Heterogeneity of Firms' Expectation and its Aggregate Implications

A Discussion of [Coibion et al., 2015]

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Outline

1. Summary
2. Discussion
3. Macro Implications

Before the Detailed Results: An Overview of Theories of Expectation Formation

- **Adaptive Expectation**: backward-looking, thus history enters the future expectation.
- **Rational Expectation**: completely forward-looking, identical across agents and model consistent, therefore can be summarized by a representative agent expectation.
- **Learning**: bounded rationality, learning from the signals to make the best guess of the underlying process, as econometricians do.
- **Information Rigidity**: sluggish in updating expectation due to various information frictions.
- **Rational Inattention**: mental cost of processing sparse information. Therefore, rationally allocate attention to important information. Not purely ignorance, there is a rationale.
- **Behavioral Theories**: macro histories experienced, demographic factors and econ-social status systematically cause heterogeneity in expectations.

Expectation Formation: from Theories to Empirics

- An active discussion in expectation formation mechanisms of economic agents: firms and households.
- Ample evidence of heterogeneity of expectations, but what are the drivers?
- A long list of theories of expectation formation mechanisms.
- Empirical tests using firms' expectation data are useful to provide insights.

Survey Data of New Zealand Firms

- **Real Decision Makers**. Firms' managers (different from professional forecasting); likely less behavioral bias compared to households.
- **Panel Structure.** Multiple waves of survey in panel structure. Extremely useful to understanding the expectation formation.
- **Not only about Tomorrow.** Asked about both current and future economic conditions.

Summary of Findings

- Wide dispersion under inflation targeting regime.
- Direct evidence of inattention by showing the firms' belief of current or recent past economic conditions are not update to date.
- Perception of current economic conditions and future expectations are correlated.
- A rational-inattention story: inflation-sensitive business pays more attention.

Paper's Findings I: Stylized Facts on Expectation Heterogeneity

- **Mean Upward Bias**. Average expectation over-predicts inflation.
- **Dispersion**. More dispersion than professional forecasting, but less than households. Under an inflation targeting regime.
- **Not driven by Confusion of Object Asked**. Similar answers given to questions worded differently about aggregate inflation.
- **Probabilistic Questions Coincide with Point Expectation**.
- **Firm-specific and Aggregate Questions Yield Different Answers**. Relative price and aggregate price are perceived as different and uncorrelated objects by firms.

Paper's Finding I. Stylized Facts

- View of current conditions correlated with future expectations.
- Mean and dispersion in the same magnitude.

Table 2: Beliefs about Future and Past Values of Macroeconomic Variables.

Variables	No firm fixed effects	Firm fixed effects
	(1)	(2)
Inflation rate, aggregate	0.339***	0.286***
	(0.025)	(0.044)
N	5,130	3,531
R^2	0.389	0.730
Inflation rate, industry	1.038***	
	(0.014)	
N	1,154	
R^2	0.959	
Unemployment rate	0.863***	0.758***
	(0.012)	(0.091)
N	1,842	770
R^2	0.826	0.828
GDP growth rate	0.909***	
	(0.010)	
N	1,194	
R^2	0.928	
Exchange rate	0.998***	
	(0.002)	
N	1,035	
R^2	0.994	

Paper's Findings II: Inattention

- **Measure.** Nowcasting errors greater than 2 percentage points grouped as uninformed firms. Compare the distribution of forecasts of two groups.
- **Distribution of Errors**. Forecasts by informed firms is more concentrated than that for uninformed firms.
- **Asymmetry.** Perception of current inflation $>$ actual.
- **Drivers**: industry characteristics.

Paper's Findings II: Inattention

- Expectation of informed group is more concentrated and less skewed.
- But the uninformed group learn over time.

Figure 3: Distribution of Inflation Expectations across Firms.

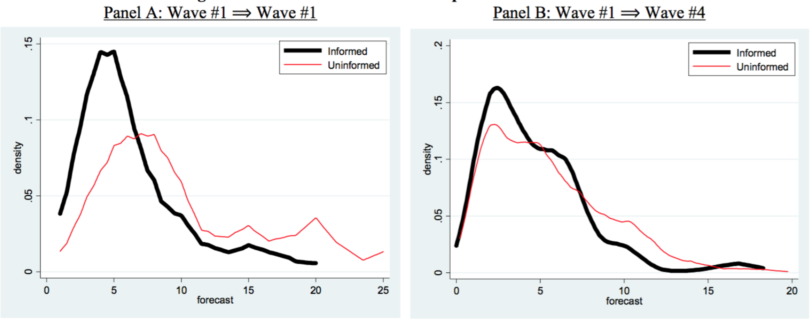
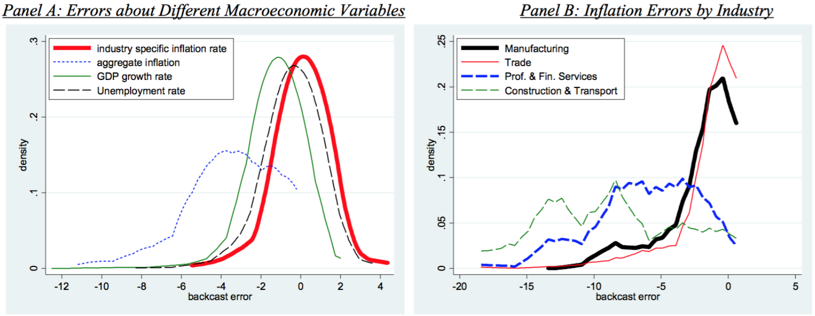


Figure: Informed and Uninformed Group

Paper's Findings II: Inattention

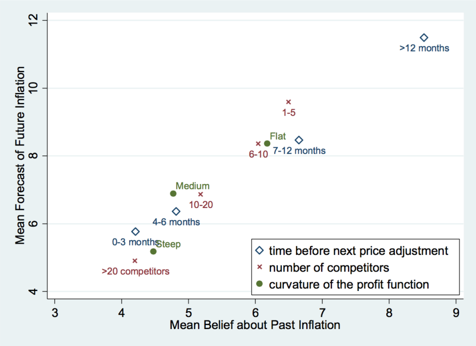
Figure 4: Distributions of Errors about Recent Macroeconomic Conditions



Paper's Findings II: Determinants of Inattention

- Firms with **more competitors**, which **expect to change their prices sooner**, with **steeper profit functions** are more attentive. They also have lower backcasts and forecasts of inflation.
- Larger and older firms are less attentive.
- Managers' personal characteristics do not matter.

Figure 5: Inflation Backcasts and Forecasts by Firm Characteristic



Paper's Findings II: Persistence of Inattention

- **Measure of persistence**: auto regression coefficient of the nowcasting(backcasting) errors across different waves of the survey. i.e. does the firms' misperception carry through over time?
- **Estimates**: 0.75 between two waves 5 months apart. Quarterly rate of 0.83.Broadly in line with the estimates of information rigidity.

Paper's Findings III: Information Choice and Learning

- Let us provide different information to firms and compare their prior and posteriors.
- Estimate the sensitivity of expectation to new information.
- New information provided include central bank target, professional forecasting, recent statistics, etc.
- Consistent with Bayesian learning. Revision toward signal and more so when they are more uncertain.
- In the long-run, the effects of being communicated with inflation target disappear.

Paper's Findings III: Information Choice and Learning

- **Rank of Information by Importance** Half firms rank Inflation as the least important variable.
- **Importance Revealed by Information Investment** How much resource firms are willing to pay to be updated of the variable.
- **More important variables, more up to date and smaller errors.** There is a rationale.
- **Time-invariant Pattern of Information Acquisition** Less competition and smaller share of foreign sale invest less on information.
- **State-Dependence of Information Acquisition** More up-to-date on bad news but not so in good news.

Paper's Findings III: Strategic Complementarity (SC)

- Related but different from an old literature on coordination failure of price setting.
- Firms with higher levels of SC prefer "common signal" over "private signal". [Hellwig and Veldkamp, 2009]
- **Measure of SC.** Sensitivity of revenues to competitors' price changes.
- **Measure of Preference over Public versus Private Signal.**
- Higher SC, more preference of public signal over private signal.

Paper's Findings: Summary

- **Rational Expectation** X
- **Adaptive Expectation** Half ✓
- **Learning** ✓
- **Information Rigidity** ✓
- **Rational Inattention** ✓
- **Behavioral Theories** ?

How does it fit in the bigger discussion?

- Rational Expectation = Identical + Model Consistent.
- Different evidence shakes the first assumption. Heterogeneity in expectation.
- Drivers of heterogeneity?
    - **Heterogeneity of the object**. Simply talk about different things.
    - **Heterogeneity in information in the first place**.
    - **Heterogeneity in processing the same information**
- This paper tells that, mostly, it is the second.

What have we learned since adaptive expectation?

- True, we cannot talk about future without talking about recent past or now. (Expectation surveys need to ask both.)
- But even the recent past is not just free out there.
- Wait, maybe not simply blind ignorance...
- Firms characteristics seem to have some explanatory power.
- Since the average inflation is lower and less volatile than before, firms choose to pay less attention to the inflation.

Extensions

- **What They Really Care.** e.g. house price for households.
- **Density Forecasts.** There is useful information beyond point estimates. Density forecasts can be better used, i.e., two expectations with same mean but different variances may reflect different level of uncertainty.
- **Different Agents.** No reason to believe households, firms' managers and professional forecasts share the same expectation formation mechanism.
- **More Behavioral.** Beyond demographic characteristics, different past experience may lead to heterogeneity of expectation.

To what extent it matters for macro dynamics?

Heterogeneity that does not matter

- Law of large numbers holds and aggregate expectation errors cancel out;
- Or making independent assumptions so that we can easily aggregate. (e.g. Poisson process of updating.)

Heterogeneity that does matter

- Further distorts the price signal: increase in price dispersion.
- Slower speed of adjustment to economic shocks.
- Interaction and amplification of economic shocks.
- Different expectations + different MPCs matter.

If yes, then how do we capture this in macro modeling?

1. Approach 1. Using micro data to test expectation formation mechanisms and choose the "right" theory in macro modeling.
2. Approach 2. Using micro surveys directly in a heterogeneous environment
   - Assume a distribution of inflation expectations across firms;
   - Household expectation in DIS and firms' expectation in NKPC?
3. Approach 3: Find a good summary statistic of cross-sectional expectation.
   - Mean versus Median, it is not that clear.
   - How about include a measure of dispersion?

Conclusion

- Much work can be done!
- It is INTERESTING.
- We need better data.

Coibion, O., Gorodnichenko, Y., and Kumar, S. (2015).
How do firms form their expectations? new survey evidence.
Technical report, National Bureau of Economic Research.

Hellwig, C. and Veldkamp, L. (2009).
Knowing what others know: Coordination motives in information acquisition.
The Review of Economic Studies, 76(1):223–251.