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:

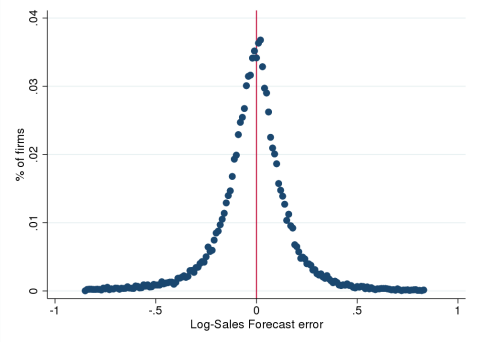
- Firms with $>$ than 20 employees registered in Italy; manufacturing and non-financial services; Representative of Italian Economy
- Matched with administrative data on balance sheet and income statement
- Contains start-of-the-year forecast for next year's total sales:

$$\mathbb{F}_{t-1}\left[\text{Sales}_{it}\right] = \text{forecast for year t sales issued at the beginning of year } t \text{ (Feb)}$$

$\Rightarrow$ Large panel (from 2002-2017, $\approx$ 4,000 firms / year) of **managerial forecast errors**

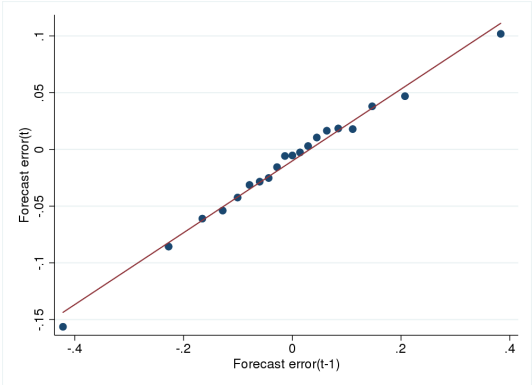
Fact 1: limited dispersion of forecast errors

Define log-Sales Forecast Error: $\log(\text{Sales}_{it}) - \log(\mathbb{F}_{t-1}[\text{Sales}_{it}])$



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

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

	Manufacturing Only (1)	All Firms (2)
$\log(F_{t-1}(Sales_{it}))$	0.366***	0.410***
	(0.034)	(0.034)
Fixed effects	Firm & Year	Firm & Year
Observations	24,891	36,996
Adj R^2	0.92	0.93

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?

$\Rightarrow$ We build a quantitative model with three features:

1. Non-rational forecasts
2. Adjustment costs and noisy forecasts
3. Managerial private information

Model setup

- Output produced from capital and labor:

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

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

$$(\nu_{it}|\mathcal{I}_{t-1}) \underset{\mathbb{F}}{\sim} \mathcal{N}\left(\underbrace{(1-\rho)\mathcal{V}_i + \rho\nu_{it-1} + \psi_{it}}_{\text{rational forecast}} + \underbrace{\gamma\rho\omega_{it-1}}_{\text{over/under-reaction}} , \sigma^2_\omega \right)$$

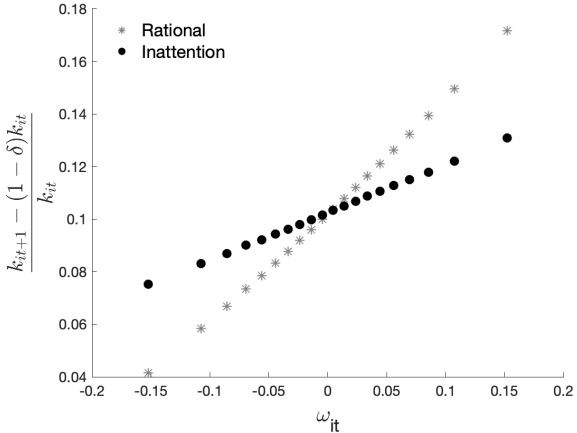
- Can originate from Bordalo et al. (2018)' diagnostic expectation:
  - $\gamma > 0$: *overreaction* to past innovations ω_{it-1}; $\gamma < 0$: *underreaction*
  - $\gamma = 0$: rational expectations
- We allow firms to report noisy forecasts:

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

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

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