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

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

CEMLA's Joint Research on Inflation Expectations.
Webinar: Expectations, Learning and Monetary Policy

April 25, 2017.

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Even though macroeconomics has benefitted tremendously from such data.

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- Etc.

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Particles do not have a sense of future.

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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.

Critique I

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Aside: recall the revealed preference approach to microeconomics.

Critique II

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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

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So, we ended up with testing big rational expectations (often DSGE) models on "objective" outcome data. Aside: this is orthogonal to the estimation-calibration distinction.

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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".)

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- Rational expectations is still an important benchmark / first pass / default – but no longer the Alpha and Omega of economics.
- 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).

More Recent Developments

This development has certainly been reinforced if not triggered by recent macroeconomic events and a resulting general openness / willingness to rethink the foundations of the field.

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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?"

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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"

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Use direct inflation expectations data to "save" the *Phillips Curve*, an important ingredient for monetary macroeconomics.

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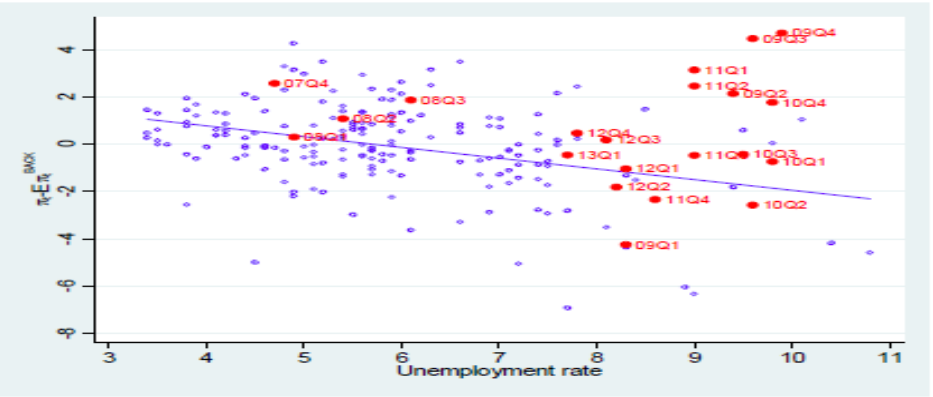
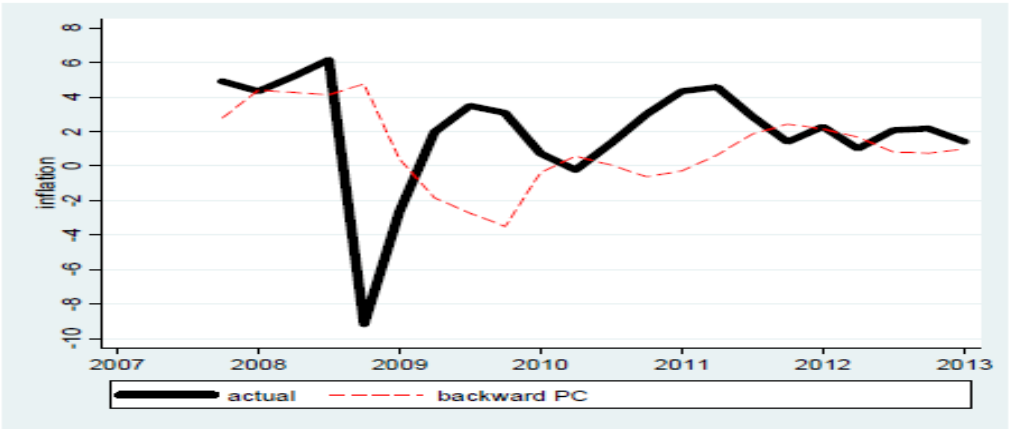
FIGURE 1: THE MISSING DISINFLATION

Panel A: CPI Inflation and U.S. Unemployment



Panel B: CPI Inflation and Predicted Inflation from Phillips Curve



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- Reason: oil price spikes during the time.

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- 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.

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- 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.

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- Test the Euler equation and estimate key structural parameters: elasticity of intertemporal substitution.

Background: Stabilization Policy and Transmission

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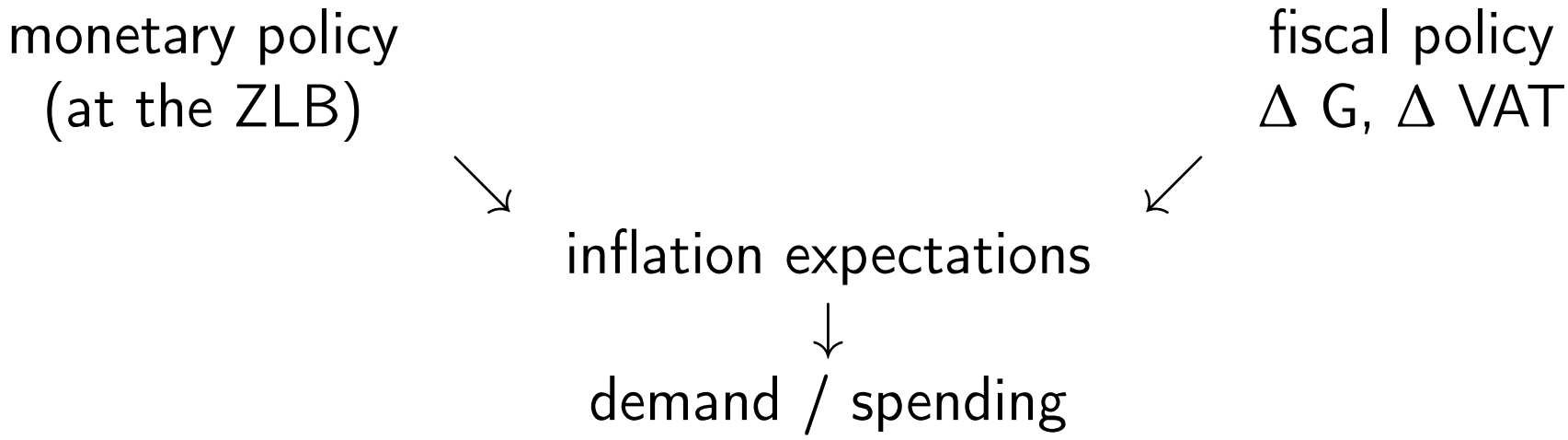

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- Economic policy trust / confidence / uncertainty

Some Quotes

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- *""They need to be willing, in fact actively pursue, letting inflation rise a bit more. That would encourage consumption. It would encourage investment." – Ken Rogoff, National Public Radio, October 2011*
- *"Another possible effect is a temporary climb in inflation expectations. Ordinarily, this would be undesirable. But in the current situation, where nominal interest rates are constrained because they can't go below zero, a small increase in expected inflation could be helpful. It would lower real borrowing costs, and encourage spending on big-ticket items like cars, homes and business equipment." – Christina Romer, New York Times, November 2011*

Literature

"But he could have paid the balance of 25 marks at any time and thus have made the teeth his own. If he did not do so, it was because he had heard from many people that the accession of the Nationalists to power would be followed by inflation of currency, [...]. And yet business was better than one might have expected during this rather quiet winter season. The talk of inflation induced many people to spend their money on household needs instead of putting it in the savings bank."

From: Lion Feuchtwangers "The Oppermanns" (in the translation by Ruth Gruber), about the business dealings of the furniture salesman Markus Oppermann with his dentist and his clients right after the rise to power of the Nazi party in January 1933.

"Inflation Expectations and Readiness to Spend: Cross-Sectional Evidence"

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- Example of testing a key micro relationship, rather than a whole model.

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- About 500 households each month
- 40 % of households are reinterviewed six months later.
- Outlier cleaning: throw out all month-year observations on inflation expectations that are larger than 20 % in absolute value.

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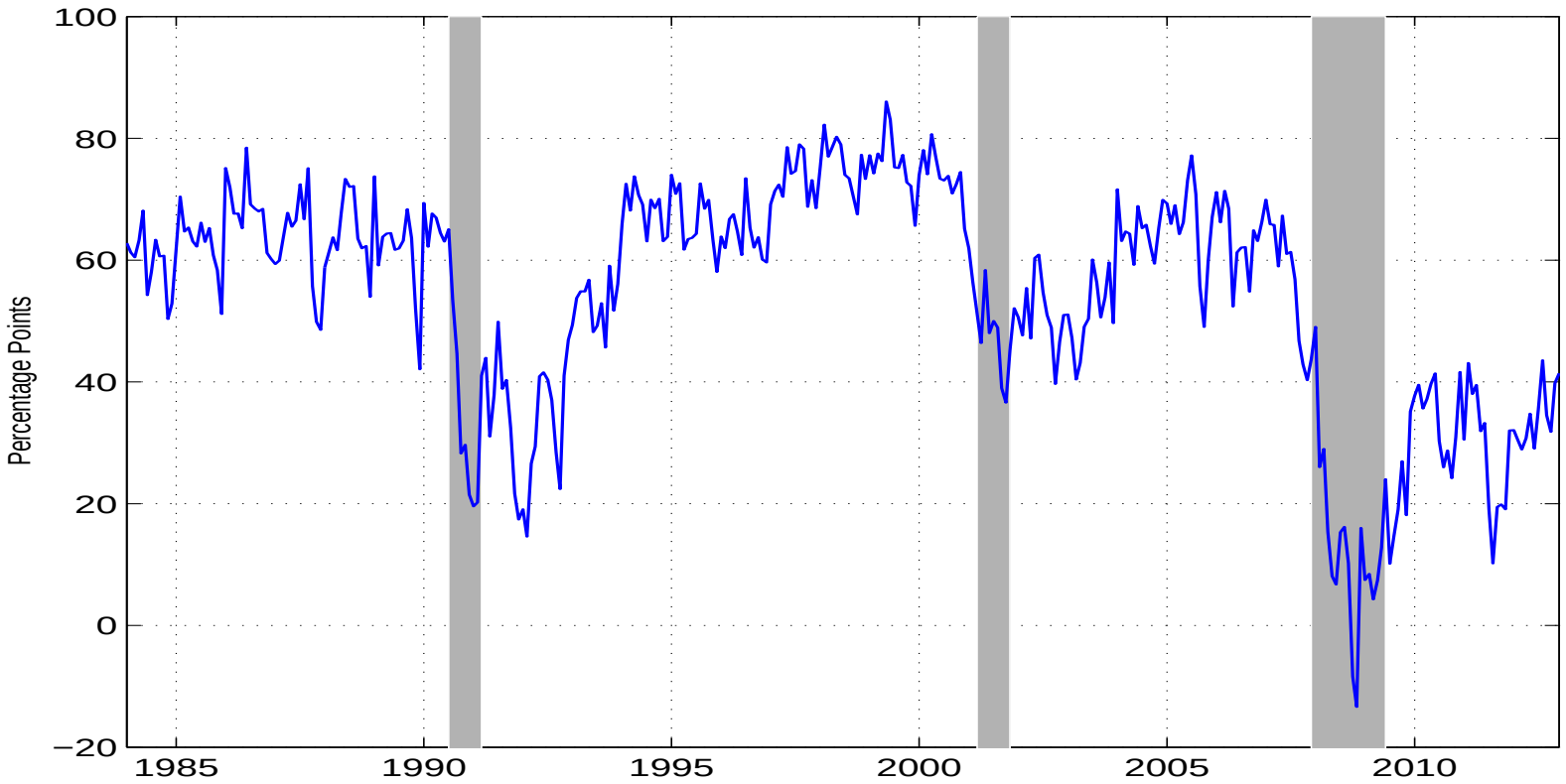
One-year inflation expectations:
"By about what percent do you expect future prices to go (up/down) on the average, during the next 12 months?"

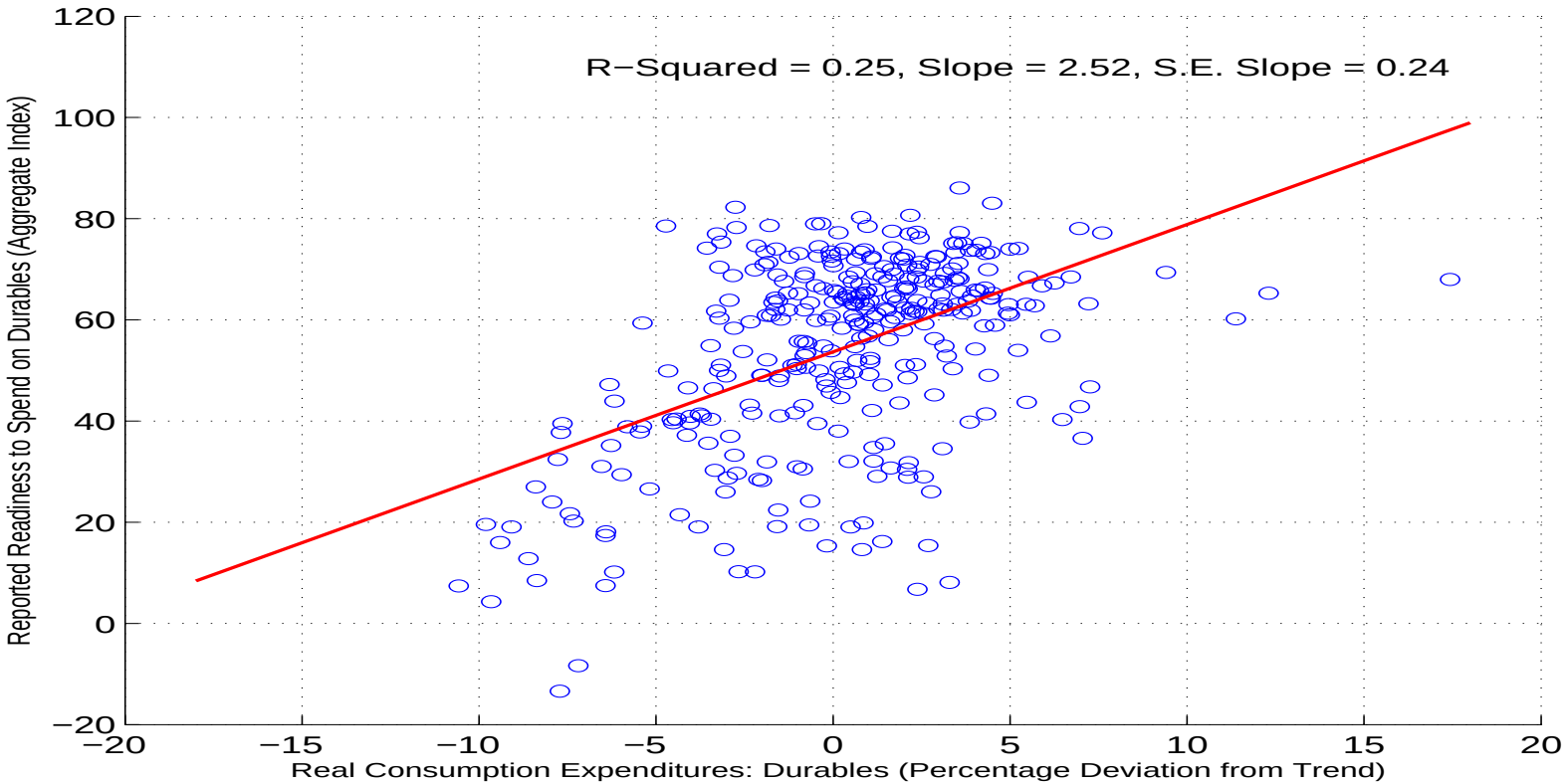
Durables

Figure: Buying Conditions for Durable Goods - Aggregate Index



Durables

Figure: Relationship between Aggregate Actual Consumption Expenditures on Durables and the Reported Readiness to Buy Durables



Alternatives

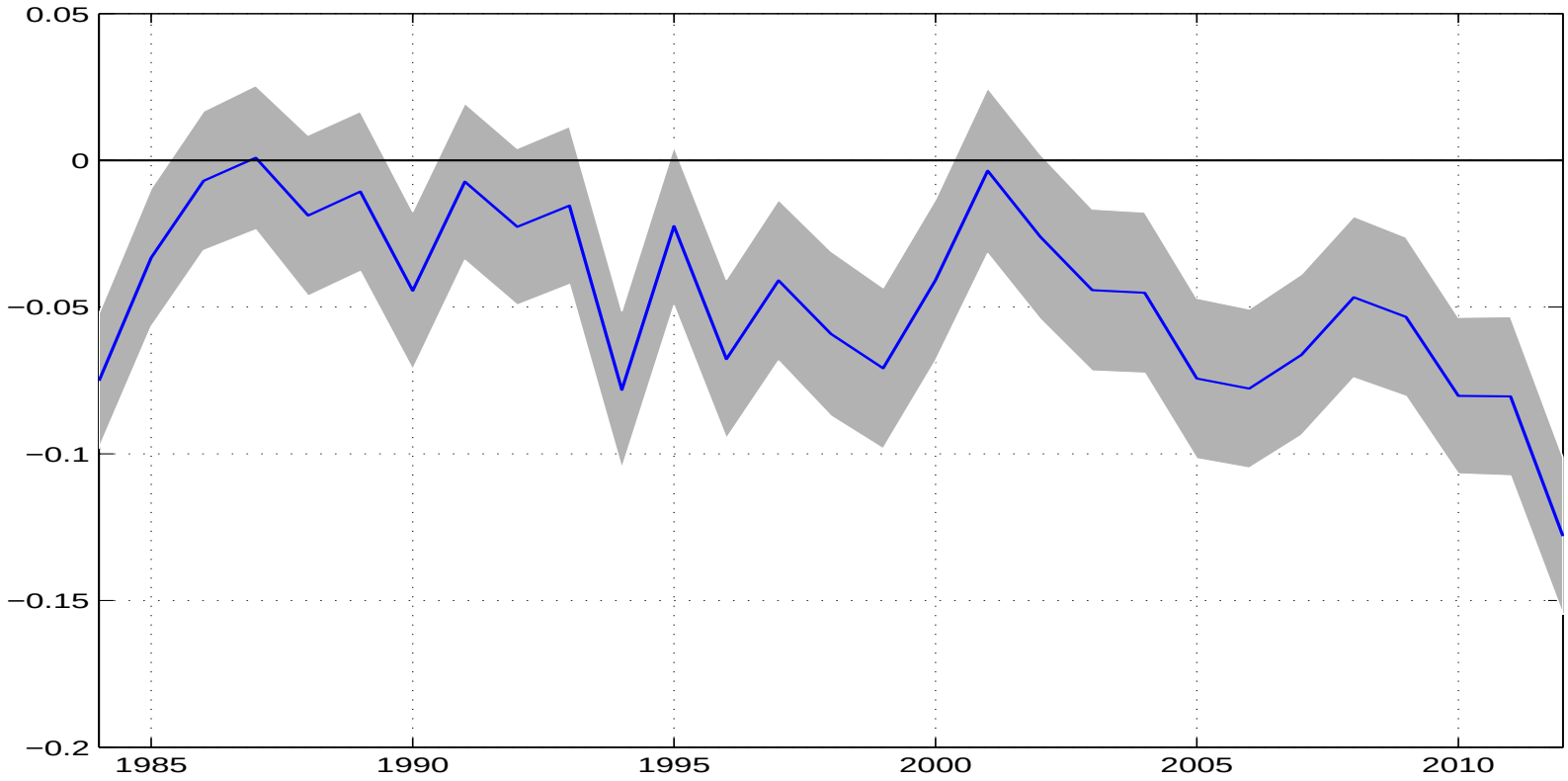
"Speaking now of the automobile market – do you think the next 12 months or so will be a good time or a bad time to buy a vehicle, such as a car, pickup, van or sport utility vehicle?"

"Generally speaking, do you think that now is a good time or a bad time to buy a house?"

"By about what percent per year do you expect prices to go (up/ down) on the average, during the next 5 to 10 years?"

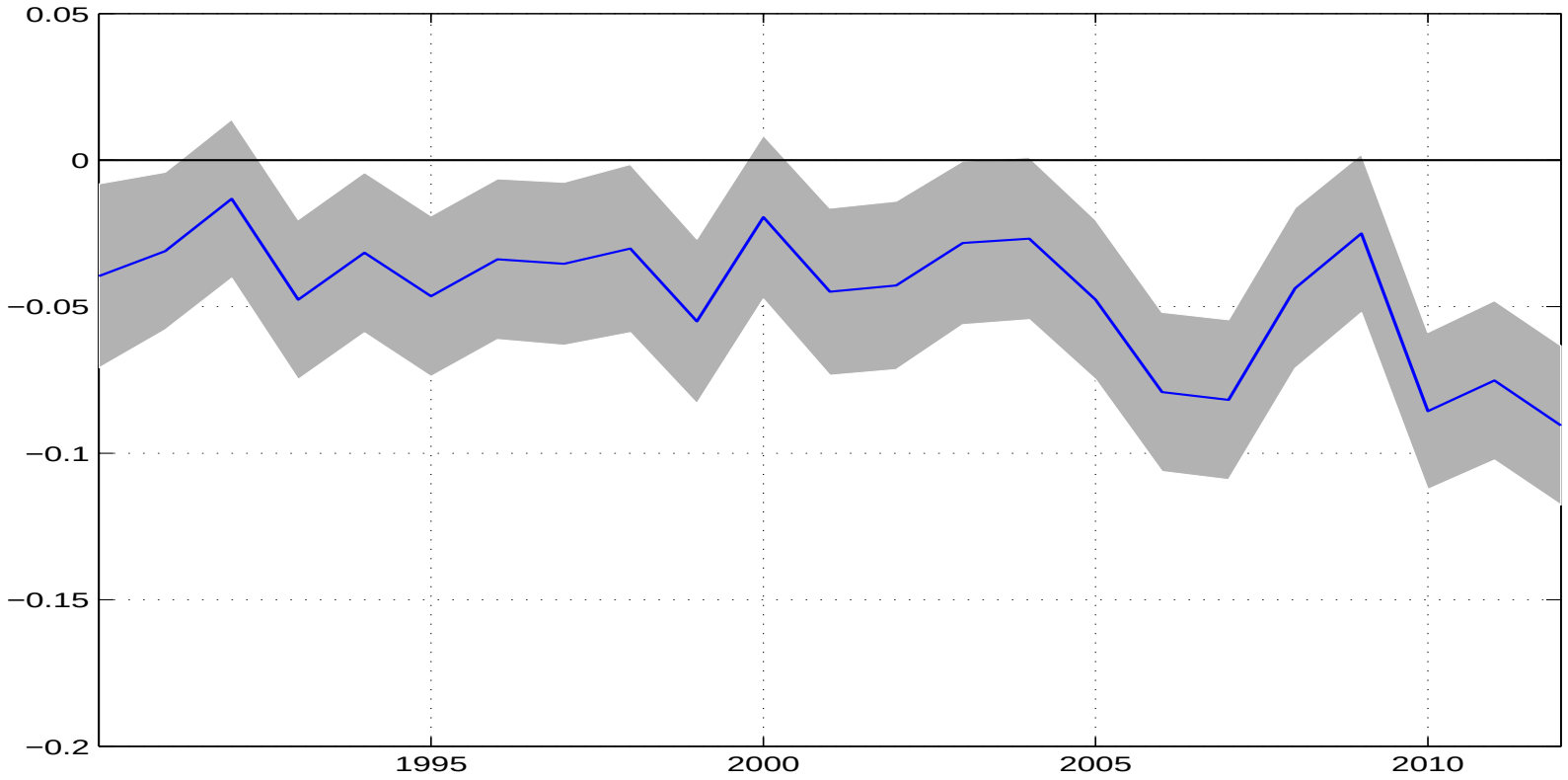
Cross-sectional Correlations - Time Series

Figure: Durables (1Y)



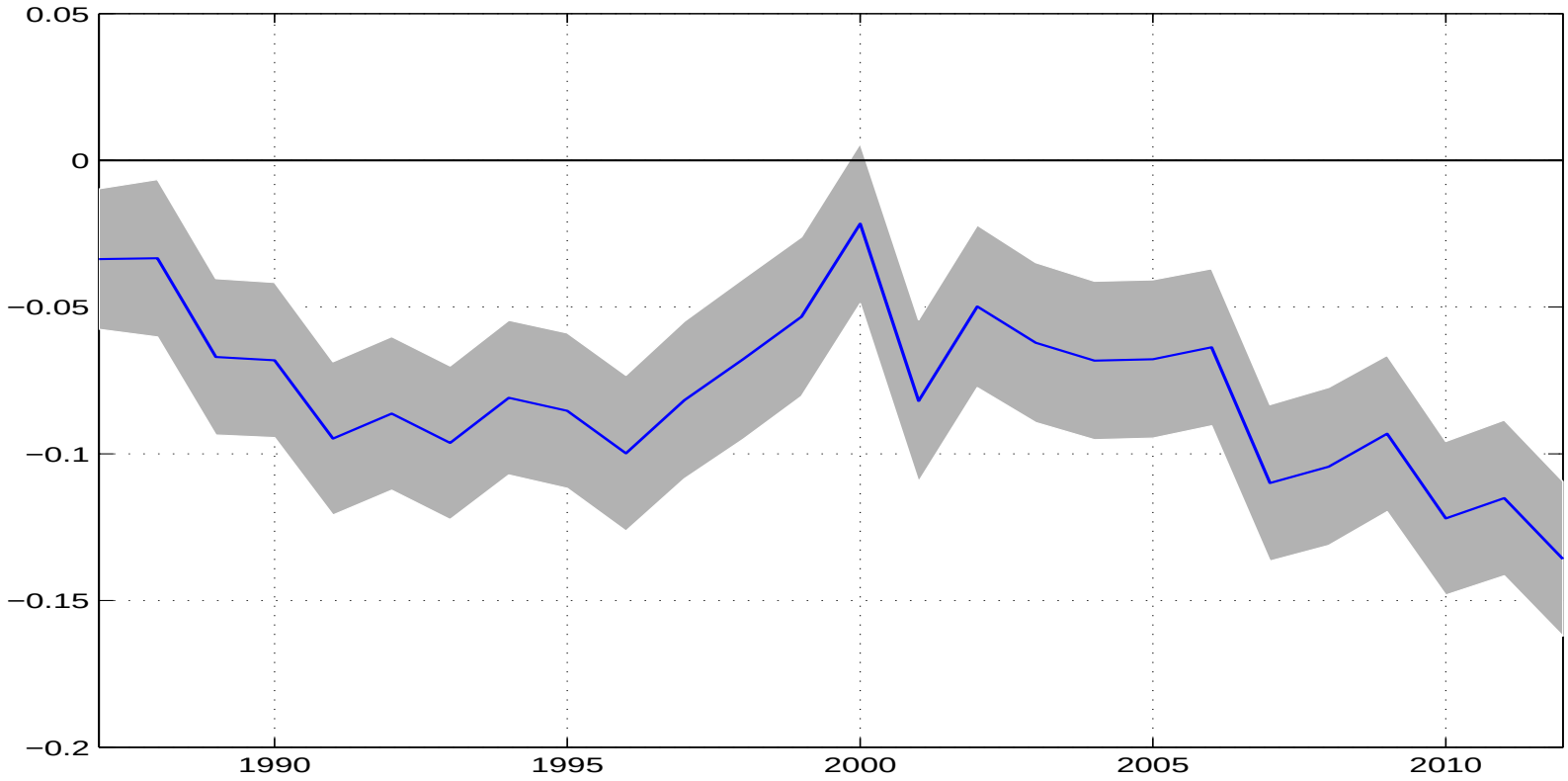
Cross-sectional Correlations - Time Series

Figure: Cars (5Y)

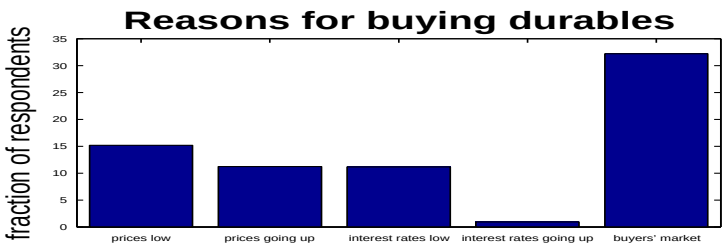


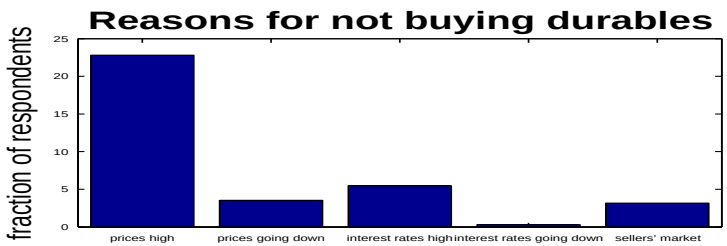
Cross-sectional Correlations - Time Series

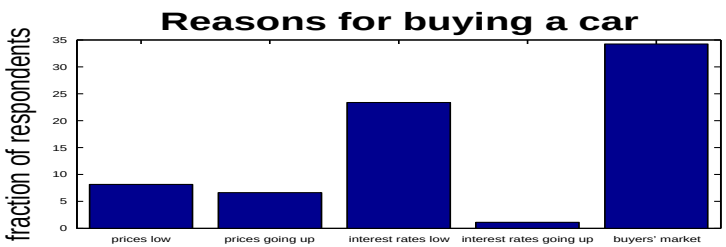
Figure: Houses (1Y)

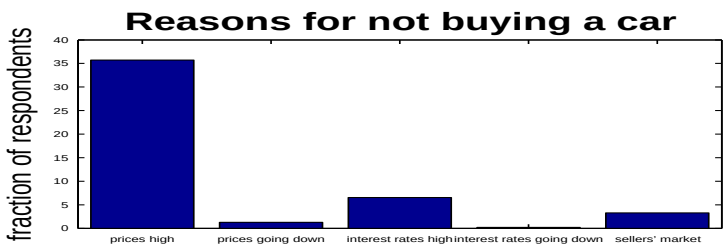


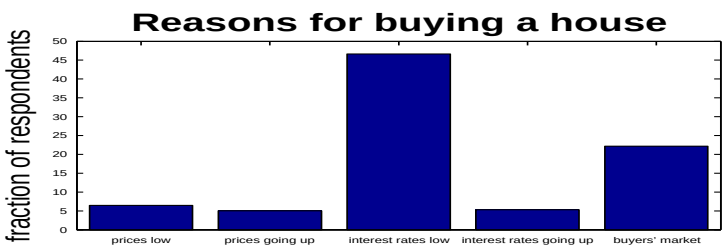
Reasons for Buying Durables

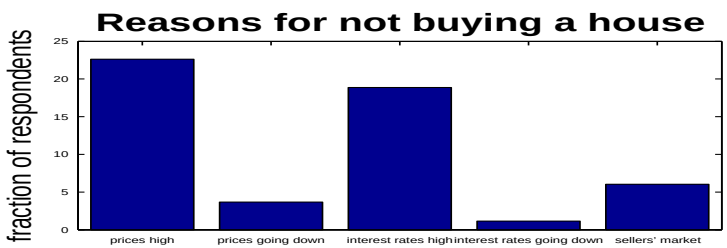












Ordered Probits

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$$\text{Survey responses } y = \begin{cases} -1 & \text{if} \quad y^* \leq \alpha_1 \\ 0 & \text{if} \quad \alpha_1 < y^* \leq \alpha_2 \\ +1 & \text{if} \quad \alpha_2 < y^* \end{cases}$$

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Are interested in β_1 and β_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		
		Marginal Effects	
Independent Variables	Coefficients	at $D_{ZLB} = 0$	at $D_{ZLB} = 1$
Inflation Expectations (1Y)	-0.0009	-0.0002	-0.0047^{***}
	(0.0015)	(0.0004)	(0.0011)
ZLB Dummy Interacted with Expected Inflation (1Y)	-0.0112^{***}		
	(0.0031)		

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		Marginal Effects	
Independent Variables	Coefficients	at $D_{ZLB} = 0$	at $D_{ZLB} = 1$
Expected Financial Situation of Household	0.0263^{***}	0.0079^{***}	0.0101^{***}
	(0.0091)	(0.0027)	(0.0035)
Expected Real Household Income	0.0211^{**}	0.0064^{**}	0.0081^{**}
	(0.0083)	(0.0025)	(0.0032)
Expected Change in Nominal Interest Rate	0.0436^{***}	0.0131^{***}	0.0168^{***}
	(0.0074)	(0.0022)	(0.0029)
Expected 1Y Aggregate Business Conditions (Idiosyncratic)	0.1300^{***}	0.0392^{***}	0.0500^{***}
	(0.0068)	(0.0020)	(0.0026)
Expected 5Y Aggregate Business Conditions (Idiosyncratic)	0.0623^{***}	0.0188^{***}	0.0240^{***}
	(0.0068)	(0.0020)	(0.0026)
Expected Unemployment	-0.0652^{***}	-0.0196^{***}	-0.0251^{***}
	(0.0089)	(0.0027)	(0.0034)
Current Financial Situation	0.1189^{***}	0.0359^{***}	0.0458^{***}
	(0.0067)	(0.0020)	(0.0026)
Economic Policy Trust (Idiosyncratic)	0.1119^{***}	0.0337^{***}	0.0431^{***}
	(0.0088)	(0.0026)	(0.0034)

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		Marginal Effects	
Independent Variables	Coefficients	at $D_{ZLB} = 0$	at $D_{ZLB} = 1$
Expected 1Y Aggregate Business Conditions (Index)	0.0016^{***}	0.0005^{***}	0.0006^{***}
	(0.0003)	(0.0001)	(0.0001)
Cross-sectional Dispersion in Expected Inflation (1Y)	-0.0810^{***}	-0.0244^{***}	-0.0312^{***}
	(0.0150)	(0.0045)	(0.0058)
VXO	-0.0047^{***}	-0.0014^{***}	-0.0018^{***}
	(0.0008)	(0.0002)	(0.0003)
Federal Funds Rate	0.0230^{***}	0.0069^{***}	0.0088^{***}
	(0.0036)	(0.0011)	(0.0014)
Civilian Unemployment Rate	-0.0504^{***}	-0.0152^{***}	-0.0194^{***}
	(0.0065)	(0.0020)	(0.0025)
Current Inflation Rate	-0.0236^{***}	-0.0071^{***}	-0.0091^{***}
	(0.0061)	(0.0018)	(0.0024)
Current Inflation Volatility	-0.0221^{***}	-0.0067^{***}	-0.0085^{***}
	(0.0067)	(0.0020)	(0.0026)
Relative Price of Durable Goods	0.0015	0.0004	0.0006
	(0.0016)	(0.0005)	(0.0006)

Baseline - Demographics

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

		Marginal Effects	
Independent Variables	Coefficients	at $D_{ZLB} = 0$	at $D_{ZLB} = 1$
Sex	-0.0692^{***}	-0.0208^{***}	-0.0266^{***}
	(0.0109)	(0.0033)	(0.0042)
Married	-0.0014	-0.0004	-0.0005
	(0.0133)	(0.0040)	(0.0051)
College Degree	-0.0294^{**}	-0.0089^{**}	-0.0113^{**}
	(0.0120)	(0.0036)	(0.0046)
African American	-0.0116	-0.0035	-0.0045
	(0.0200)	(0.0059)	(0.0075)
Hispanic American	-0.1167^{***}	-0.0352^{***}	-0.0450^{***}
	(0.0248)	(0.0075)	(0.0096)
Native American	-0.0436	-0.0131	-0.0168
	(0.0551)	(0.0166)	(0.0212)
Asian American	-0.1473^{***}	-0.0444^{***}	-0.0567^{***}
	(0.0390)	(0.0118)	(0.0150)
Current Real Household Income (in logs)	0.0525^{***}	0.0159^{***}	0.0202^{***}
	(0.0081)	(0.0025)	(0.0031)

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- Very consistent across demographic subgroups: income, age, education, birth cohort.

Houses – ($N = 5560$,Sample: 2007:05 to 2010:12)

		Marginal Effects	
Independent Variables	Coefficients	at ZLB = 0	at ZLB = 1
Exp. Inflation(1Y)	-0.0148^{**}	-0.0043^{**}	-0.0059^{***}
	(0.0059)	(0.0017)	(0.0022)
ZLB Dummy × Exp. Inflation (1Y)	-0.0017		
	(0.0077)		
ZLB Dummy	-0.2657	-0.0762	
	(0.2314)	(0.0590)	
Subjective Prob. of Job Loss	-0.0010	-0.0003	-0.0003
	(0.0008)	(0.0002)	(0.0003)
Subjective Prob. of Real Income Gains	0.0022^{***}	0.0006^{**}	0.0008^{**}
	(0.0009)	(0.0003)	(0.0003)
Expected Change in House Prices (1Y)	0.0719^{**}	0.0206^{**}	0.0255^{**}
	(0.0285)	(0.0084)	(0.0114)
Expected Change in Gas Price (1Y)	0.0001	0.0000	0.0000
	(0.0005)	(0.0001)	(0.0002)
Mortgage Rate	-0.1895	-0.0543	-0.0673^{*}
	(0.1251)	(0.0332)	(0.0385)
S&P Case-Shiller Index	-0.0485^{**}	-0.0139^{**}	-0.0172^{***}
	(0.0208)	(0.0062)	(0.0053)
Home Owner	0.1803^{***}	0.0517^{***}	0.0640^{***}
	(0.0544)	(0.0163)	(0.0235)

"Accurate" and "Reasonable" Inflation Expectations

Specification	Coefficients	Marginal Effects at $D_{ZLB} = 0$	Marginal Effects at $D_{ZLB} = 1$
Within one time series std of actual inflation ($N = 20814$, Sample: 1984:01 to 2012:12)	0.0084	0.0025	0.0057
	(0.0097)	(0.0029)	(0.0083)
Within one time series std of actual inflation, 2x ($N = 6551$, Sample: 1984:01 to 2012:12)	0.0157	0.0044	0.0222
	(0.0184)	(0.052)	(0.0157)
Within 0.5 percentage points of actual inflation ($N = 8577$, Sample: 1984:01 to 2012:12)	0.0019	0.0006	0.0379**
	(0.0190)	(0.0056)	(0.0177)
Outside 0.5 percentage points of actual inflation ($N = 59278$, Sample: 1984:01 to 2012:12)	−0.0010	−0.0003	−0.0048***
	(0.0015)	(0.0004)	(0.0011)
Within 1.28 percentage points of mean inflation expectations ($N = 22439$, Sample: 1984:01 to 2012:12)	0.0040	0.0012	0.0019
	(0.0126)	(0.0038)	(0.0098)
Within 1.28 percentage points of mean SPF inflation expectations ($N = 22061$, Sample: 1984:01 to 2012:12)	−0.0218	−0.0066	−0.0200
	(0.0142)	(0.0044)	(0.0122)

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- Quantity expectations matter positively (Old Keynesianism appears to be alive and well).

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  - Agents may not yet have understood how monetary policy works at the ZLB.
  - Agents come from a long period of low inflation and low inflation volatility, so that rational inattention makes them not pay attention to inflation until it actually happens.
  - Inflation expectations may rather work through investment, rather than consumption demand.

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

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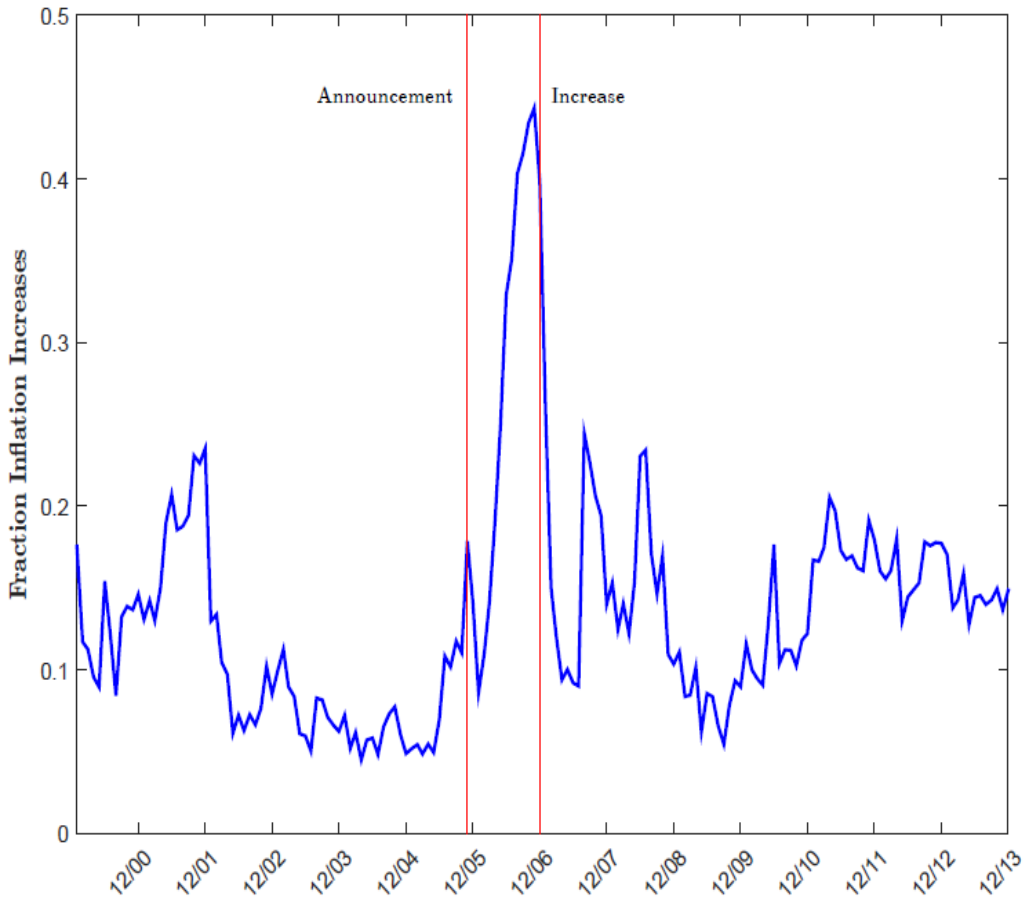
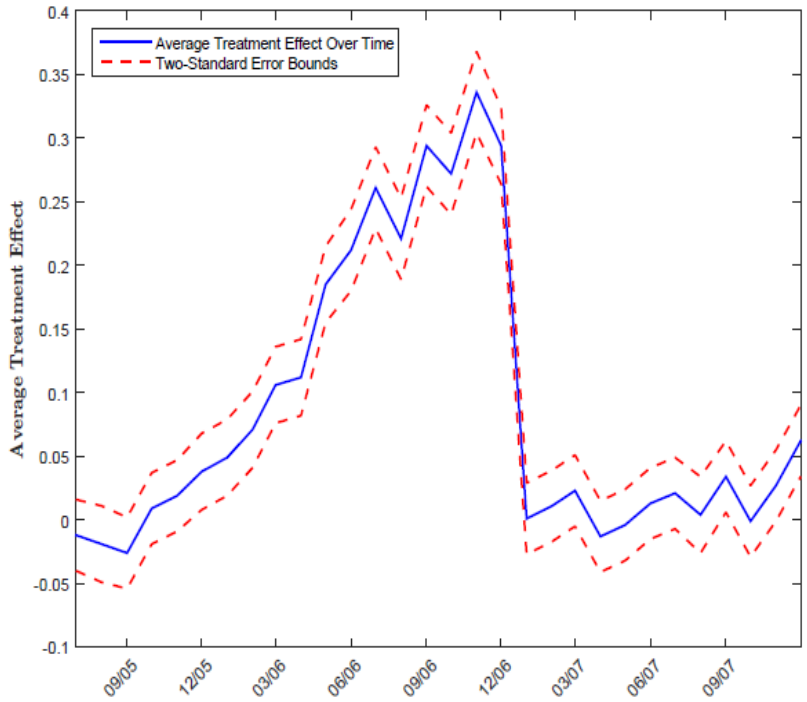
- Nominal rate did not increase to offset inflation expectations.

Inflation Expectations Increased in Germany ...



... and So Did Readiness to Spend Relative to Other European Countries



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- Communication of policy is key.

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"What Drives Aggregate Investment? Evidence from German Survey Data," joint with Peter Zorn, 2016, working paper.

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- Even more specifically: the fluctuations of the year-over-year investment growth rate.
- Novel approach: narrative, survey-based.

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- In other words: we move from investment determinants to economic shocks.

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2. Making more assumptions and putting more structure on the empirical model: extract also aggregate demand and finance shocks.

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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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Also: these data are confidential, so there is probably little danger of decision makers strategically lying.

Preview of Results

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2. But: technology shocks explain (only) roughly *one third* of the variance of aggregate (manufacturing) investment growth.
3. Aggregate demand shocks: explain roughly *one half*. Find suggestive evidence that these demand shocks are sentiment shocks.

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- Recovery from the slump in the latter half of the 2000s is a positive sentiment shock.
- Great Recession shock looks like a combination of a negative sentiment shocks and a significant technological slow down.

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- Starts in 1955, but the for us relevant questions start only in 1989. Our baseline sample period: 1989-2008, to focus on regular year-to-year business cycle fluctuations first.

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

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:

			[This Year]		
Investment Determinant	strongly positive influence	weakly positive influence	no influence	weakly negative influence	strongly negative influence
Sales Situation and Expectation	☐	☐	☐	☐	☐
Finance	☐	☐	☐	☐	☐
Profit Expectation	☐	☐	☐	☐	☐
Technical Factors	☐	☐	☐	☐	☐
Macro Policy Environment	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐
[Codification]	*[+2]*	*[+1]*	*[0]*	*[-1]*	*[-2]*

Investment Determinants

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

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Quantification: -2 (strongly negative influence), -1 (weakly negative influence), 0 (no influence), +1 (weakly positive influence), or +2 (strongly positive influence)

Aggregation

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Then the aggregate investment growth rate, ΔI_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

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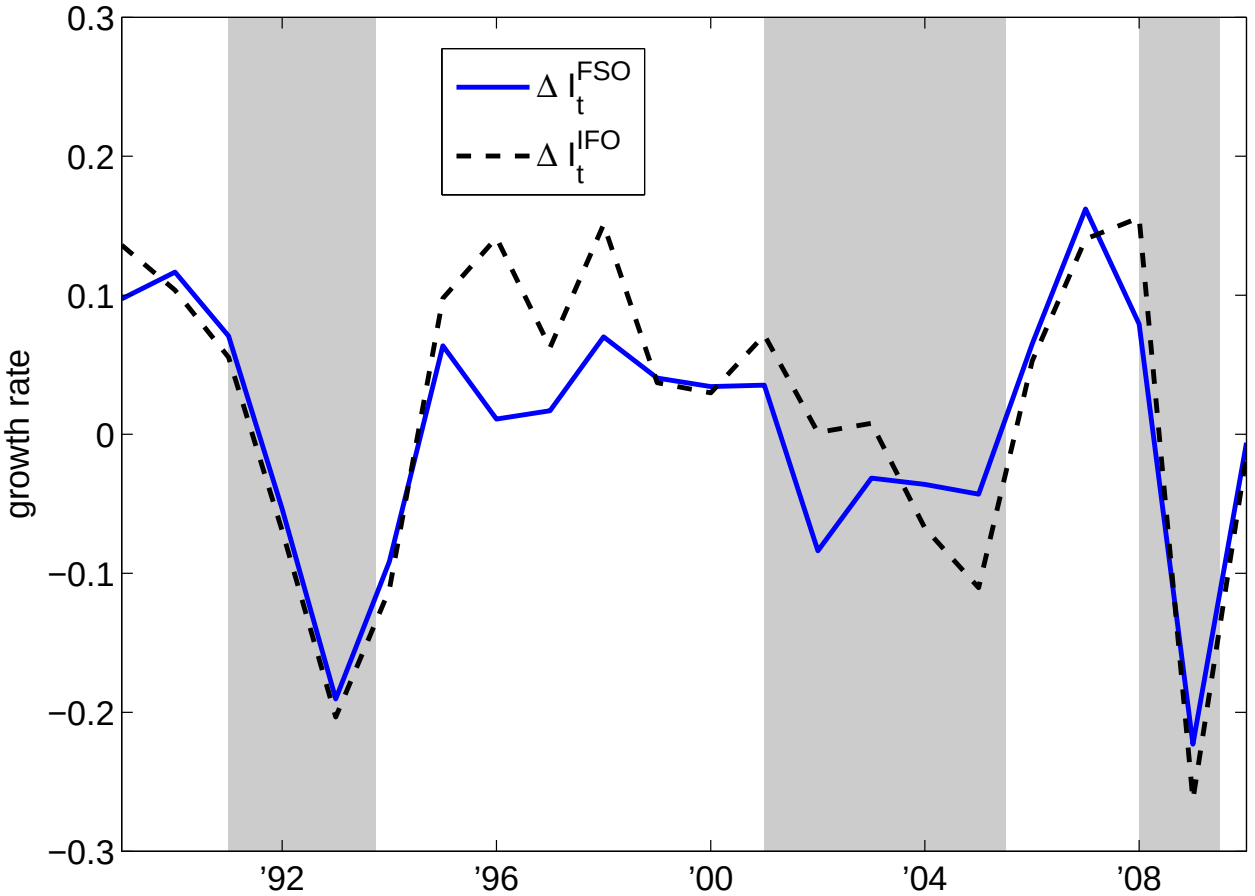
Then, for every investment determinant, we aggregate up to an investment determinant index, X_t, as follows:

$$X_t = \sum_{i=1}^{N_t} \omega_{it} \, x_{it}$$

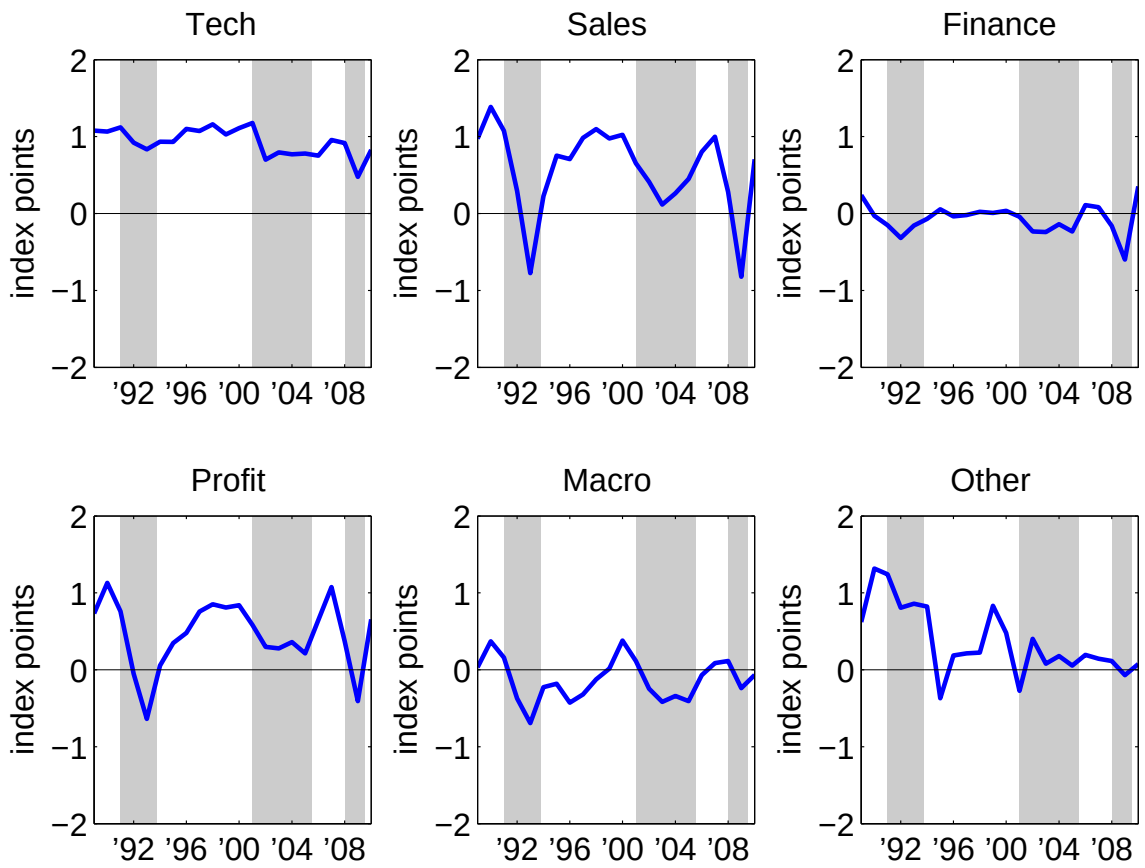
A First Look at the Data - Investment Growth Rate

Measures of aggregate investment growth ($\rho = 0.91$)



A First Look at the Data - Investment Determinant Indices

Aggregate investment determinant indices



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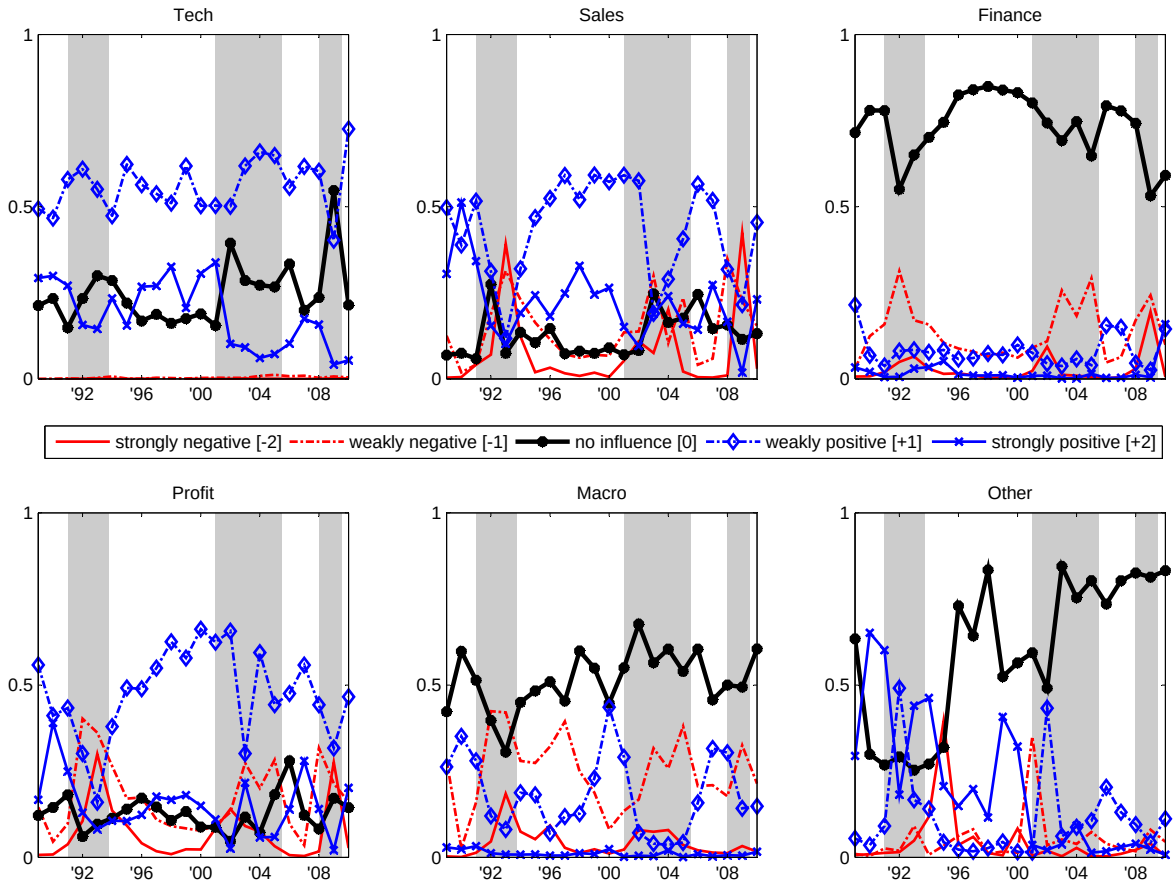

A First Look at the Data

	Tech	Sales	Finance	Profit	Macro	Other	ΔI_t^{FSO}
Baseline Sample Results (1989-2008)							
Panel A:							
Tech	1						
Sales	0.6071***	1					
Finance	0.4574**	0.5801***	1				
Profit	0.5434***	0.9434***	0.5920***	1			
Macro	0.5253***	0.7337***	0.4674***	0.7746***	1		
Other	0.1676	0.0879	-0.1100	0.0241	0.2073	1	
Panel B:							
ΔI_t^{FSO}	0.5029***	0.8392***	0.6279***	0.8849***	0.7601***	-0.1073	1
Panel C:							
μ	0.9602	0.6347	-0.0641	0.4947	-0.1275	0.4062	0.0166
σ	0.1490	0.4889	0.1391	0.4173	0.2846	0.4567	0.0832

Economic Content: Tech

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

Tercile	N	Mean(Tech)
1	11341	0.7818501
2	7690	0.9721699
3	9411	1.125008

Difference in means statistically significant at the 1% level.

Economic Content: Tech

Mean of |Tech|, conditional on Eurostat's Technology Classification:

Industries	N	Mean(|Tech|)
Low-technology	10911	0.8956025
Medium-low-technology	8448	0.9669374
Medium-high/High-technology	8645	0.9783141

Economic Content: Tech and Sales

We just recently matched the investment survey with a pricing survey and found that Tech is negatively correlated with price increases, and positively with price decreases; and vice versa for Sales.

Economic Content: Finance

Mean of |Finance|, conditional on share of external finance (IFO survey):

Share of External Finance	N	Mean(|Finance|)
up to 33.33%	11564	0.2520984
33.33% to 66.66%	2194	0.5049183
above 66.66%	1982	0.5344153

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2. Within non-technological shocks:
   1. Orthogonalize `Profit`, `Macro` and `Other` with respect to `Technology`, `Finance` and `Sales`.
   2. Baseline: Orthogonalize `Finance` with respect to `Sales`. External finance is not that important in Germany.

Orthogonalization - Regression Framework

$$
\begin{aligned}
\texttt{Tech}_t &= \nu_{\mathbf{1}} + \widehat{\texttt{Tech}_t} \\
\texttt{Sales}_t &= \nu_{\mathbf{2}} + \delta_{\mathbf{21}} \widehat{\texttt{Tech}_t} + \widehat{\texttt{Sales}_t} \\
\texttt{Finance}_t &= \nu_{\mathbf{2}} + \delta_{\mathbf{31}} \widehat{\texttt{Tech}_t} + \delta_{\mathbf{32}} \widehat{\texttt{Sales}_t} + \widehat{\texttt{Finance}_t} \\
\texttt{Profit}_t &= \nu_{\mathbf{4}} + \delta_{\mathbf{41}} \widehat{\texttt{Tech}_t} + \delta_{\mathbf{42}} \widehat{\texttt{Sales}_t} + \delta_{\mathbf{43}} \widehat{\texttt{Finance}_t} + \widehat{\texttt{Profit}_t} \\
\texttt{Macro}_t &= \nu_{\mathbf{5}} + \delta_{\mathbf{51}} \widehat{\texttt{Tech}_t} + \delta_{\mathbf{52}} \widehat{\texttt{Sales}_t} + \delta_{\mathbf{53}} \widehat{\texttt{Finance}_t} + \delta_{\mathbf{54}} \widehat{\texttt{Profit}_t} + \widehat{\texttt{Macro}_t} \\
\texttt{Other}_t &= \nu_{\mathbf{6}} + \delta_{\mathbf{61}} \widehat{\texttt{Tech}_t} + \delta_{\mathbf{62}} \widehat{\texttt{Sales}_t} + \delta_{\mathbf{63}} \widehat{\texttt{Finance}_t} + \delta_{\mathbf{64}} \widehat{\texttt{Profit}_t} + \delta_{\mathbf{65}} \widehat{\texttt{Macro}_t} + \widehat{\texttt{Other}_t}
\end{aligned}
$$

Remark: we verify that orthogonalized series are not autocorrelated.

Final Regression

$$\begin{aligned}\Delta I_t^{FSO} &= c + \beta_1 \widehat{\texttt{Tech}_t} + \beta_2 \widehat{\texttt{Sales}_t} + \beta_3 \widehat{\texttt{Finance}_t} + \\ &\quad \beta_4 \widehat{\texttt{Profit}_t} + \beta_5 \widehat{\texttt{Macro}_t} + \beta_6 \widehat{\texttt{Other}_t} + u_t\end{aligned}$$

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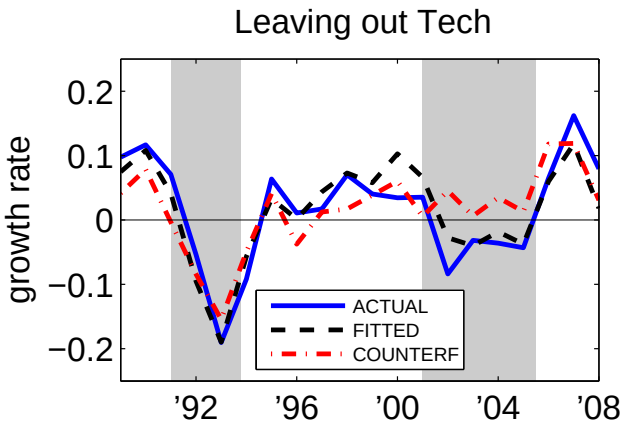
Residuals do not display significant autocorrelation.

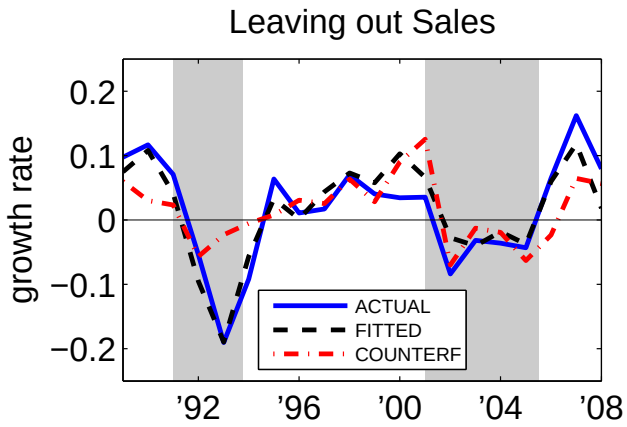
Variance Decomposition

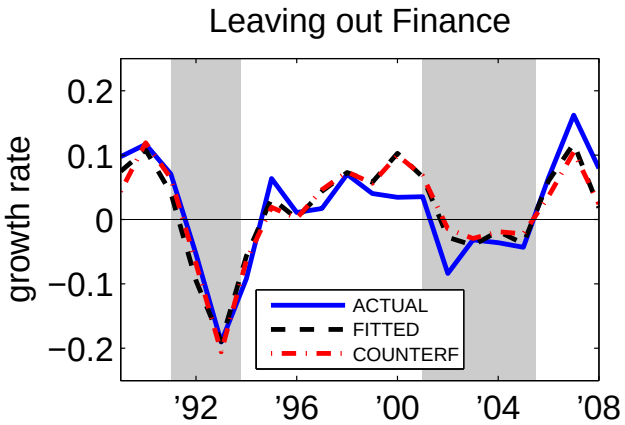
Relative contributions to the R^2 (in percent) with different orthogonalizations of Tech - Total R^2: 84 percent!

Orthogonalization:	Tech Sales Finance Profit Macro Other	Tech Finance Sales Profit Macro Other
$\widehat{\texttt{Tech}}$	30.19	30.19
$\widehat{\texttt{Sales}}$	53.89	33.73
$\widehat{\texttt{Finance}}$	3.73	23.89
$\widehat{\texttt{Profit}}$	7.65	
$\widehat{\texttt{Macro}}$	1.67	
$\widehat{\texttt{Other}}$	2.87	
R^2	0.8377	

Counterfactuals







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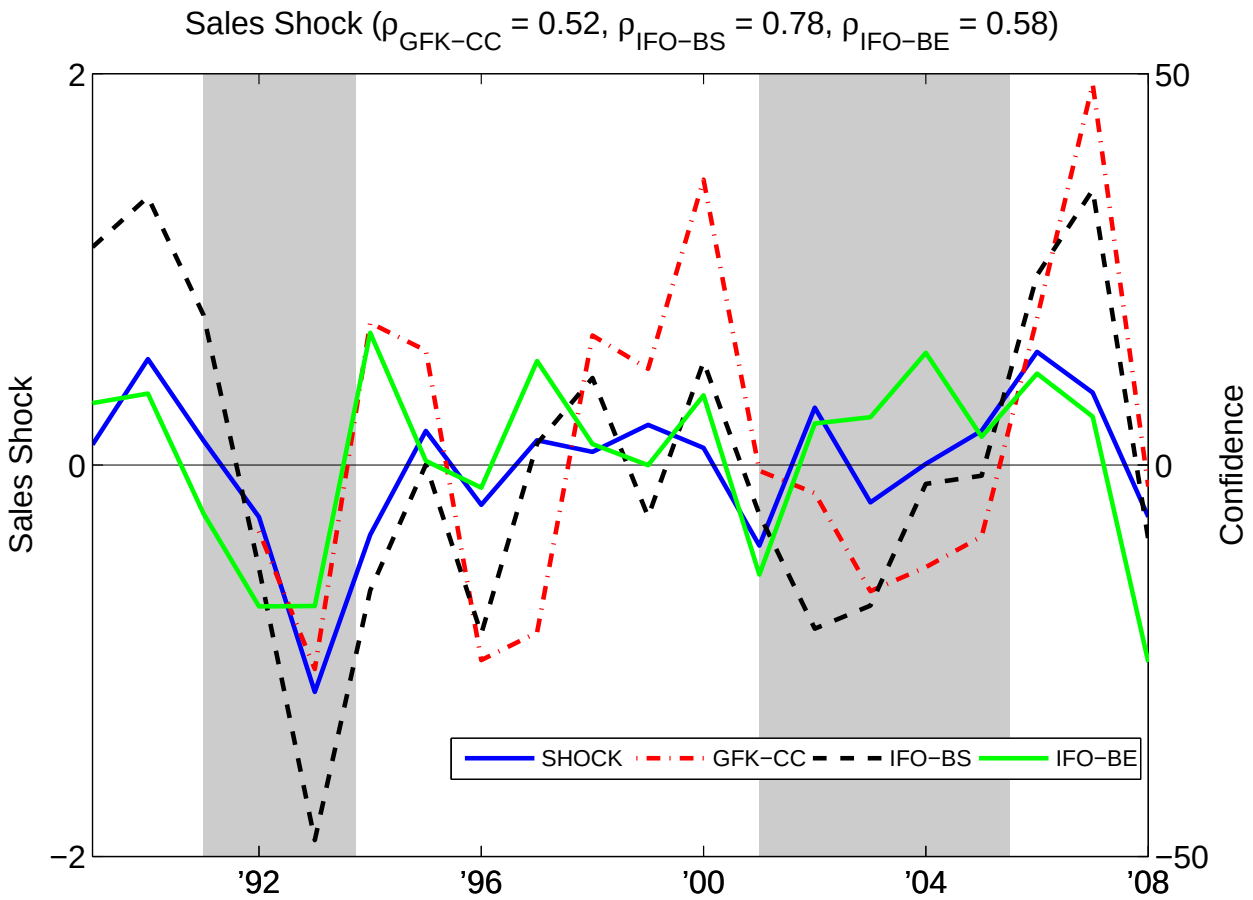
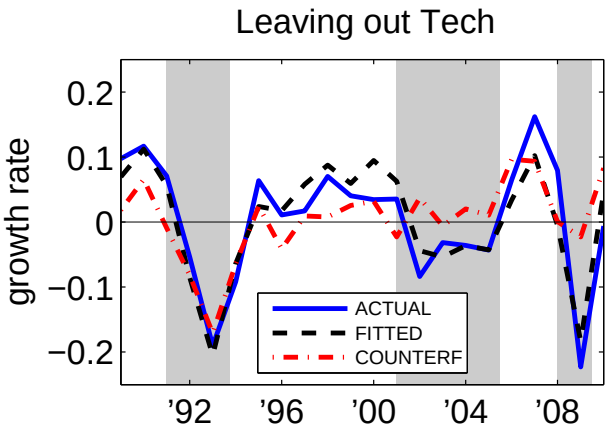
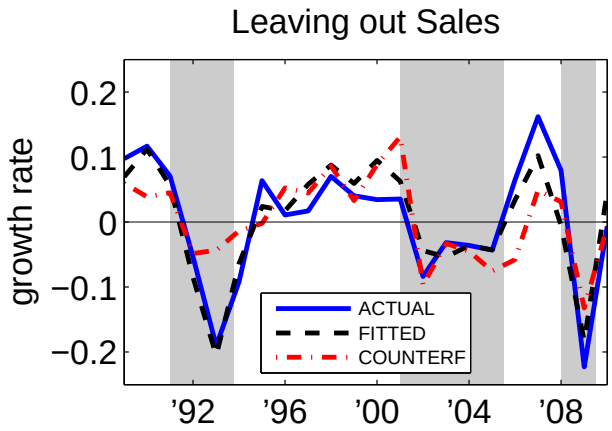
- Run a more parsimonious VAR with $\texttt{Tech}_t$, $\texttt{Sales}_t$ and the investment growth rate, and find similar results.
- Disaggregate results for Laender and 2-digit industries tell the same story.

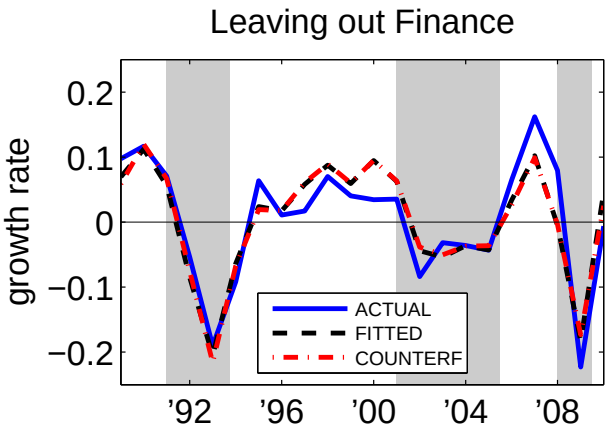
What Are the Demand Shocks?



Counterfactuals - Extended Sample







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- I would argue we should go a step further and ask economic agents why they did what they did.
- I applied this idea of looking at "subjective reasons" to study the ultimate business cycle question: What drives aggregate fluctuations?