NO FIRM IS AN ISLAND?

HOW INDUSTRY CONDITIONS

SHAPE FIRMS’ AGGREGATE EXPECTATIONS

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FRB Boston              UT Austin and NBER     Banque de France      UC Berkeley and NBER

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The views expressed here are those of the authors and should not be interpreted as reflecting those of the Banque de France, the Eurosystem, the Federal Reserve Bank of Boston, or the Federal Reserve System.
Motivation

(what Francesco said)
WHAT WE KNOW ABOUT FIRMS’ MACRO EXPECTATIONS

• They show the same order of disagreement as do households.
What we know about firms’ macro expectations

- They show the same order of disagreement as do households.

<table>
<thead>
<tr>
<th>Survey Date</th>
<th>Recent data(c)</th>
<th>1-year ahead CPI forecasts</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
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</tr>
<tr>
<td></td>
<td></td>
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<td>2018Q4</td>
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<td>2019Q2</td>
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<tr>
<td>2019Q3</td>
<td>1.7</td>
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</tr>
<tr>
<td>2019Q4</td>
<td>1.8</td>
<td>2.1</td>
</tr>
</tbody>
</table>
**WHAT WE KNOW ABOUT FIRMS’ MACRO EXPECTATIONS**

- They show the same order of disagreement as do households.

- Firms’ attention is related to incentives:
  - Time to next price change (CGK 2018)
  - Curvature of profit function (CGK 2018)
  - Competition (Afrouzi 2018)
  - Number of products (Yang 2019)
WHAT WE KNOW ABOUT FIRMS’ MACRO EXPECTATIONS

- They show the same order of disagreement as do households.

- Firms’ attention is related to incentives.

- As with households, exogenous changes in inflation expectations affect firms’:
  - prices (CGR 2019)
  - employment (CGK 2018, CGKR 2019, CGR 2019)
  - investment (CGK 2018, CGKR 2019, CGR 2019)
  - profits (CGR 2019)
HOW CAN WE EXPLAIN PERVERSIVE DISAGREEMENT?

- Managers form expectations based on their individual experiences (d’Acunto et al. 2019)
HOW CAN WE EXPLAIN PERVERSIVE DISAGREEMENT?

- Managers form expectations based on their individual experiences (d’Acunto et al. 2019)

- Firms rely on their industries/sectors to inform them about aggregate conditions: Lucas (1972), Mackowiak, Moench and Wiederholt (2009)

  - Because industry volatility is so high relative to aggregate volatility, firms should devote most of their information processing to tracking industry conditions rather than aggregate conditions.

  - Their aggregate beliefs should therefore be largely driven by industry-specific and idiosyncratic shocks, generating high levels of disagreement.

  - Can we provide direct evidence for this mechanism using actual data on expectations?
WHAT WE DO

• Use a unique survey of firms in France with information on
  • firms’ individual pricing, production and labor decisions, and other characteristics
  • firms’ expectations about own variables and macroeconomic variables,
  • for a large panel of firms observed over a long period of time (covering two monetary policy regimes).
WHAT WE DO

- Use a unique survey of firms in France with information on
  - firms’ individual pricing, production and labor decisions, and other characteristics
  - firms’ expectations about own variables and macroeconomic variables,
  - for a large panel of firms observed over a long period of time (covering two monetary policy regimes).

- Provide new evidence on how firms form their macroeconomic expectations
  - Look at how firms’ idiosyncratic conditions shape their views on aggregate variables.
  - Direct test of Lucas (1972)’s imperfect information island model: firms extract information on the macroeconomic outlook from the conditions they observe in their industry.
  - Investigate differences across firms (depending on incentives to observe aggregates)
WHAT WE FIND

- Individual firms’ expectations about own variables (prices and quantities) react more rapidly to sectoral shocks than to aggregate shocks.
  - In line with evidence in Boivin et al. (2009) & Mackowiak et al. (2009).

- Individual firms’ expectations on macroeconomic outcomes react to both macroeconomic conditions, and own sectoral conditions even if these have no macroeconomic impact.
  - Consistent with Lucas (1972) or Lorenzoni (2009).

- Sectoral shocks have stronger impact on firms’ aggregate expectations for more volatile sectors, …
  - Consistent with rational inattention models of Sims (2003) and Mackowiak & Wiederholt (2009).
LITERATURE

- Long tradition of theoretical models with firms deriving beliefs about macro from observation of micro

- But much less empirical evidence

- Indirect evidence on how firms’ expectations react differently to macro and micro shocks (looking at actions)

- Direct evidence that firms’ expectations behave as in imperfect information models

- Here direct evidence on how firms’ expectations react differently to macro and micro shocks
SURVEY OF FRENCH FIRMS IN THE INDUSTRIAL SECTOR

- *Enquête Trimestrielle de Conjoncture dans l’Industrie* (INSEE)

- A large (≈ 3,000), nationally representative panel (for firms ≥ 20 or more employees): covers about 1 million workers

- A long sample (quarterly observations from 1992 to present)

- Overall, about 360,000 individual observations (product-firm-date)

- Expectations about macroeconomic aggregates (inflation, wage growth, output) but also about their future firm-specific or product-specific outcomes (e.g., prices, sales, wages and employment growth)

- Firm-specific outcomes (prices, sales, wages and employment growth)
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- Firm-specific outcomes (prices, sales, wages and employment growth)

- Mainly qualitative answers except for firm-specific prices and wages
## Survey of French Firms in the Industrial Sector

### Questions on Product-specific or firm-specific outcomes and expectations

**YOUR PRODUCTION**: (in columns the different products)

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>a. Evolution</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>during the last 3 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>b. Probable evolution</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>over the next 3 months</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**YOUR SELLING PRICES**

- Evolution of your sales prices (excluding taxes) during the last 3 months
- Please also indicate their approximate variation over the last 3 months

- Probable evolution of your sales prices (excluding taxes) over the next 3 months
- Please also indicate their approximate variation

**YOUR WAGES** (put 0 if they have not changed)

- On average, how much did hourly wages vary in your business during the last quarter?
PRODUCT-SPECIFIC PRICES VS OFFICIAL STATISTICS

EXPECTED PRICE CHANGES (%)

PAST PRICE CHANGES (%)

% OF EXPECTED PRICE INCREASES

% OF PAST PRICE INCREASES
DISTRIBUTION OF PRICE CHANGES

- Expected price changes
- Past price changes
FIRM-SPECIFIC PRODUCTION AND WAGES

% OF PAST PROD. INCREASE

% OF EXPECTED PROD. INCREASE

AVERAGE WAGE PAST INCREASE
OUR EMPIRICAL SPECIFICATION

We characterize the dynamic response of firms’ expectations to industry and aggregate shocks using:

$$\sum_{k=0}^{h} E_t^i y_t^i y_{t+k+1} = \alpha_i + \beta_h \pi_t + \gamma_h \pi_t^i + \varepsilon_t^i$$

such that

- $\beta_h$ tells us the dynamic (horizon $h$) response of expectations to aggregate shocks
- $\gamma_h$ tells us the dynamic response of expectations to industry-shocks
FIRMS’ EXPECTATIONS OF OWN PRICES AND OUTPUT

• Reaction to **aggregate** and **industry** specific variables

Own price expectation

\[
\sum_{k=0}^{h} E_{t+k}^i \pi_{t+k+1}^i = \alpha_i + \beta_h \pi_t + \gamma_h \pi_t^j + \varepsilon_t^i
\]

Prices react more rapidly to industry shocks (Boivin et al, 2009, Mackowiak et al. 2008)
**Firms’ Expectations of Own Prices and Output**

- Reaction to *aggregate* and *industry* specific variables

  **Own price expectation**

  \[
  \sum_{k=0}^{h} E_{t+k}^{i} \pi_{t+k+1} = \alpha_i + \beta_h \pi_t + \gamma_h \pi_t^j + \epsilon_t^i
  \]

  **Own output expectation**

  \[
  \sum_{k=0}^{h} E_{t+k}^{i} x_{t+k+1} = \alpha_i + \beta_h x_t + \gamma_h x_t^j + \epsilon_t^i
  \]

Output displays the opposite pattern (Boivin et al, 2009, Mackowiak et al. 2008)
SURVEY OF FRENCH FIRMS IN THE INDUSTRIAL SECTOR

Questions on Aggregate Expectations

YOUR FORECASTS ON THE FRENCH INDUSTRY AS A WHOLE
This is your opinion on the entire French industry. Please circle the arrow corresponding to your answer.

PROBABLE EVOLUTION IN THE NEXT 3 MONTHS:
1. The volume of industrial production
   
2. The volume of exports of products manufactured abroad
   
3. General level of prices of industrial products
   
4. Hourly wages ............................................. significant increase // low rise // stability

% OF ANSWERS

<table>
<thead>
<tr>
<th>%</th>
<th>PRICES</th>
<th>PRODUCTION</th>
<th>WAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>INCREASES</td>
<td>21.1</td>
<td>22.3</td>
<td>51.4</td>
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<tr>
<td>NO CHANGE</td>
<td>64.3</td>
<td>48.6</td>
<td>48.6</td>
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<tr>
<td>DECREASES</td>
<td>14.6</td>
<td>19.1</td>
<td>0.0</td>
</tr>
</tbody>
</table>
AGGREGATE EXPECTATIONS VS OFFICIAL STATISTICS

**Prices**

- % of increases (Aggregate Inflation)
- PPI inflation (excluding energy, food)

**Production**

- Share of Aggregate Production Increase
- Annual growth production (SA)
AGGREGATE EXPECTATIONS VS OFFICIAL STATISTICS

PRICES

WAGES

PRODUCTION

EXPORTS
Firms’ Expectations of Aggregate Inflation

- Reaction to aggregate inflation

\[ \sum_{k=0}^{h} E_t^{i} \pi_{t+k+1} = \alpha_i + \beta_h \pi_t + \gamma_h \pi_t^j + \varepsilon_t^{i} \]

As expected, firms’ aggregate expectations respond to aggregate shocks.
Firms’ Expectations of Aggregate Inflation

- Reaction to aggregate and industry (4 digits) specific inflation

\[ \sum_{k=0}^{h} E_{t+k}^i \pi_{t+k+1} = \alpha_i + \beta_h \pi_t + \gamma_i \pi_t^j + \varepsilon_t^i \]

Firms’ aggregate expectations respond to industry-specific shocks!
Firms’ Expectations of Aggregate Inflation

- Reaction to aggregate output growth

\[ \sum_{k=0}^{h} E_{t+k}^{i} \pi_{t+k+1} = \alpha_{i} + \beta_{h} x_{t} + \gamma_{h} x_{t}^{j} + \varepsilon_{t}^{i} \]
FIRMS’ EXPECTATIONS OF AGGREGATE INFLATION

- Reaction to aggregate and industry (4 digits) specific output growth

\[ \sum_{k=0}^{h} E_{t+k}^i \pi_{t+k+1} = \alpha_i + \beta_h x_t + \gamma_h x_t^j + \varepsilon_t^i \]

Same qualitative results when shocks are identified from production data.
Firms’ Expectations of Aggregate Output

- Reaction to aggregate output growth

\[
\sum_{k=0}^{h} E_t^i x_{t+k+1} = \alpha_i + \beta_n x_t + \gamma_n x_t^j + \epsilon_t^i
\]
Firms’ Expectations of Aggregate Output

- Reaction to aggregate and industry (4 digits) specific output growth

\[ \sum_{k=0}^{h} E_{t+k}^i x_{t+k+1} = \alpha_i + \beta_h x_t + \gamma_h x_t^j + \varepsilon_t^i \]

Same pattern holds using expectations of aggregate production.
DO INDUSTRY-SPECIFIC SHOCKS HAVE AGGREGATE EFFECTS?

For each industry $j$ (4-digit, 200 industries), we run:

$$\Delta p_{t,t+h} = \alpha_j + \delta_{hj} \pi_t^j + \eta_{hj} \pi_t + \varepsilon_t^i$$

$$\Delta y_{t,t+h} = \alpha_j + \delta_{hj} \Delta y_t^j + \eta_{hj} \Delta y_t + \varepsilon_t^i$$
DO INDUSTRY-SPECIFIC SHOCKS HAVE AGGREGATE EFFECTS?

For each industry $j$ (4-digit, 200 industries), we run:

$$\Delta p_{t,t+h} = \alpha_j + \delta_{hj}\pi^j_t + \eta_{hj}\pi_t + \varepsilon_t^i$$

$$\Delta y_{t,t+h} = \alpha_j + \delta_{hj}\Delta y^j_t + \eta_{hj}\Delta y_t + \varepsilon_t^i$$

Share of industry with statistically significant $\delta_{hj}$ (95% level):

<table>
<thead>
<tr>
<th>HORIZON</th>
<th>PRICES</th>
<th>PRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>H=1</td>
<td>0.27</td>
<td>0.13</td>
</tr>
<tr>
<td>H=2</td>
<td>0.22</td>
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<td>H=3</td>
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<td>H=4</td>
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<td>H=7</td>
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<td>0.02</td>
</tr>
<tr>
<td>H=8</td>
<td>0.09</td>
<td>0.02</td>
</tr>
</tbody>
</table>

There are some sectors for which sectoral shocks have aggregate effects.
## Response of Firms’ Aggregate Expectations to Sectoral Shocks - Robustness

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>(1)</th>
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<tbody>
<tr>
<td>$\gamma_0$</td>
<td>0.0374***</td>
<td>0.0261***</td>
</tr>
<tr>
<td></td>
<td>(0.00478)</td>
<td>(0.00588)</td>
</tr>
<tr>
<td>#</td>
<td>142,432</td>
<td>68,745</td>
</tr>
<tr>
<td>R2</td>
<td>0.239</td>
<td>0.251</td>
</tr>
</tbody>
</table>

\[ \sum_{k=0}^{h} E_{t+k}^i \pi_{t+k+1} = \alpha_i + \beta_h \pi_t + \gamma_h \pi_t^i + \text{Controls}_t^i + \varepsilon_t^i \]

(1): Excluding sectors for which sectoral inflation at $t$ have a significant correlation with aggregate inflation at $t + 1$. 
### RESPONSE OF FIRMS’ AGGREGATE EXPECTATIONS TO SECTORAL SHOCKS - ROBUSTNESS

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
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<th>(2)</th>
<th>(3)</th>
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</thead>
<tbody>
<tr>
<td>$\gamma_0$</td>
<td>.0374***</td>
<td>.0261***</td>
<td>.0246***</td>
<td>.0259***</td>
</tr>
<tr>
<td></td>
<td>(.00478)</td>
<td>(.00588)</td>
<td>(.00346)</td>
<td>(.00389)</td>
</tr>
<tr>
<td>#</td>
<td>142,432</td>
<td>68,745</td>
<td>151,312</td>
<td>98,939</td>
</tr>
<tr>
<td>R2</td>
<td>.239</td>
<td>.251</td>
<td>.293</td>
<td>.321</td>
</tr>
</tbody>
</table>

$$\sum_{k=0}^{h} E_t^{i} \pi_{t+k+1} = \alpha_i + \beta_h \pi_t + \gamma_h \pi_t^j + \text{Controls}_t^j + \epsilon_t^i$$

(1): Excluding sectors for which sectoral inflation at $t$ have a significant correlation with aggregate inflation at $t + 1$.

(2): Control for time fixed effects (instead of aggregate inflation)

(3): Add controls for lagged sectoral inflation
**Response of Firms’ Aggregate Expectations to Sectoral Shocks - Robustness**

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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<tbody>
<tr>
<td>( \gamma_0 )</td>
<td>0.0374***</td>
<td>0.0261***</td>
<td>0.0246***</td>
<td>0.0259***</td>
<td>0.0248***</td>
<td>0.0224***</td>
<td>0.0248***</td>
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<tr>
<td></td>
<td>(.00478)</td>
<td>(.00588)</td>
<td>(.00346)</td>
<td>(.00389)</td>
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<td>#</td>
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<td>.293</td>
<td>.321</td>
<td>.248</td>
<td>.260</td>
<td>.250</td>
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</tbody>
</table>

\[ \sum_{k=0}^{h} E_{t+k}^i \pi_{t+k+1} = \alpha_i + \beta_h \pi_t + \gamma_h \pi_t^j + Controls_t^j + \varepsilon_t^i \]

(1): Excluding sectors for which sectoral inflation at \( t \) have a significant correlation with aggregate inflation at \( t + 1 \).

(2): Control for time fixed effects (instead of aggregate inflation)

(3): Add controls for lagged sectoral inflation

(4): Add controls for 2 digit sectoral inflation

(5): Control for core aggregate PPI inflation instead of aggregate PPI

(6): Add controls for sectoral output growth and wage growth inflation
HETEROGENEOUS FIRMS’ AGGREGATE EXPECTATIONS

Reaction to aggregate and industry (4 digits) specific inflation

\[ \sum_{k=0}^{h} E_t^i \pi_{t+k+1} = \alpha_i + \beta_h \pi_t + \gamma_h \pi_t^j + \varepsilon_t^i \]

Compare reaction of aggregate expectations for firms in industries with relatively large \( \sigma(\pi_t^j) \) vs firms in industries with relatively small \( \sigma(\pi_t^j) \).
HETEROGENEOUS FIRMS’ AGGREGATE EXPECTATIONS

Reaction to aggregate and industry (4 digits) specific inflation

\[ \sum_{k=0}^{h} E_t^i \pi_{t+k+1} = \alpha_i + \beta_h \pi_t + \gamma_h \pi_t^j + \varepsilon_t^i \]

Compare reaction of aggregate expectations for firms in industries with relatively large \( \sigma(\pi_t^j) \) vs firms in industries with relatively small \( \sigma(\pi_t) \).

Aggregate price expectations \( \gamma_h \)
**Heterogeneous Firms’ Aggregate Expectations**

Reaction to aggregate and industry (4 digits) specific inflation

$$\sum_{k=0}^{h} E_{t+k}^i \pi_{t+k+1} = \alpha_i + \beta_h \pi_t + \gamma_h \pi_t^j + \varepsilon_t^i$$

Compare reaction of aggregate expectations for firms in industries with relatively large $\sigma(\pi_t^j)$ vs firms in industries with relatively small $\sigma(\pi_t^j)$.

Aggregate price expectations $\gamma_h$  
Aggregate production expectations $\gamma_h$
CONCLUSION

- We provide novel evidence using firm-level expectations that firms confound industry-level shocks with aggregate shocks.

- This is consistent with rational inattention models of information frictions, which provide one source for monetary non-neutrality.

- It also provides a potential explanation for why we observe so much disagreement among firms.

- If firms are rationally inattentive to macroeconomic information, it will likely be more difficult for policy-makers to affect economic outcomes as strongly as implied by standard full information models.
## APPENDIX

### Sample Firm Characteristics

<table>
<thead>
<tr>
<th></th>
<th># Employees</th>
<th>Sales (Million €)</th>
<th>% Exports</th>
<th>Duration (in Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>435</td>
<td>332.6</td>
<td>19.9</td>
<td>6.75</td>
</tr>
<tr>
<td>P10</td>
<td>32</td>
<td>6.6</td>
<td>0</td>
<td>0.50</td>
</tr>
<tr>
<td>P25</td>
<td>60</td>
<td>17.5</td>
<td>0</td>
<td>1.75</td>
</tr>
<tr>
<td>P50</td>
<td>146</td>
<td>51.3</td>
<td>8.6</td>
<td>5.25</td>
</tr>
<tr>
<td>P75</td>
<td>350</td>
<td>165.5</td>
<td>31.8</td>
<td>10.0</td>
</tr>
<tr>
<td>P90</td>
<td>810</td>
<td>477.0</td>
<td>60.8</td>
<td>15.5</td>
</tr>
</tbody>
</table>

Main sectors:
- 16.4% Manuf. of food products
- 13.1% Manuf. of basic metals and fabricated metal products
- 11.0% Manuf. of rubber and plastics
- 9.3% Manuf. of machinery and equipment
- 8.8% Manuf. of textiles, apparel, leather and related products
- 8.3% Manuf. of wood and paper products, and printing
- 7.7% Manuf. of chemicals and chemical products
- 7.3% Other manufacturing, and repair and installation of machinery and equipment products