Expectations Are Observables. And We Haven’t Even Started Yet . . .

Rüdiger Bachmann, University of Notre Dame, CEPR, CESifo, ifo

Keynote — 8th Ifo Conference on Macroeconomics and Survey Data

December 8, 2017.
Preliminary Remarks

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In addition to the standard national accounting data:
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- SCF
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- SIPP
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- Matched employer-employee data sets (in Denmark, Germany)
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- Social sentiment
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I want to start with the most prominent example of such data — expectations — and study a bit the related history of thought.
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This is what makes our object of inquiry different: economic agents have a sense of future and make decisions with information about the future and relevance for the future.
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Particles do not have a sense of future.
Expectations in Economics

Saying it with Heidegger (*Being and Time*): An Existenziale of Dasein is temporality. Dasein is care, being-ahead-of-itself.
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Studies empirically with survey data how firms form and update their expectations.
A behaviorist tradition in economics: what people say they do is irrelevant – only what people do matters.
A *behaviorist* tradition in economics: what people say they do is irrelevant – only what people do matters.

Aside: recall the revealed preference approach to microeconomics.
The *rational expectations* revolution: the economic model itself – a physical environment and the stochastic make-up of that physical environment – deliver what expectations have to be: they have to be the best expectations given the model.
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In a sense, rational expectations took expectations *as economic data* off the table, because the models took care of it.
Both Strands of Critique Together

This was not a strictly necessary development, because one could have tested rational expectations plus the model assumptions jointly against expectational and other economic data – but the behaviorist streak in economics was quite happy to get rid of expectations as data.
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So, we ended up with testing big rational expectation (often DSGE) models on “objective” outcome data only. Aside: this is orthogonal to the estimation-calibration distinction.
What Happened to Expectation Data?

Was left to practitioners, to business cycle forecasters in (central) banks, think tanks, industry, etc.

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Both household and firm level expectation data are reasonably predictive of the business cycle, and contain often a strong news component about future productivity. (Barsky and Sims, 2012, American Economic Review: “Information, Animal Spirits, and the Meaning of Innovations in Consumer Confidence”.)
More Recent Developments

- The behaviorist orthodoxy is less predominant. At least a subgroup of economists is now more comfortable asking people stuff and use it as data. Some of us seem to have learned from our friends in political sciences and sociology.
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- Rational expectations is still an important benchmark / first pass / default – but no longer the Alpha and Omega of economics.
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Economists see value again in testing not entire large models, but certain key elements / modules of them (the way they had been doing it in earlier times – think of all the PIH tests in the literature).
These developments have certainly been reinforced if not triggered by recent macroeconomic events and a resulting general openness / willingness to rethink the foundations of the field.
More Recent Developments

Narayana Kocherlakota, former Minnesota, freshwater economist extraordinaire, in a short note “Thoughts on ‘The Trouble with Macroeconomics’” (2016):
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We need to encourage those who are trying to learn more about how people actually form expectations. [...] At the same time, we need to be a lot more flexible in our thinking about models and theory, so that they can be firmly grounded in this improved empirical understanding.
“What Can Survey Forecasts Tell Us about Information Rigidities?”

Coibion and Gorodnichenko, 2012, Journal of Political Economy:
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- Use (amongst others) Michigan Survey of Consumers and Survey of Professional Forecasters data on inflation expectations to test theories of informational rigidities.
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- Expectations react gradually to news, ruling out full-information models.
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- Expectations react gradually to news, ruling out full-information models.

- Disagreement in inflation forecasts does not seem to respond to shocks, which means that noisy information models are favored over sticky information models.
“Is The Phillips Curve Alive and Well After All? Inflation Expectations and the Missing Disinflation”

Coibion and Gorodnichenko, 2015, American Economic Journal: Macroeconomics:
“Is The Phillips Curve Alive and Well After All? Inflation Expectations and the Missing Disinflation”

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Use direct inflation expectations data to “save” the *Phillips Curve*, an important ingredient for monetary macroeconomics.
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- Inflation was higher during the recession because of increased inflation expectations (which a backward-looking Phillips Curve simply cannot capture).
- Reason: oil price spikes during the time.
“Do people understand monetary policy?”

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- Use Michigan Survey (household) expectation data on inflation, interest rates and unemployment to see whether respondents understand the *Taylor rule*. 

Higher-income and higher-education households more so. Taylor rule type reasoning especially prevalent when labor markets are weak (rational inattention story?).
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- Forecasts of future inflation: very uncertain, dispersed and volatile.
“Subjective Intertemporal Substitution”

Crump, Eusepi, Tambalotti, and Topa, 2015, Staff Report:
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- Have direct data on consumption growth and inflation expectations.
- Can thus estimate directly the Euler equation and the corresponding elasticity of intertemporal substitution, a key macroeconomic parameter.
- Recall, that the Euler equation features expected consumption growth, while the literature traditionally has estimated Euler equations on realized consumption growth (Attanasio and Weber in many papers), essentially presupposing rational expectations.
“Inflation Expectations and Readiness to Spend: Cross-Sectional Evidence”

Bachmann, Berg and Sims (BBS), 2015, American Economic Journal: Economic Policy:
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- Use micro data from Michigan Survey of Consumers to study the association between a respondent’s (quantitative) inflation expectations and their readiness to buy durables / cars / houses.
- Example of testing a key micro relationship, rather than a whole model.
Focus on Two Questions

Spending on durables:
“About the big things people buy for their homes – such as furniture, a refrigerator, stove, television, and things like that. Generally speaking, do you think now is a good or a bad time for people to buy major household items?”
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“About the big things people buy for their homes – such as furniture, a refrigerator, stove, television, and things like that. Generally speaking, do you think now is a good or a bad time for people to buy major household items?”

One-year inflation expectations:
“By about what percent do you expect future prices to go (up/down) on the average, during the next 12 months?”
Ordered Probits

\[ y^* = \beta_1 \pi^e + \beta_2 \pi^e \times D_{ZLB} + x\gamma + \epsilon, \]
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Survey responses \( y = \begin{cases} 
-1 & \text{if } y^* \leq \alpha_1 \\
0 & \text{if } \alpha_1 < y^* \leq \alpha_2 \\
+1 & \text{if } \alpha_2 < y^* 
\end{cases} \)
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\( x \Rightarrow \text{controls, including } D_{ZLB} \quad \gamma \Rightarrow \text{coefficients of controls} \)

\( D_{ZLB} = 1 \text{ from 2008:12 to 2012:12, zero otherwise.} \)
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\]

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\( D_{ZLB} = 1 \) from 2008:12 to 2012:12, zero otherwise.

Are interested in \( \beta_1 \) and \( \beta_2 \) and the associated average marginal effects.
Baseline

Dependent Variable: Buying Conditions for Durables  
Sample: 1984:01 to 2012:12  
Number of observations: 67855  
Pseudo $R^2$: 0.0671

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Coefficients</th>
<th>Marginal Effects at $D_{ZLB} = 0$</th>
<th>Marginal Effects at $D_{ZLB} = 1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflation Expectations (1Y)</td>
<td>$-0.0009$</td>
<td>$-0.0002$</td>
<td>$-0.0047^{***}$</td>
</tr>
<tr>
<td></td>
<td>$(0.0015)$</td>
<td>$(0.0004)$</td>
<td>$(0.0011)$</td>
</tr>
<tr>
<td>ZLB Dummy Interacted with Expected Inflation (1Y)</td>
<td>$-0.0112^{***}$</td>
<td>$(0.0031)$</td>
<td></td>
</tr>
</tbody>
</table>
Baseline

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<tbody>
<tr>
<td>Expected Financial Situation of Household</td>
<td>0.0263***</td>
<td>0.0079***</td>
<td>0.0101***</td>
</tr>
<tr>
<td></td>
<td>(0.0091)</td>
<td>(0.0027)</td>
<td>(0.0035)</td>
</tr>
<tr>
<td>Expected Real Household Income</td>
<td>0.0211**</td>
<td>0.0064**</td>
<td>0.0081**</td>
</tr>
<tr>
<td></td>
<td>(0.0083)</td>
<td>(0.0025)</td>
<td>(0.0032)</td>
</tr>
<tr>
<td>Expected Change in Nominal Interest Rate</td>
<td>0.0436***</td>
<td>0.0131***</td>
<td>0.0168***</td>
</tr>
<tr>
<td></td>
<td>(0.0074)</td>
<td>(0.0022)</td>
<td>(0.0029)</td>
</tr>
<tr>
<td>Expected 1Y Aggregate Business Conditions (Idiosyncratic)</td>
<td>0.1300***</td>
<td>0.0392***</td>
<td>0.0500***</td>
</tr>
<tr>
<td></td>
<td>(0.0068)</td>
<td>(0.0020)</td>
<td>(0.0026)</td>
</tr>
<tr>
<td>Expected 5Y Aggregate Business Conditions (Idiosyncratic)</td>
<td>0.0623***</td>
<td>0.0188***</td>
<td>0.0240***</td>
</tr>
<tr>
<td></td>
<td>(0.0068)</td>
<td>(0.0020)</td>
<td>(0.0026)</td>
</tr>
<tr>
<td>Expected Unemployment</td>
<td>−0.0652***</td>
<td>−0.0196***</td>
<td>−0.0251***</td>
</tr>
<tr>
<td></td>
<td>(0.0089)</td>
<td>(0.0027)</td>
<td>(0.0034)</td>
</tr>
<tr>
<td>Current Financial Situation</td>
<td>0.1189***</td>
<td>0.0359***</td>
<td>0.0458***</td>
</tr>
<tr>
<td></td>
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<td>(0.0020)</td>
<td>(0.0026)</td>
</tr>
<tr>
<td>Economic Policy Trust (Idiosyncratic)</td>
<td>0.1119***</td>
<td>0.0337***</td>
<td>0.0431***</td>
</tr>
<tr>
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### “Accurate” and “Reasonable” Inflation Expectations

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<tr>
<td>Within one time series std of actual inflation</td>
<td>0.0084</td>
<td>0.0025</td>
<td>0.0057</td>
</tr>
<tr>
<td>$(N = 20814, \text{Sample: 1984:01 to 2012:12})$</td>
<td>(0.0097)</td>
<td>(0.0029)</td>
<td>(0.0083)</td>
</tr>
<tr>
<td>Within one time series std of actual inflation, 2x</td>
<td>0.0157</td>
<td>0.0044</td>
<td>0.0222</td>
</tr>
<tr>
<td>$(N = 6551, \text{Sample: 1984:01 to 2012:12})$</td>
<td>(0.0184)</td>
<td>(0.052)</td>
<td>(0.0157)</td>
</tr>
<tr>
<td>Within 0.5 percentage points of actual inflation</td>
<td>0.0019</td>
<td>0.0006</td>
<td>0.0379**</td>
</tr>
<tr>
<td>$(N = 8577, \text{Sample: 1984:01 to 2012:12})$</td>
<td>(0.0190)</td>
<td>(0.0056)</td>
<td>(0.0177)</td>
</tr>
<tr>
<td>Outside 0.5 percentage points of actual inflation</td>
<td>-0.0010</td>
<td>-0.0003</td>
<td>-0.0048***</td>
</tr>
<tr>
<td>$(N = 59278, \text{Sample: 1984:01 to 2012:12})$</td>
<td>(0.0015)</td>
<td>(0.0004)</td>
<td>(0.0011)</td>
</tr>
<tr>
<td>Within 1.28 percentage points of mean inflation expectations</td>
<td>0.0040</td>
<td>0.0012</td>
<td>0.0019</td>
</tr>
<tr>
<td>$(N = 22439, \text{Sample: 1984:01 to 2012:12})$</td>
<td>(0.0126)</td>
<td>(0.0038)</td>
<td>(0.0098)</td>
</tr>
<tr>
<td>Within 1.28 percentage points of mean SPF inflation expectations</td>
<td>-0.0218</td>
<td>-0.0066</td>
<td>-0.0200</td>
</tr>
<tr>
<td>$(N = 22061, \text{Sample: 1984:01 to 2012:12})$</td>
<td>(0.0142)</td>
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- We view the results as suggestive that raising inflation expectations may at the very least pose a tough communication problem for central bankers.
- Panel dimension: for “good” inflation forecasters / informed households, we get a significantly positive sign. Salience seems to matter.
An Interpretation of the Results

- Prima facie these results tell a cautionary tale about using inflation expectations as a policy instrument.
- We view the results as suggestive that raising inflation expectations may at the very least pose a tough communication problem for central bankers.
- Panel dimension: for “good” inflation forecasters / informed households, we get a significantly positive sign. Salience seems to matter.
- Quantity expectations matter (Old Keynesianism appears to be alive and well).
Micro literature in the wake of BBS:


Ichiue and Nishiguchi (2015): Japanese households have a positive sign (long life under a ZLB regime?)

D’Acunto, Hoang, and Weber (2016): use a pre-announced VAT increase in Germany to instrument increases in inflation expectations to uncover a causal effect of inflation expectations on spending. They find a positive, stimulative sign of inflation expectations on purchases.

Interpretation of these results together?
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Interpretation of these results together?
Taking Stock

What can one do with expectation data?
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- Inform the literature on informational rigidities.
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- Inform the literature on informational rigidities.
- Inform a major current monetary policy puzzle (missing deflation) and test the validity of the Phillips Curve.
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- Test the Euler equation and estimate key structural parameters: elasticity of intertemporal substitution.
- Test a key theoretical transmission mechanism of monetary policy and get guidance for its conduct – salience.
Potential Next Steps

- Expectation data are not the only “subjective” data in surveys that might be useful for (macro)economics.
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  - subjective-reason data from the IFO Investment Survey (that is, on firms) to inform an important macroeconomic question.
Expectation data are not the only “subjective” data in surveys that might be useful for (macro)economics. Will now present the results from two new projects that use

1. *subjective-reason data* from the IFO Investment Survey (that is, on firms) to inform an important macroeconomic question.

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- Expectation data are not the only “subjective” data in surveys that might be useful for (macro)economics.
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  1. *subjective-reason data* from the IFO Investment Survey (that is, on firms) to inform an important macroeconomic question.
  2. *social media sentiment data* from Twitter to test an important economic theory.
- This is what I mean by “…and we haven’t even started yet.”
What Do We Do?

What Do We Do?


- Tackle an old question: *What (the h . . .) drives aggregate fluctuations?*

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- Even more specifically: the fluctuations of the year-over-year investment growth rate.
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What Do We Do?

- Use data from the IFO manufacturing investment survey (focusing on West Germany) about determinants for investment.
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- In the fall of every year decision makers in firms are asked what issues (six to choose from) determined their investment activity in the current (but ending) year, and to what extent - on an ordinal scale.
What Do We Do?

- Use data from the IFO manufacturing investment survey (focusing on West Germany) about determinants for investment.

- In the fall of every year decision makers in firms are asked what issues (six to choose from) determined their investment activity in the current (but ending) year, and to what extent - on an ordinal scale.

- We use the micro data to these answers, aggregate (or semi-aggregate) them up and extract things like “demand shocks” and “technological shocks”.
Basic Idea

We see the advantage of a survey-based approach towards identifying shocks in its putative *directness*: the survey respondents (*decision makers*) directly report whether their investment activity in a given year was influenced by, for instance, technological considerations and, if so, how strongly.
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See, for instance, Romer (2004, 2010).
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See, for instance, Romer (2004, 2010).

Also: these data are confidential, so there is probably little danger of decision makers strategically lying.
On average and in the long-run, technological considerations are the most important investment determinant in the survey. A very neoclassical result!
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But: aggregate demand shocks explain the bulk of investment fluctuations.
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But: aggregate demand shocks explain the bulk of investment fluctuations.

Find suggestive evidence that these demand shocks are sentiment shocks.
Some Background on the Survey

- Semi-annual. Spring and fall - with slightly different questions.
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- Manufacturing.
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- Advantages:

  - Relatively large number of observations: roughly 1,600 obs. per survey on average; 40,905 firm-year observations.
  - Well-correlated with official aggregate investment data.
  - Has questions on investment determinants and quantitative capital expenditures.

- Drawbacks:
  - Investment determinants only annually asked (fall).
  - Relatively short time series, few data, though sectoral disaggregation can help here.
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Our Two Questions

Q1. Gross Fixed Capital Formation in Fiscal Year [Last Year]

[Last Year] ____________________________ (in 1000 Euro)

Q2. Investment Determinants [This Year]

Our investment activity in the Old Laender in [This Year] was positively/negatively affected by:

<table>
<thead>
<tr>
<th>Investment Determinant</th>
<th>strongly positive influence</th>
<th>weakly positive influence</th>
<th>no influence</th>
<th>weakly negative influence</th>
<th>strongly negative influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales Situation and Expectation</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Finance</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Profit Expectation</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Technical Factors</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Macro Policy Environment</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Other</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

[Codification] 

[+2] [+1] [0] [-1] [-2]
Investment Determinants

Terminology: Tech, Finance, Sales, Profit, Macro, and Other
Investment Determinants

Terminology: Tech, Finance, Sales, Profit, Macro, and Other

Quantification: -2 (strongly negative influence), -1 (weakly negative influence), 0 (no influence), +1 (weakly positive influence), or +2 (strongly positive influence)
Define firm $i$’s share in total investment at time $t$ by:

\[
\omega_{it} = \frac{\text{inv}_{it}}{\sum_{i=1}^{N_t} \text{inv}_{it}}.
\]

Then the aggregate investment growth rate, $\Delta I_{IFO_t}$, is given by:

\[
\Delta I_{IFO_t} = \sum_{i=1}^{N_t} \omega_{it} - \Delta \text{inv}_{it} - \Delta \text{inv}_{it-1}.
\]
Define firm $i$’s share in total investment at time $t$ by:

$$\omega_{it} = \frac{\text{inv}_{it}}{\sum_{i=1}^{N_t} \text{inv}_{it}}.$$
Aggregation

Define firm $i$’s share in total investment at time $t$ by:

$$\omega_{it} = \frac{inv_{it}}{\sum_{i=1}^{N_t} inv_{it}}.$$ 

Then the aggregate investment growth rate, $\Delta I_t^{IFO}$, is given by:

$$\Delta I_t^{IFO} = \sum_{i=1}^{N_t} \omega_{it-1} \frac{inv_{it} - inv_{it-1}}{inv_{it-1}}.$$
Aggregation

Similarly, let $x_{it}$ denote one of the six firm-level investment determinants.
Similarly, let $x_{it}$ denote one of the six firm-level investment determinants.

Then, for every investment determinant, we aggregate up to an investment determinant index, $X_t$, as follows:

$$X_t = \sum_{i=1}^{N_t} \omega_{it} x_{it}$$
A First Look at the Data - Investment Growth Rate

Measures of aggregate investment growth ($\rho = 0.89$)
A First Look at the Data - Investment Determinant Indices

Aggregate investment determinant indices
A First Look at the Data - Investment Determinant Indices

Sales

Tech

Finance

Return

Macro

Other

A First Look at the Data

<table>
<thead>
<tr>
<th></th>
<th>Sales</th>
<th>Tech</th>
<th>Finance</th>
<th>Return</th>
<th>Macro</th>
<th>Other</th>
<th>$\Delta I_t^{FSO}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tech</td>
<td>0.6640***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finance</td>
<td>0.6059***</td>
<td>0.3183*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return</td>
<td>0.9539***</td>
<td>0.5802***</td>
<td>0.6165***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macro</td>
<td>0.6381***</td>
<td>0.3733**</td>
<td>0.4481***</td>
<td>0.6987***</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.2228</td>
<td>0.3416*</td>
<td>-0.0796</td>
<td>0.1426</td>
<td>0.2538</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Panel B:</strong></th>
<th>$\Delta I_t^{FSO}$</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta I_t^{FSO}$</td>
<td>0.8645***</td>
<td>0.5539***</td>
<td>0.6191***</td>
<td>0.8895***</td>
<td>0.6148***</td>
<td>0.0346</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Panel C:</strong></th>
<th>$\hat{\mu}$</th>
<th>$\hat{\sigma}$</th>
<th>$\hat{\mu}$</th>
<th>$\hat{\sigma}$</th>
<th>$\hat{\mu}$</th>
<th>$\hat{\sigma}$</th>
<th>$\hat{\mu}$</th>
<th>$\hat{\sigma}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\mu}$</td>
<td>0.6005</td>
<td>0.9193</td>
<td>-0.0245</td>
<td>0.4806</td>
<td>-0.1046</td>
<td>0.3347</td>
<td>0.0123</td>
<td></td>
</tr>
<tr>
<td>$\hat{\sigma}$</td>
<td>0.5155</td>
<td>0.1642</td>
<td>0.2243</td>
<td>0.4192</td>
<td>0.2630</td>
<td>0.4021</td>
<td>0.0943</td>
<td></td>
</tr>
</tbody>
</table>
Economic Content: Tech

Mean of Tech, conditional on investment in restructuring and rationalization:

<table>
<thead>
<tr>
<th>Tercile of Restructuring and Rationalization Investment</th>
<th>Mean(Tech)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>less or equal 20%</td>
<td>0.7640</td>
<td>16403</td>
</tr>
<tr>
<td>between 20% and 40%</td>
<td>0.9285</td>
<td>9069</td>
</tr>
<tr>
<td>more or equal 40%</td>
<td>1.0657</td>
<td>12654</td>
</tr>
</tbody>
</table>

Difference in means statistically significant at the 1% level.
Economic Content: Finance

Mean of $|\text{Finance}|$, conditional on share of external finance (IFO survey):

| Tercile of External Finance | Mean($|\text{Finance}|$) | N   |
|-----------------------------|--------------------------|-----|
| exactly 0%                  | 0.2299                   | 10597|
| between 0% and 20%          | 0.4193                   | 1280 |
| more or equal 20%           | 0.5080                   | 5525 |
## Economic Content: Sales and Tech

LHS Variable is...

<table>
<thead>
<tr>
<th></th>
<th>Frequency of Price Increases</th>
<th>Frequency of Price Decreases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Sales</td>
<td>0.015***</td>
<td>0.0069***</td>
</tr>
<tr>
<td></td>
<td>(0.0015)</td>
<td>(0.0015)</td>
</tr>
<tr>
<td>Tech</td>
<td>-0.0086***</td>
<td>-0.0076***</td>
</tr>
<tr>
<td></td>
<td>(0.0030)</td>
<td>(0.0029)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.096***</td>
<td>0.14***</td>
</tr>
<tr>
<td></td>
<td>(0.0039)</td>
<td>(0.0081)</td>
</tr>
<tr>
<td>Observations</td>
<td>11539</td>
<td>11539</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.013</td>
<td>0.061</td>
</tr>
<tr>
<td>Year Effects</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Firm Fixed Effects</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Industry Effects</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Identification

Set identification combined with Choleski:

1. Want $\hat{\text{Sales}}_t$ and $\hat{\text{Tech}}_t$ to be as close as possible to their raw determinants (narrative restriction). Correlation threshold: 0.5.

2. Want $\hat{\text{Sales}}_t$ to be positively correlated with PPI inflation: Correlation threshold: 0.005.

3. Want $\hat{\text{Tech}}_t$ to be negatively correlated with PPI inflation: Correlation threshold: -0.005.
Identification

Set identification combined with Choleski:

- For demand versus technology shocks we require three correlation conditions (set identification):
  - Want $\hat{Sales}_t$ and $\hat{Tech}_t$ to be as close as possible to their raw determinants (narrative restriction). Correlation threshold: 0.5.
  - Want $\hat{Sales}_t$ to be positively correlated with PPI inflation: Correlation threshold: 0.005.
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Orthogonalize Finance, Profit, Macro and Other with respect to $\hat{Sales}_t$ and $\hat{Tech}_t$ (and – in that order – to each other, Choleski).
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- Orthogonalize Finance, Profit, Macro and Other with respect to $\hat{\text{Sales}}_t$ and $\hat{\text{Tech}}_t$ (and – in that order – to each other, Choleski).
Final Regression

$$\Delta I_t^{FSO} = c + \beta_1 \hat{\text{Tech}}_t + \beta_2 \hat{\text{Sales}}_t + \beta_3 \hat{\text{Finance}}_t + \beta_4 \hat{\text{Profit}}_t + \beta_5 \hat{\text{Macro}}_t + \beta_6 \hat{\text{Other}}_t + u_t$$

Since we have orthogonal regressors (by construction) we can decompose their contribution to the $R^2$ of this multivariate regression by computing a series of univariate regressions. We do so for every orthogonalization in the admissible set.
Final Regression

\[ \Delta I_t^{FSO} = c + \beta_1 \widehat{\text{Tech}}_t + \beta_2 \widehat{\text{Sales}}_t + \beta_3 \widehat{\text{Finance}}_t + \beta_4 \widehat{\text{Profit}}_t + \beta_5 \widehat{\text{Macro}}_t + \beta_6 \widehat{\text{Other}}_t + u_t \]

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Recall: $R^2$s are additive with orthogonal regressors.
Relative Contribution to the Variance of $\Delta I_t^{FSO}$ (in percent)

<table>
<thead>
<tr>
<th></th>
<th>Correlation Restrictions</th>
<th>Recursive: Sales first</th>
<th>Recursive: Tech first</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales</td>
<td>[65.92, 74.81]</td>
<td>74.74</td>
<td>44.13</td>
</tr>
<tr>
<td>Tech</td>
<td>[ 0.00, 8.89]</td>
<td>0.07</td>
<td>30.68</td>
</tr>
<tr>
<td>Finance</td>
<td>1.37</td>
<td>1.37</td>
<td>1.37</td>
</tr>
<tr>
<td>Return</td>
<td>4.08</td>
<td>4.08</td>
<td>4.08</td>
</tr>
<tr>
<td>Macro</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Other</td>
<td>1.15</td>
<td>1.15</td>
<td>1.15</td>
</tr>
<tr>
<td>$R^2$ of Regression Equation</td>
<td>0.81</td>
<td>0.81</td>
<td>0.81</td>
</tr>
<tr>
<td><strong>Panel B:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corr (Sales, PPI)</td>
<td>[0.47, 0.52]</td>
<td>0.51</td>
<td>0.42</td>
</tr>
<tr>
<td>Corr (Tech, PPI)</td>
<td>[-0.22, -0.01]</td>
<td>-0.06</td>
<td>0.30</td>
</tr>
<tr>
<td>Corr (Sales, Sales)</td>
<td>[0.95, 1.00]</td>
<td>1.00</td>
<td>0.75</td>
</tr>
<tr>
<td>Corr (Tech, Tech)</td>
<td>[0.50, 0.81]</td>
<td>0.75</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Sales\(_t\) and Sentiment Indicators

Sales Shock (\(\rho_{GFK-CC} = 0.58, \rho_{IFO-BS} = 0.82, \rho_{IFO-BE} = 0.46\))
Robustness

- Run this with lower narrative correlation threshold: 0.25.
Robustness

- Run this with lower narrative correlation threshold: 0.25.
- Run this with real investment growth on the LHS.

Deal with potential sectoral spill over issues.

Run a VAR with $Tech_t$, $Sales_t$, the investment growth rate and PPI inflation, and find similar results.

Disaggregate results for 2-digit industries (and Länder) tell the same story.
Robustness

- Run this with lower narrative correlation threshold: 0.25.
- Run this with real investment growth on the LHS.
- Run this with the growth rate of industrial production on the LHS.
Robustness

- Run this with lower narrative correlation threshold: 0.25.
- Run this with real investment growth on the LHS.
- Run this with the growth rate of industrial production on the LHS.
- Deal with potential sectoral spill over issues.
Robustness

- Run this with lower narrative correlation threshold: 0.25.
- Run this with real investment growth on the LHS.
- Run this with the growth rate of industrial production on the LHS.
- Deal with potential sectoral spill over issues.
- Run a VAR with $Tech_t$, $Sales_t$, the investment growth rate and PPI inflation, and find similar results.
Robustness

- Run this with lower narrative correlation threshold: 0.25.
- Run this with real investment growth on the LHS.
- Run this with the growth rate of industrial production on the LHS.
- Deal with potential sectoral spill over issues.
- Run a VAR with $Tech_t$, $Sales_t$, the investment growth rate and PPI inflation, and find similar results.
- Disaggregate results for 2-digit industries (and Länder) tell the same story.

Collective reputations play an important role in economics and the social sciences. Countries, ethnic, racial or religious groups are known to be hard-working, honest, corrupt, hospitable or belligerent.

Use the Volkswagen 2015 emissions scandal as an exogenous event to study whether there are (reputational) spillovers on other German car manufacturers.
Use the Volkswagen 2015 emissions scandal as an exogenous event to study whether there are (reputational) spillovers on other German car manufacturers.

Do so with difference-in-differences regressions, where we compare non-VW German car makers with non-German car makers.
## Sales Effect

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>12-month Log Sales Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>non-VW</td>
</tr>
<tr>
<td>German × Post-Scandal</td>
<td>(1)</td>
</tr>
<tr>
<td>-0.104</td>
<td>-0.151</td>
</tr>
<tr>
<td>(0.035)</td>
<td>(0.012)</td>
</tr>
</tbody>
</table>

- **Time Fixed Effects**: Yes, Yes, Yes, Yes
- **Make Fixed Effects**: Yes, Yes, Yes, Yes
- **R²**: 0.292, 0.296, 0.294, 0.295
## Rate of Return Effect

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Abnormal Returns</th>
<th>Cumulative Abnormal Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>German × Post-Scandal</td>
<td>-0.019 (0.004)</td>
<td>-0.019 (0.005)</td>
</tr>
<tr>
<td>Weighting</td>
<td>None</td>
<td>Sales Volume</td>
</tr>
<tr>
<td>Time Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Company Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.687</td>
<td>0.600</td>
</tr>
<tr>
<td>N</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>
# It is not Just Diesel

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>12-month Log Sales Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Type</td>
<td>Baseline</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>German × Post-Scandal</td>
<td>-0.104</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
</tr>
<tr>
<td>Time Fixed Effects</td>
<td>Yes</td>
</tr>
<tr>
<td>Make Fixed Effects</td>
<td>Yes</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.292</td>
</tr>
<tr>
<td>N</td>
<td>2150</td>
</tr>
</tbody>
</table>
# Reputational Effect

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Positive Sentiment</th>
<th>Negative Sentiment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>German × Post-Scandal</td>
<td>-0.035</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Time Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Make Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.348</td>
<td>0.268</td>
</tr>
<tr>
<td>N</td>
<td>840</td>
<td>840</td>
</tr>
</tbody>
</table>
“Subjective” survey data are back on the map!
“Subjective” survey data are back on the map!

Especially expectation data have a lot to teach us about important macroeconomic ideas and issues.
“Subjective” survey data are back on the map!

Especially expectation data have a lot to teach us about important macroeconomic ideas and issues.

I would argue we should go a step further and ask economic agents why they did what they did and how they feel about stuff.