Households' Subjective Expectations: Disagreement, Common Drivers and Reaction to Monetary Policy

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How Do Households Form Their Beliefs?

- In standard macroeconomic models, households make decisions based on expectations about many variables
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  3. How have they evolved over time?
- Address these questions by sequentially imposing more structure on the data, using identified shocks, natural experiments and theory

What We Do & What We Find: Overview of Results

- Reaction to contractionary monetary policy: negative effect on expected economic growth and positive effect on expected inflation. Result consistent with
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- Imposing more structure: A **factor model** shows that since the Russia-Ukraine war, supply has been perceived strongly inflationary

Literature Review

- Monetary Policy and Household Expectations Formation: Andre, Pizzinelli, Roth, Wohlfart (2022), Binetti, Nuzzi, Stancheva, (2024), Ahn, Xie, Yang (2024)
  - Here: Panel local projections on half a million observations with focus on a wide range of expectations in the euro area
- Household Expectations Formation: Kamdar (2019), Candia, Coibon, Gorodnichenko (2020, 2022), Andre, Pizzinelli, Roth, Wohlfart (2022)
  - Here: Study expectations about a broader range of variables across different countries and their determinants both in the cross-section and over time
- Analyze drivers using a factor structure: Stock and Watson (2014), Eickmeier and Hofmann (2022), Altavilla, Brugnolini, Gürkaynak, Motto (2019), Andrade, Ferroni (2021)
  - Here: Study how drivers of expectations relating to supply and demand evolve over the business cycle

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Data: Consumer Expectation Survey

The Effects of Monetary Policy on Expectations
- Impulse responses to identified MP surprises
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- The CES is an online panel survey of euro area consumer expectations
- It covers the 6 largest countries (expanded to 11 of the euro area. We will use data between April 2020 - February 2024
- Sample size is approximately 10,000 households per month
- Upon entry into the panel, households are asked background information (such as demographic characteristics)

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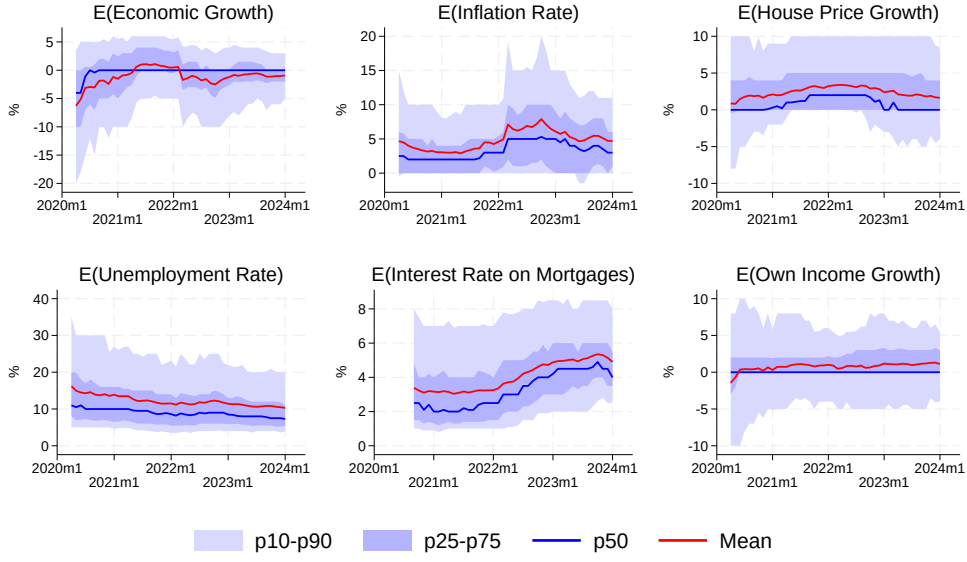
- Upon entry into the panel, households are asked background information (such as demographic characteristics)
- Expectations about aggregate and individual level variables are asked monthly and refer to a 12 months horizon: Descriptive Statistics
  - Aggregate: Economic growth, inflation (also over 3 year horizon), unemployment rate, house price growth, interest rate on mortgages
  - Individual: Income growth, financial situation, credit access, plans on buying durable goods

Households Disagree But React to the Business Cycle Country



Relative Optimists and pessimists are persistently so

	Persistence t to $t+1$			Persistence t to $t+3$			
		Low_t	Mid_t	$High_t$		Low_t	Mid_t	$High_t$
E(Economic Gr.)	Low_{t+1}	0.71	0.09	0.05	Low_{t+3}	0.69	0.1	0.05
	Mid_{t+1}	0.19	0.73	0.17	Mid_{t+3}	0.2	0.71	0.18
	$High_{t+1}$	0.11	0.18	0.78	$High_{t+3}$	0.12	0.19	0.76
		Low_t	Mid_t	$High_t$		Low_t	Mid_t	$High_t$
E(Inflation 1yr)	Low_{t+1}	0.71	0.09	0.05	Low_{t+3}	0.68	0.1	0.05
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E(Inflation 3yr)	Low_{t+1}	0.77	0.08	0.05	Low_{t+3}	0.74	0.09	0.05
	Mid_{t+1}	0.14	0.74	0.16	Mid_{t+3}	0.16	0.72	0.18
	$High_{t+1}$	0.09	0.18	0.8	$High_{t+3}$	0.1	0.19	0.77

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Monetary Policy and Expectations

- Lots of discussion about the recent inflation surge and the risk of inflation expectation de-anchoring
- We investigate how expectations react to monetary policy surprises using two complementary approaches:
  1. IRFs on panel of household expectations (inflation, output growth, unemployment...)
  2. Event study exploiting natural experiment arising from the randomization of interiews around ECB meetings.

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Response of expectations to identified MP surprises

- We estimate standard panel LPs at montly frequency
- Time frame: April 2020 - February 2024
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- y^i expectation of household i of a specific variable: inflation, output growth, unemployment rate, mortgage interest rate...

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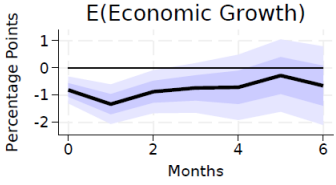
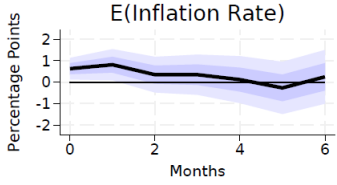
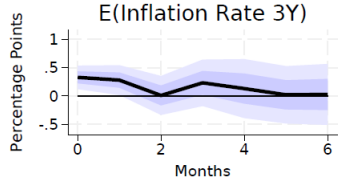
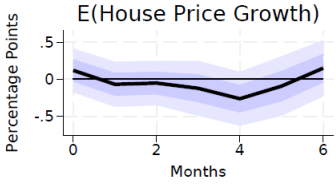
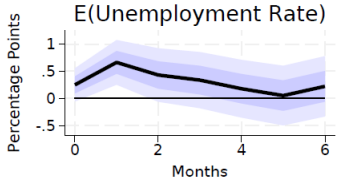
Tightening MP Surprises Increase $E(\pi)$...

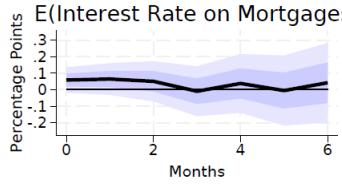












...which seems robust across countries...

Figure: $E(\pi)$ by countries

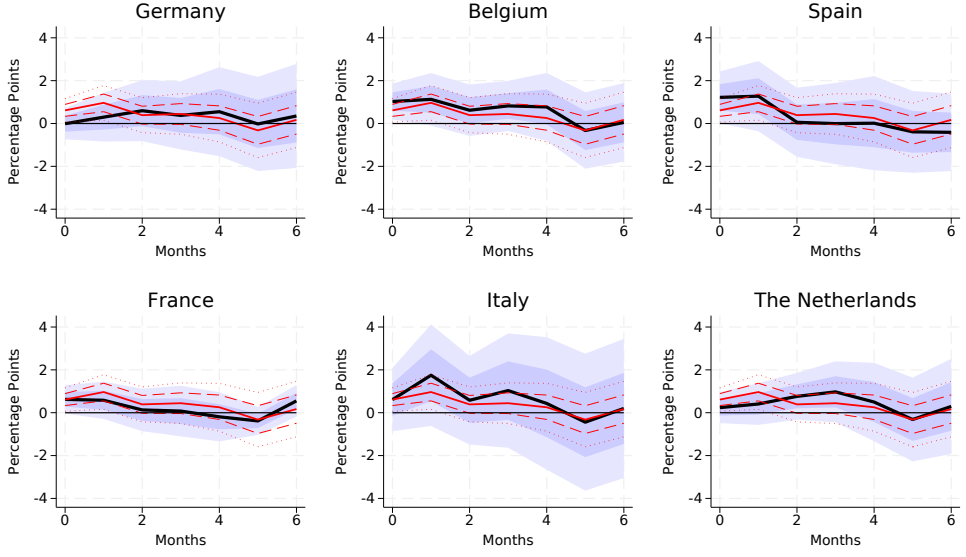


Figure: E(ec. growth) by countries

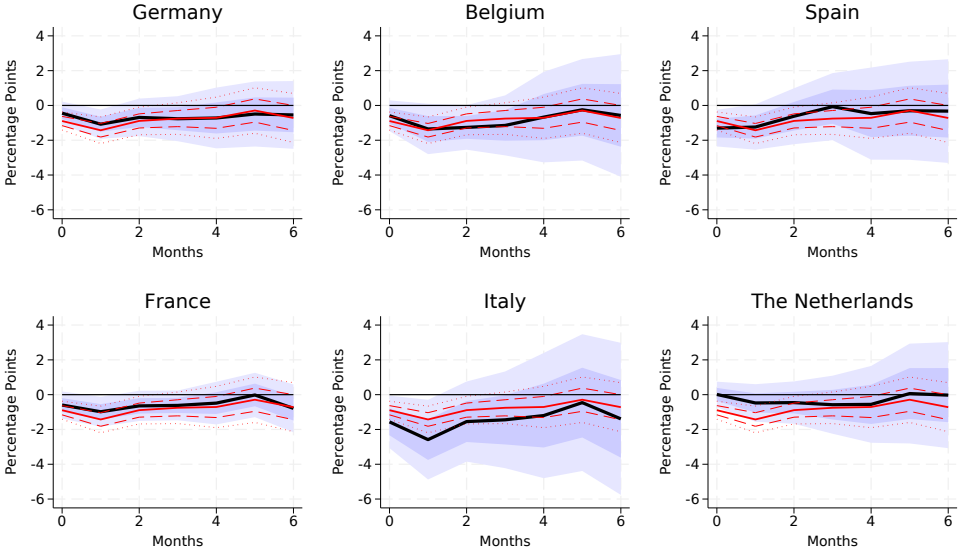
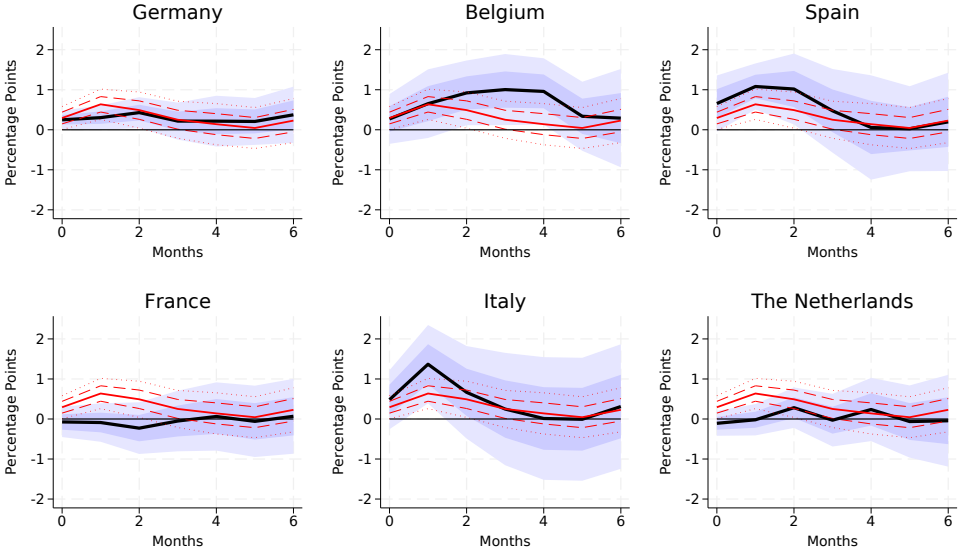
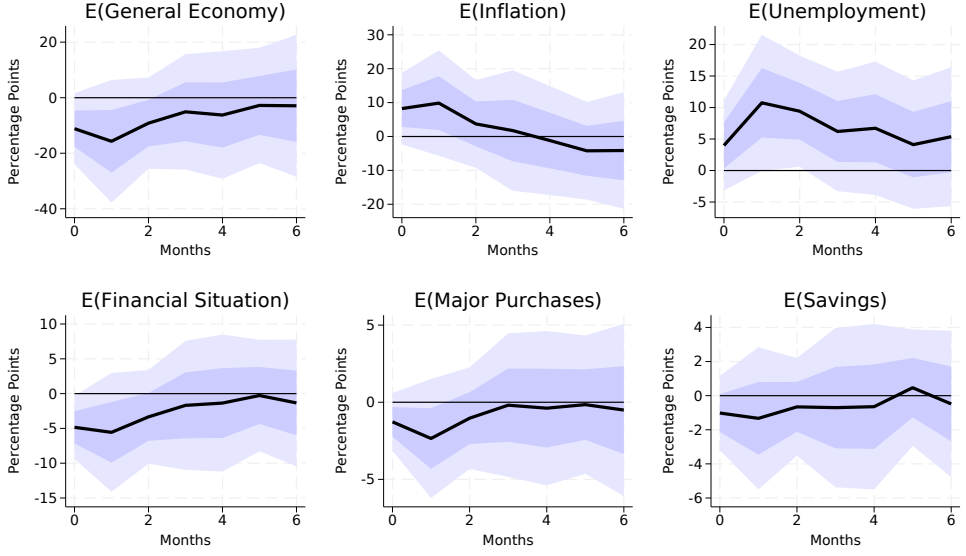


Figure: E(unemployment) by countries



... and robust to using a different survey (European Commission)

Figure: IRFs using survey from EC



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$$[\boldsymbol{m}-1-d, \boldsymbol{m}+1+d] \equiv [\boldsymbol{m}^{-}, \boldsymbol{m}^{+}] \tag{2}$$

- Given the random assignment, the effect on expectation y of a MP surprise s in meeting $\boldsymbol{m}$

$$ATE_{\boldsymbol{m}}\left(y \middle| MPS = s\right) = E\left(y_{\boldsymbol{m}^{+}} \middle| MPS = s\right) - E\left(y_{\boldsymbol{m}^{-}}\right) \tag{3}$$

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- Identifying assumption: window is "tight enough".

So... **what´s going on??**

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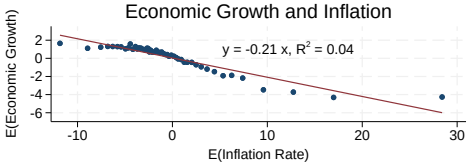
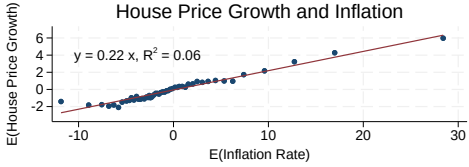
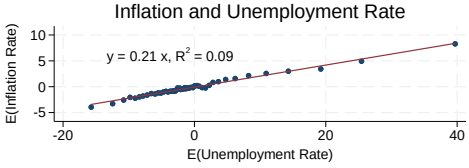
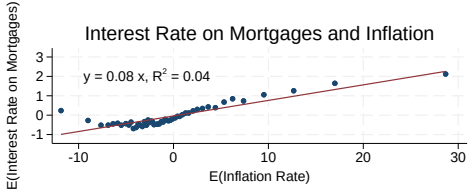
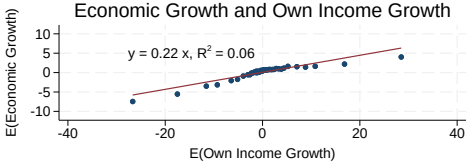
Household Expectations Are Correlated

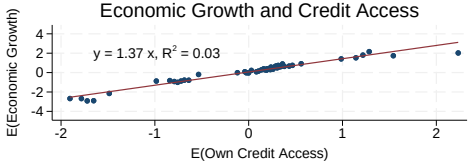












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Loadings of The First Two Principal Components

	Component 1	Component 2
E(Economic Growth)	0.31	0.22
E(Inflation Rate)	-0.46	0.26
E(Inflation Rate 3Y)	-0.44	0.31
E(House Price Growth)	-0.23	0.42
E(Unemployment Rate)	-0.31	0.11
E(Interest Rate on Mortgages)	-0.23	0.15
E(Own Income Growth)	0.18	0.56
E(Own Financial Situation)	0.38	0.39
E(Own Credit Access)	0.33	0.28
E(Own Durable Spending)	0.04	0.20
Observations	503134	503134
% Variance Explained	25.1	15.1

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E(Unemployment Rate)	-0.31	0.11
E(Interest Rate on Mortgages)	-0.23	0.15
E(Own Income Growth)	0.18	0.56
E(Own Financial Situation)	0.38	0.39
E(Own Credit Access)	0.33	0.28
E(Own Durable Spending)	0.04	0.20
Observations	503134	503134
% Variance Explained	25.1	15.1

Loadings of The First Two Principal Components

	Component 1	Component 2
E(Economic Growth)	0.31	0.22
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- **PC1**: Econ Growth +, Inflation - $\Longrightarrow$ Supply-Side or **"inflation bad"**
- **PC2**: Econ Growth +, Inflation + $\Longrightarrow$ Demand-Side or **"inflation good"**
- PC1 captures most of the variation PC Scores Diagram Scree Plot

Similar Results by Age and Education Groups

	Age 18-49		Age 50+		Lower Education		Higher Education	
	PC1	PC2	PC1	PC2	PC1	PC2	PC1	PC2
E(Economic Growth)	0.29	0.23	0.33	0.22	0.30	0.27	0.32	0.17
E(Inflation Rate)	-0.47	0.24	-0.46	0.29	-0.47	0.25	-0.46	0.27
E(Inflation Rate 3Y)	-0.46	0.28	-0.43	0.34	-0.44	0.31	-0.44	0.31
E(House Price Growth)	-0.26	0.39	-0.20	0.47	-0.23	0.43	-0.23	0.41
E(Unemployment Rate)	-0.32	0.10	-0.31	0.06	-0.31	0.09	-0.30	0.10
E(Interest Rate on Mortgages)	-0.23	0.15	-0.23	0.12	-0.23	0.13	-0.21	0.16
E(Own Income Growth)	0.14	0.56	0.21	0.55	0.16	0.56	0.20	0.55
E(Own Financial Situation)	0.36	0.42	0.39	0.35	0.38	0.37	0.38	0.40
E(Own Credit Access)	0.33	0.31	0.33	0.25	0.34	0.27	0.33	0.30
E(Own Durable Spending)	0.02	0.21	0.04	0.18	0.04	0.19	0.03	0.21
Observations	237952	237952	177905	177905	188417	188417	227440	227440
% Variance Explained	24.8	16.2	25.5	14.2	24.9	15.2	25.3	15.2

Additional Results & Robustness

- Using within individual variation: Table
  - residuals from an individual and and time FE regression show similar structure of disagreement
  - But lower explained variance: disagreement is persistent

- PCA in each month separately and in each country separately show results are similar both across countries and over time By-Month By-Country By-Country-Month

- PPCA using only $E(\pi), E(y)$ and $E(r)$ (i.e. main variables in a standard NK model) fails to capture structure described above three variables

- Household-level supply and demand perceived sources of fluctuations have often opposite effects on household consumption and savings: Setting and Results
  - First component: negative correlation with spending, positive correlation with precautionary savings
  - Second component: positive correlation with spending, positive correlation with precautionary savings

Outline

Data: Consumer Expectation Survey

The Effects of Monetary Policy on Expectations
- Impulse responses to identified MP surprises
- Natural experiment: event study around ECB meetings

Co-movement Between Expectations and disagreement

A Cross-Sectional Principal Component Analysis of Expectations
- Main Results
- Additional Results and Robustness

A Factor Structure of Expectations

Conclusion

Factor Structure of Expectations

- Collect the expectations E of all households H in the columns of vector $\boldsymbol{X}_t$

$$x_{i,t} = \lambda_i \boldsymbol{F_t} + e_{i,t} \qquad i = 1, \ldots, E \times H \tag{4}$$

  - F_t: 2×1 **common factors** and uncorrelated with $e_{i,t}$
  - λ_i: 2×1 vector of household-expectation loadings

- Factors are estimated as the first 2 principal components of $\boldsymbol{X}_t$, which are identified only up to a rotation of orthonormal matrix 2×2 Q. Get $\hat{F}_t$.

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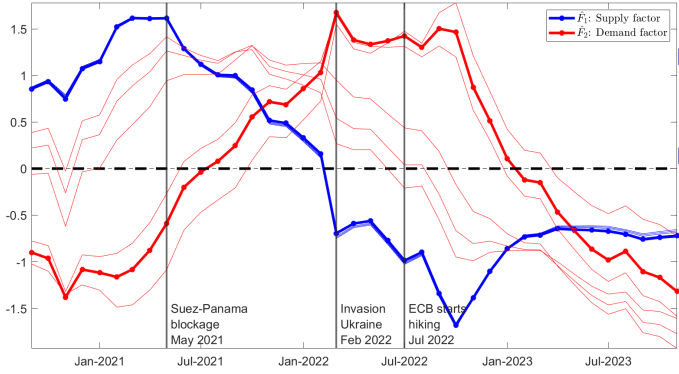
- $\hat{F}_t$ are rotated as in Rubio-Ramirez et al 2010: Q is obtained from a QR decomposition of a 2×2 matrix where each element is a standard normal
- OLS estimation of $x_{i,t} = \lambda_i' \hat{F}_t + v_{i,t}$, get $\hat{\lambda}_i$
- Sign restriction: first factor loads (+) on $\mathbb{E}_h Y$ and (-) on $\mathbb{E}_h \pi$; second factor loads (+) on $\mathbb{E}_h Y$ and (+) on $\mathbb{E}_h \pi$.

Evolution of Perceived Sources of Fluctuations By-Country



- ↑ Supply Factor: ↑ $\mathbf{E}Y$, ↓ $\mathbf{E}\pi$
- ↑ Demand Factor: ↑ $\mathbf{E}Y$, ↑ $\mathbf{E}\pi$
- ↑ levels of factors: more expansionary D & S

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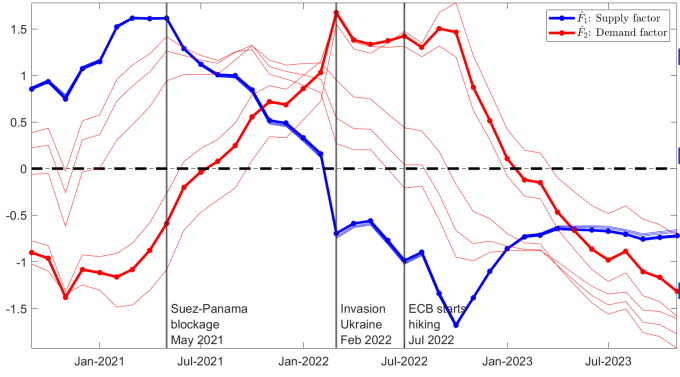

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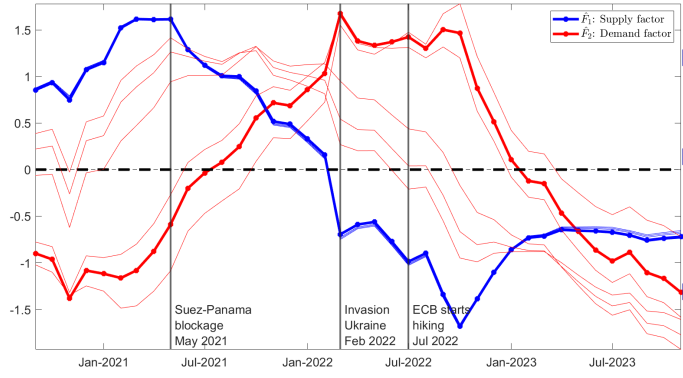

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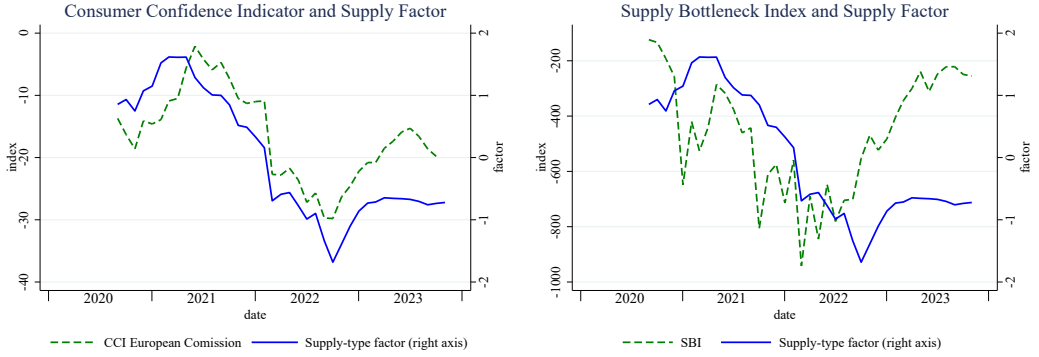
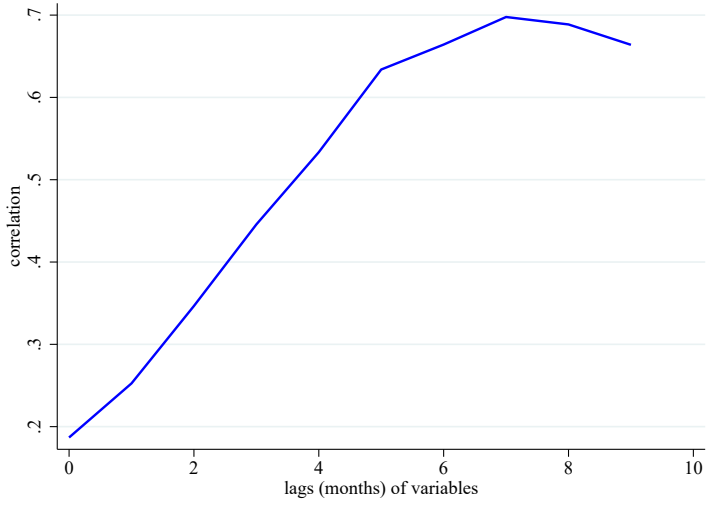
- Results are (surprisingly?) similar by age and education groups

Consumer Confidence Index and Supply Bottleneck Index

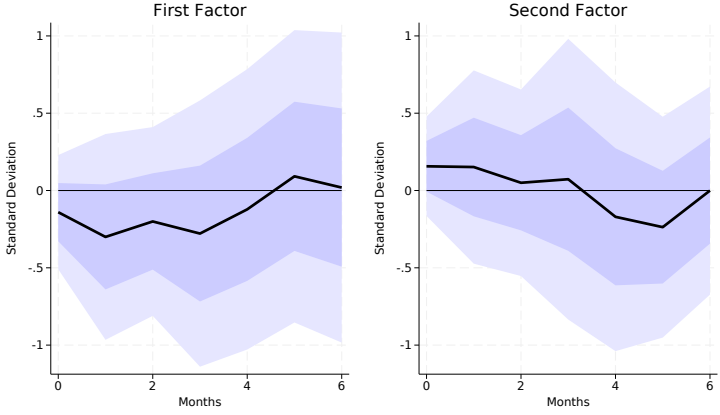


Sources: Consumer Confidence Indicator (CCI) is constructed by the European Commission based on questions about (i) personal finances and (ii) expectations about macro developments. The Supply Bottleneck Index (SBI) is constructed by Burriel et al. 2023) based on text analysis of newspaper articles.

Interestingly, SBI strong lagged correlation with F1



Tightening MP Surprises Affect Both Factors



Conclusion

- Following a tightening of monetary policy, households expect worse economic outlook accompanied by higher inflation
- We show that household expectations are correlated, and optimism / pessimism is very persistent.
- We show that two principal components explain a large fraction of the variance of the joint distribution of expectations
  - Supply-side and demand-side forces of business cycle fluctuations
- A factor model identified using cross-sectional results shows that
  - since the Russia-Ukraine war, supply has been perceived strongly inflationary and demand mildly inflationary
  - ECB tightening cycle stronger effect on demand perceptions
- Theoretical implications for dynamics and general equilibrium? WORK IN PROGRESS

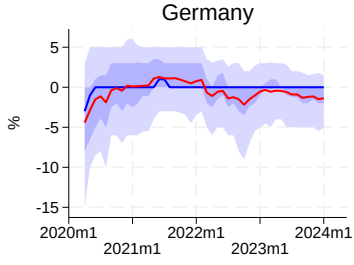
Appendix

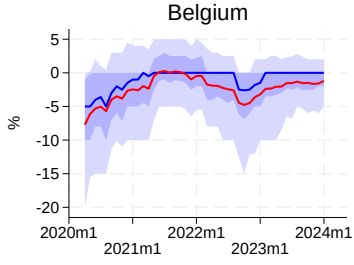
Descriptive Statistics (April2020-October2023) Back

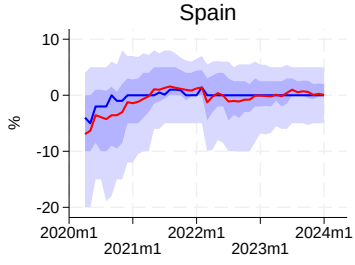
	Mean	p10	Median	p90	N
Age	51.03	26.00	57.00	80.00	516,604
Disposable Income	34,862.09	12,500.00	35,000.00	67,500.00	516,604
Nondurable Spending	19,972.65	7,320.00	18,072.00	35,148.00	175,318
Spent on Durables (0-1)	0.18	0.00	0.00	1.00	150,606
Precautionary Savings	8,958.00	340.00	4,400.00	22,000.00	160,591
E(Economic Growth)	-1.10	-10.00	0.00	5.00	516,604
E(Inflation Rate)	4.81	0.00	3.00	12.00	516,601
E(Inflation Rate 3Y)	3.76	0.00	2.00	10.00	511,944
E(House Price Growth)	2.45	-2.20	1.00	10.00	516,604
E(Unemployment Rate)	12.25	4.00	9.00	25.00	516,604
E(Interest Rate on Mortgages)	3.97	1.00	3.40	8.00	477,043
E(Own Income Growth)	0.76	-5.00	0.00	7.00	516,604
E(Own Spending Growth)	2.80	0.00	0.00	10.00	440,711
E(Own Durable Spending)	0.29	0.00	0.00	1.00	516,122
E(Own Credit Access)	2.78	2.00	3.00	4.00	512,137
E(Own Financial Situation)	2.81	2.00	3.00	4.00	516,604

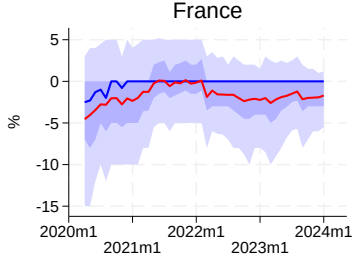
- Income refers to the previous 12 months, asked once
- Spending refers to previous month, annualized, asked quarterly
- Savings refer to 12 months horizon, asked quarterly

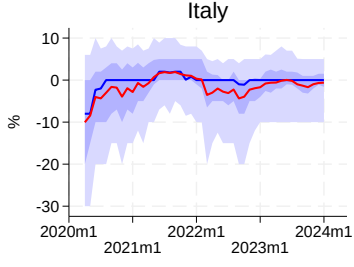
Distribution of E(Economic Growth) Back

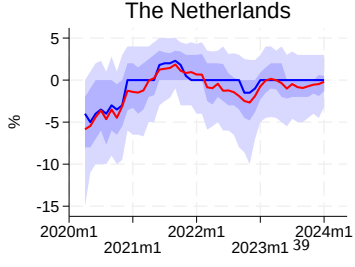




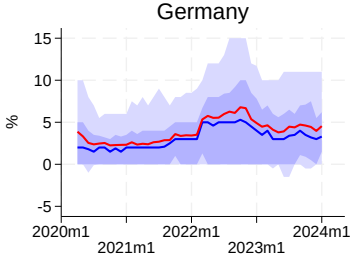


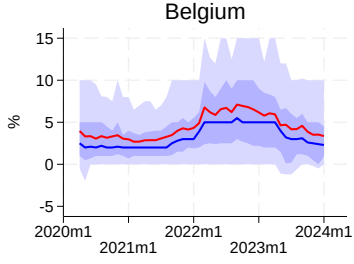


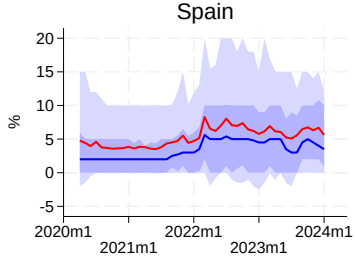


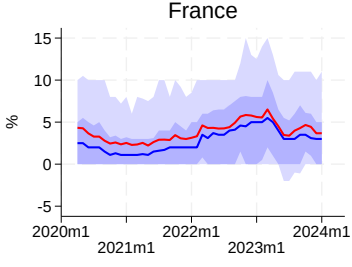


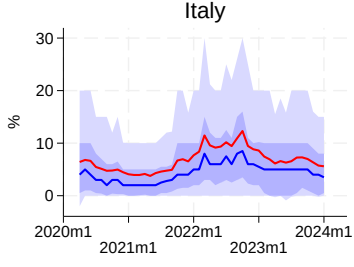
Distribution of E(12m Inflation) Back

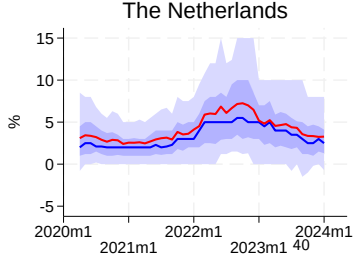












Math Behind the PCA

Back

- Our raw data matrix $\boldsymbol{X}$ has dimensions $H \times E$, where H is the number of households, and $E = 10$ is the number of expectations
- An observation about household h is a $1 \times E$ vector $\boldsymbol{x}_h = \{x_{h,1}, \ldots, x_{h,E}\}$
  - This is providing the collection of household h expectations
- The PCA consists of extracting through an optimization problem a set of size K of E-dimensional vectors of weights $\boldsymbol{w}_k = \{w_{1,k}, \ldots, w_{E,k}\}$ mapping the data matrix $\boldsymbol{X}$ to a data matrix $\boldsymbol{S}$ of dimension $H \times K$, with $K < E$
- The new data matrix $\boldsymbol{S}$ is made of principal component scores $\boldsymbol{s}_h = \{s_{h,1}, \ldots, s_{h,K}\}$ given by:

$$s_{h,k} = \boldsymbol{x}_h \cdot \boldsymbol{w}_k \qquad h = 1, \ldots, H; \;\; k = 1, \ldots, K \tag{5}$$

so that the scores inherit the maximum possible variance from the data $\boldsymbol{X}$

PCA: A Simple Example

- Consider H households, each household h holds expectations about inflation x_h^{π}, output x_h^{Y}, and unemployment rate x_h^{U}
- Assume we run a PCA and retain two principal components $\implies$ obtain two sets of loadings $\boldsymbol{w}_1$ and $\boldsymbol{w}_2$ (each one 3×1)

PCA: A Simple Example

- Consider H households, each household h holds expectations about inflation x_h^π, output x_h^Y, and unemployment rate x_h^U
- Assume we run a PCA and retain two principal components $\implies$ obtain two sets of loadings $\boldsymbol{w}_1$ and $\boldsymbol{w}_2$ (each one 3×1)
- The principal components scores for household h are defined as:

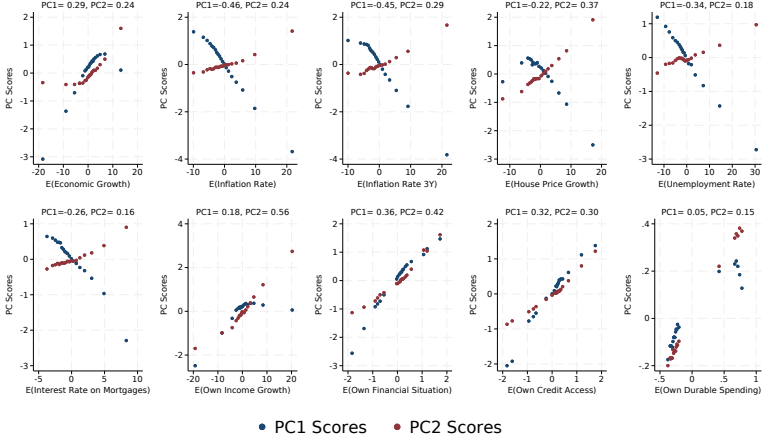
$$s_{h,1} = x_h^\pi \cdot w_1^\pi + x_h^Y \cdot w_1^Y + x_h^U \cdot w_1^U$$

$$s_{h,2} = x_h^\pi \cdot w_2^\pi + x_h^Y \cdot w_2^Y + x_h^U \cdot w_2^U$$

- We have reduced the dimension of our data from $H \times 3$ to $H \times 2$ while retaining most of the original variation.

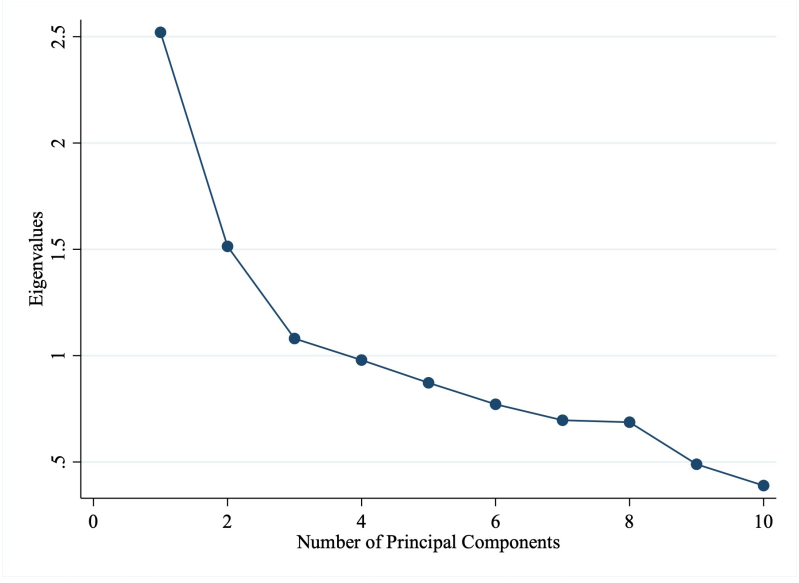
Perceived Sources of Fluctuations and Expectations

Back



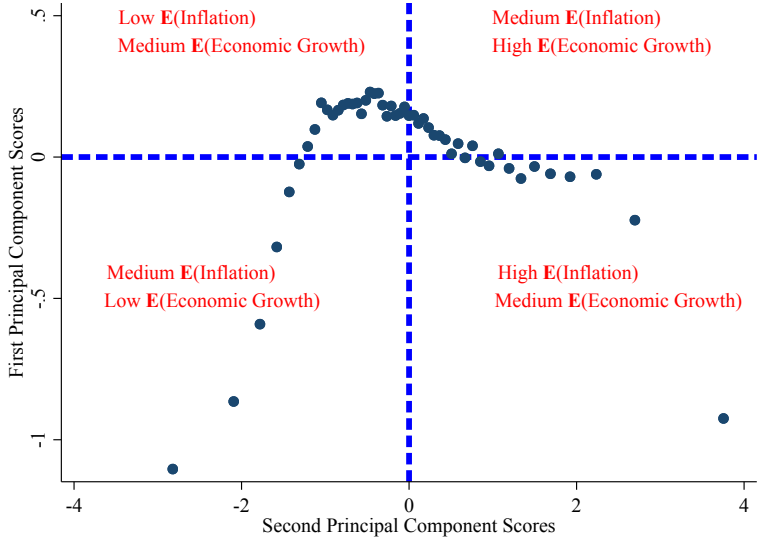
Scree Plot

Back



Scores Summarize Distribution of Expectations

Back



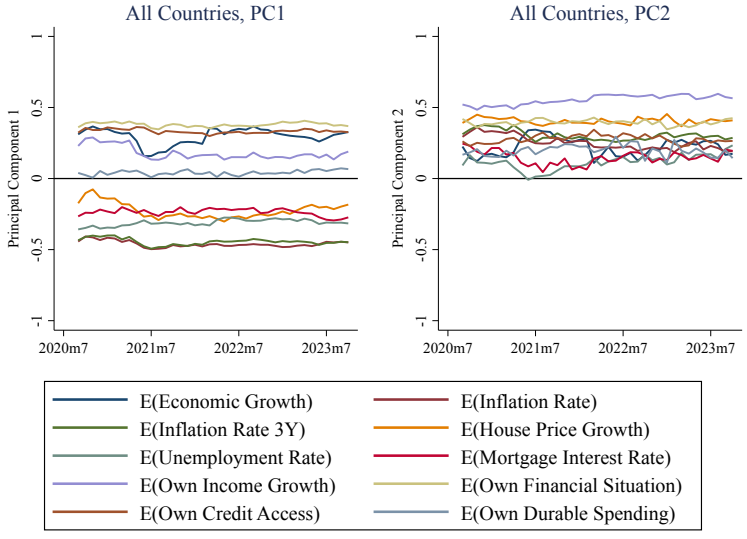
PCA Controlling for Individual Fixed Effects

Back

	Component 1	Component 2
E(Economic Growth)	0.27	0.31
E(Inflation Rate)	-0.54	0.21
E(Inflation Rate 3Y)	-0.51	0.31
E(House Price Growth)	-0.29	0.38
E(Unemployment Rate)	-0.27	-0.06
E(Interest Rate on Mortgages)	-0.14	0.03
E(Own Income Growth)	0.12	0.56
E(Own Financial Situation)	0.34	0.43
E(Own Credit Access)	0.25	0.30
E(Own Durable Spending)	0.01	0.12
Observations	517501	517501
% Variance Explained	17.1	13.7

PCA-by-Month: Loadings Are Stable Over Time

Back



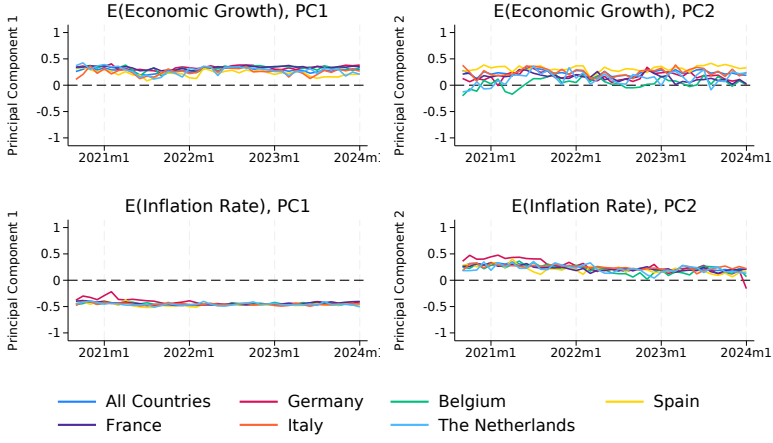
Principal Components Are Similar Across Countries

Back

	DE		BE		ES		FR		IT		NL	
	PC1	PC2	PC1	PC2	PC1	PC2	PC1	PC2	PC1	PC2	PC1	PC2
E(Economic Growth)	0.34	0.16	0.33	0.03	0.23	0.33	0.34	0.16	0.27	0.25	0.30	0.10
E(Inflation Rate)	-0.44	0.25	-0.45	0.20	-0.47	0.21	-0.44	0.23	-0.45	0.26	-0.45	0.23
E(Inflation Rate 3Y)	-0.42	0.32	-0.44	0.22	-0.46	0.26	-0.44	0.31	-0.44	0.29	-0.45	0.29
E(House Price Growth)	-0.28	0.37	-0.29	0.36	-0.28	0.33	-0.24	0.44	-0.12	0.40	-0.27	0.36
E(Unemployment Rate)	-0.32	0.14	-0.30	0.18	-0.36	0.13	-0.30	0.19	-0.36	0.21	-0.33	0.16
E(Interest Rate on Mortgages)	-0.21	0.10	-0.25	0.19	-0.28	0.13	-0.21	0.14	-0.30	0.21	-0.25	0.14
E(Own Income Growth)	0.16	0.58	0.16	0.55	0.14	0.58	0.22	0.52	0.21	0.55	0.18	0.53
E(Own Financial Situation)	0.39	0.40	0.35	0.47	0.32	0.46	0.38	0.42	0.37	0.40	0.34	0.47
E(Own Credit Access)	0.33	0.32	0.32	0.38	0.30	0.29	0.34	0.31	0.33	0.26	0.33	0.34
E(Own Durable Spending)	0.02	0.20	0.05	0.22	0.07	0.10	0.01	0.19	0.10	0.13	0.07	0.23
Observations	111583	111583	41715	41715	115841	115841	116925	116925	120003	120003	40337	40337
% Variance Explained	25.8	14.5	28.0	14.0	25.9	16.7	26.0	14.9	25.8	15.8	25.9	15.1

Components in Each Country Are Stable Over Time

Back



Introducing Real Outcomes Back

- **Spending on Nondurables**$_{t-1}$ is constructed using the quarterly question asking about spending on nondurables and services in the previous 30 days
- **Spent on Durables**$_{t-1}$ is constructed using questions asking whether the households bought any durable goods in the previous 30 days
  - Durables we include are: cars, home appliances, and luxury items. We exclude house purchases, holidays, and other other major items
- **Expected Spending Growth** is constructed using monthly questions asking household expected change in total spending over the next 12 months
- **Precautionary Savings** is constructed using the quarterly question asking how much households need to save to deal with unexpected events

Scores, Realized Spending, and Savings Back

- A one unit increase in the first principal component score (normalized to 1 pp increase in expected economic growth) is associated with:
  - 0.9% decrease in nondurable spending
  - No change in the probability of spending on durables
  - 0.9% increase in precautionary savings

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  - 0.9% decrease in nondurable spending
  - No change in the probability of spending on durables
  - 0.9% increase in precautionary savings
- A one unit increase in the second principal component score (normalized to 1 pp increase in expected economic growth) is associated with:
  - 0.6% increase in nondurable spending
  - An increase in the probability of spending on durables of 0.6 pp
  - No change in precautionary savings
- Expansionary supply and demand perceived sources of fluctuations have often opposite effects on real outcomes! Table1 Table2

How do the Scores Relate to Real Outcomes?

- We exploit survey questions about consumption and savings Real Outcomes
- Get scores from the PCA-by-month. Then we run the fixed-effect (FE) regression:

$$y_{h,c,t} = \alpha_h + \alpha_t + \alpha_{c,t} + \beta_1 s_{1,h,c,t} + \beta_2 s_{2,h,c,t} + \boldsymbol{x}_{h,c,t}\boldsymbol{\gamma} + \epsilon_{h,c,t} \tag{6}$$

  - $y_{h,c,t}$: consumption and savings variables for household h, country c, time t
  - $s_{1,h,c,t}$ and $s_{2,h,c,t}$: the two principal component scores normalized to a 1pp increase in economic growth expectation
  - $\boldsymbol{x}_{h,c,t}$: household-level controls containing a measure of liquidity
  - β_1 and β_2 measure the associations between the PC scores and real outcomes

Scores And Realized Spending

Back

	Nondurable Spending$_{t-1}$		Spent on Durables$_{t-1}$ (0-1)	
	Pooled	FE	Pooled	FE
PC1 Scores$_{t-2}$	-0.0252***	-0.0037*	-0.0023***	0.0018
	(0.0011)	(0.0019)	(0.0007)	(0.0014)
PC2 Scores$_{t-2}$	0.0275***	0.0053**	0.0183***	0.0055***
	(0.0020)	(0.0024)	(0.0013)	(0.0018)
Has Liquidity$_{t-2}$	0.0329***	0.0043	0.0205***	-0.0020
	(0.0083)	(0.0091)	(0.0045)	(0.0057)
Has Liquidity$_{t-1}$	0.0573***	0.0172	0.0336***	0.0165***
	(0.0084)	(0.0107)	(0.0044)	(0.0055)
Demographic Controls	Yes	No	Yes	No
Household FE	No	Yes	No	Yes
Wave FE	Yes	Yes	Yes	Yes
Country x Wave FE	Yes	Yes	Yes	Yes
Observations	124,397	124,387	124,618	124,718
R^2	0.1877	0.0149	0.0263	0.0111

Scores And Precautionary Savings

Back

	Precautionary Savings		$\mathbb{E}$(Spending Growth)	
	Pooled	FE	Pooled	FE
PC1 Scores$_t$	-0.0150***	0.0076**	-0.7172***	-0.3988***
	(0.0022)	(0.0033)	(0.0052)	(0.0118)
PC2 Scores$_t$	0.0448***	0.0126***	0.6546***	0.4390***
	(0.0039)	(0.0047)	(0.0091)	(0.0158)
Has Liquidity$_t$	0.6859***	0.2762***	0.4126***	0.2501***
	(0.0109)	(0.0201)	(0.0197)	(0.0319)
Demographic Controls	Yes	No	Yes	No
Household FE	No	Yes	No	Yes
Wave FE	Yes	Yes	Yes	Yes
Country x Wave FE	Yes	Yes	Yes	Yes
Observations	162,257	162,244	426,229	426,214
R^2	0.1553	0.0333	0.2093	0.083