A Quantitative Analysis of Distortions in Managerial Forecasts

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Do systematic biases in forecasts matter quantitatively?

- Managers prone to behavioral biases (1/2 of behavioral corporate finance literature)

- In particular, managers make systematic forecast errors:
  - Macro-level forecasts (Coibion et al. (2018), Tanaka et al. (2019))
  - Firm-level forecasts (e.g., Ben-David et al. (2013), Gennaioli et al. (2016))

- Statistically significant but economically?
  - Effect on firm investment? On firm value?
  - Effect on aggregate efficiency?
We answer these questions using novel, administrative, data

Survey on Industrial and Service Firms (INVIND) run by Bank of Italy since 1975:

- Firms with > than 20 employees registered in Italy; manufacturing and non-financial services; Representative of Italian Economy

- Matched with administrative data on balance sheet and income statement

- Contains start-of-the-year forecast for next year’s total sales:

  \[ F_{t-1} [Sales_{yt}] = \text{forecast for year t sales issued at the beginning of year } t \ (Feb) \]

⇒ Large panel (from 2002-2017, ≈ 4,000 firms / year) of managerial forecast errors
Fact 1: limited dispersion of forecast errors

Define log-Sales Forecast Error: \( \log(Sales_{it}) - \log(F_{t-1}[Sales_{it}]) \)

Standard deviation of log-sales forecast error \( \approx 18\% \)
Fact 2: log-sales forecast errors are persistent

AR(1) coefficient: .32***. Robust.
Fact 3: small elasticity of capital to sales forecast

\[ \log(k_{it}) = \alpha_i + \delta_t + \beta \log(F_{t-1}[Sales_{it}]) + \epsilon_{it} \]

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<th>Manufacturing Only (1)</th>
<th>All Firms (2)</th>
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<tbody>
<tr>
<td>( \log(F_{t-1}(Sales_{it})) )</td>
<td>0.366***</td>
<td>0.410***</td>
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<tr>
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<td>(0.034)</td>
<td>(0.034)</td>
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Fixed effects: Firm & Year

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<tr>
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<th>Firm &amp; Year</th>
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<td>Observations</td>
<td>24,891</td>
<td>36,996</td>
</tr>
<tr>
<td>Adj R²</td>
<td>0.92</td>
<td>0.93</td>
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Standard errors double-clustered (firm and year)
What do we learn?

- Significant persistence of forecast errors suggest under-reaction / inattention:
  
  - But is this *economically* significant?

⇒ We build a quantitative model with three features:

1. Non-rational forecasts
2. Adjustment costs and noisy forecasts
3. Managerial private information
Output produced from capital and labor:

\[ p_{it}y_{it} = Ae^{\nu_{it} \left( k_{it}^{\alpha} l_{it}^{1-\alpha} \right)^\theta}, \text{ with: } \nu_{it} = (1 - \rho)\nu_i + \rho\nu_{it-1} + \psi_{it} + \omega_{it} \]

- \( \psi_{it} \sim \mathcal{N}(0, \sigma^2_\psi) \): privately observed by firm at date \( t - 1 \)
- \( \omega_{it} \sim \mathcal{N}(0, \sigma^2_\omega) \): innovation in TFP, \( \perp \) to \( \psi_{it} \)

No friction in optimizing labor inputs

Real frictions in optimizing capital inputs: (1) 1-period time to build (2) quadratic adjustment costs
Belief formation: non-bayesian expectation

- Formulation of distorted forecasts:

\[
(v_{it}|\mathcal{I}_{t-1}) \sim \mathcal{N}\left(\frac{(1 - \rho)V_i + \rho v_{it-1} + \psi_{it} + \gamma \rho \omega_{it-1}}{\text{rational forecast}} + \frac{\gamma \rho \omega_{it-1}}{\text{over/under-reaction}}, \sigma^2_\omega\right)
\]

- Can originate from Bordalo et al. (2018)' diagnostic expectation:
  - \(\gamma > 0\): overreaction to past innovations \(\omega_{it-1}\); \(\gamma < 0\): underreaction
  - \(\gamma = 0\): rational expectations

- We allow firms to report noisy forecasts:

\[
\log(\hat{F}_{i,t-1}[p_{it}y_{it}]) = \log(\mathcal{F}_{i,t-1}[p_{it}y_{it}]) + \zeta_{it}, \text{ where: } \zeta_{it} \sim \mathcal{N}(0, \sigma^2_\zeta)
\]
Estimation

- We use a Simulated Method of Moments to structurally estimate the model.

- In particular, our estimation targets:
  - the dispersion of forecast errors (fact 1)
  - the persistence of forecast errors (fact 2)
  - the elasticity of capital to sales forecast (fact 3)
  - additional moments are standard in the investment literature
Significant effect on firm-level investment but not on firm value

But relative to rational expectations, firm value is only 0.65% larger.
Negligible effect in general equilibrium

- We nest our firm-level model into a general equilibrium framework (Hsieh and Klenow (2009)).

- Conceptually, distorted forecasts act as a capital wedge in production and generate misallocation.

- Quantitatively negligible effect: TFP losses due to distortions in forecasts $\approx 0.07\%$. 
References I


