0.487 ***
- pensioner	31916	27.6	5.1	11.7	0.178	0.205
- other [e]	32214	27.8	6.2	13.8	0.334 **	0.295 **
Education						
- university	11918	10.3	4.9	10.9	-0.385 ***	-0.316 ***
- upper secondary	45514	39.3	5.5	12.3		
- lower secondary	35757	30.9	6.0	13.1	0.587 ***	0.627 ***
- elementary	22600	19.5	5.7	13.1	0.931 ***	0.987 ***
Full sample	115789	100.0	5.6	12.6	5.621 ***	5.659 ***

([a]) The reference group is: white collar employee, upper secondary educated, male, and aged 30-49.

Repeated cross–sections analysis: Table 1, part 2

	# obs.	% share	mean	std. dev.	% points deviation from reference group [a, b]	
	(1)	(2)	(3)	(4)	(5) [c]	(6) [d]
Gender						
- male	57824	49.9	5.3	11.7		
- female	57965	50.1	6.0	13.4	0.482 ***	0.510 ***
Age						
- < 30	11138	9.6	6.3	14.0	0.113	0.071
- 30 – 49	40736	35.2	6.0	13.1		
- 50 – 64	33629	29.0	5.6	12.4	-0.733 ***	-0.685 ***
- > 64	30286	26.2	4.9	11.5	-1.767 ***	-1.655 ***
Full sample	115789	100.0	5.6	12.6	5.621 ***	5.659 ***

([a]) The reference group is: white collar employee, upper secondary educated, male, and aged 30-49.

Repeated cross-secion analysis: Table 2, part 1

	only individual characteristics	plus time effects	plus perceived inflation, consensus, and interactions
P-values of joint zero restrictions to: [b]			
individual characteristics	0.0000	0.0000	0.1247
- employment	0.0000	0.0000	0.5458
- education	0.0000	0.0000	0.0112
- gender	0.0000	0.0000	0.1324
- age	0.0000	0.0000	0.8187
time effects		0.0000	0.0000

Repeated cross-secion analysis: Table 2, part 2

	only individual characteristics	plus time effects	plus perceived inflation, consensus, and interactions
interaction of individual characteristics with			
perceived inflation			0.0000
- employment			0.0000
- education			0.0544
- gender			0.2819
- age			0.0434
consensus forecast			0.0022
- employment			0.1565
- education			0.0001
- gender			0.1944
- age			0.9605
R^2	0.0044	0.1868	0.2984
# parameters	12	95	118

Psesudo-panel “individuals”

	Male	Female	Working	Not working
	panel # 2		***panel # 1***	
University	1 (5.0)	2 (4.3)	1 (6.7)	2 (2.5)
Upper secondary	3 (19.2)	4 (16.9)	3 (22.0)	4 (14.1)
Lower secondary	5 (15.5)	6 (15.5)	5 (10.8)	6 (20.1)
Elementary	7 (8.4)	8 (15.4)		7 (23.8)
	panel # 3			
Self-employed	1 (5.9)	2 (2.3)		
White collar	3 (12.9)	4 (10.2)		
Blue collar	5 (6.5)	6 (3.2)		
Pensioner	7 (18.3)	8 (11.8)		
Other [b]	9 (4.3)	10 (24.6)		
	panel # 4			
Age < 30	1 (4.5)	5 (3.9)		
30 – 49	2 (15.6)	6 (16.9)		
50 – 64	3 (14.0)	7 (14.9)		
> 64	4 (13.8)	8 (16.5)		