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

Clodomiro Ferreira
Bank of Spain

Stefano Pica
Bank of Italy

Inflation, Inflation Expectations, and Policy: New Perspectives

November 18, 2024

Disclaimer: The views expressed are those of the authors and do not necessarily reflect the views of the Bank of Spain, the Bank of Italy, or the Euro-system.

How Do Households Form Their Beliefs?

- In standard macroeconomic models, households make decisions based on expectations about many variables
  - Examples: consumption Euler equation, housing Euler equation; individuals care about expected real wages, interest rate on mortgages...
  - Focus of literature mostly on inflation and output expectations

How Do Households Form Their Beliefs?

- In standard macroeconomic models, households make decisions based on expectations about many variables
  - Examples: consumption Euler equation, housing Euler equation; individuals care about expected real wages, interest rate on mortgages...
  - Focus of literature mostly on inflation and output expectations
- **This paper** uses a novel monthly survey of household expectations about a wide set of variables in 6 major European countries to ask:

How Do Households Form Their Beliefs?

- In standard macroeconomic models, households make decisions based on expectations about many variables
  - Examples: consumption Euler equation, housing Euler equation; individuals care about expected real wages, interest rate on mortgages...
  - Focus of literature mostly on inflation and output expectations
- **This paper** uses a novel monthly survey of household expectations about a wide set of variables in 6 major European countries to ask:
  1. How does monetary policy affect them?

How Do Households Form Their Beliefs?

- In standard macroeconomic models, households make decisions based on expectations about many variables
  - Examples: consumption Euler equation, housing Euler equation; individuals care about expected real wages, interest rate on mortgages...
  - Focus of literature mostly on inflation and output expectations
- **This paper** uses a novel monthly survey of household expectations about a wide set of variables in 6 major European countries to ask:
  1. How does monetary policy affect them?
  2. What are the household perceived sources of macroeconomic dynamics?

How Do Households Form Their Beliefs?

- In standard macroeconomic models, households make decisions based on expectations about many variables
  - Examples: consumption Euler equation, housing Euler equation; individuals care about expected real wages, interest rate on mortgages...
  - Focus of literature mostly on inflation and output expectations
- **This paper** uses a novel monthly survey of household expectations about a wide set of variables in 6 major European countries to ask:
  1. How does monetary policy affect them?
  2. What are the household perceived sources of macroeconomic dynamics?
  3. How have they evolved over time?

How Do Households Form Their Beliefs?

- In standard macroeconomic models, households make decisions based on expectations about many variables
  - Examples: consumption Euler equation, housing Euler equation; individuals care about expected real wages, interest rate on mortgages...
  - Focus of literature mostly on inflation and output expectations
- **This paper** uses a novel monthly survey of household expectations about a wide set of variables in 6 major European countries to ask:
  1. How does monetary policy affect them?
  2. What are the household perceived sources of macroeconomic dynamics?
  3. How have they evolved over time?
- Address these questions using identified shocks and by sequentially imposing more structure on the data

What We Do & What We Find: Overview of Results

- Contractionary monetary policy: Impulse responses show negative effect on expected economic growth and positive short-run effect on expected inflation

What We Do & What We Find: Overview of Results

- Contractionary monetary policy: Impulse responses show negative effect on expected economic growth and positive short-run effect on expected inflation
- Imposing no structure: Householdas disagree, but expectations are correlated
  - Households tend to expect lower inflation, lower unemployment in periods of higher forecasts for economic growth

What We Do & What We Find: Overview of Results

- Contractionary monetary policy: Impulse responses show negative effect on expected economic growth and positive short-run effect on expected inflation
- Imposing no structure: Householdas disagree, but expectations are correlated
  - Households tend to expect lower inflation, lower unemployment in periods of higher forecasts for economic growth
- Imposing minimal structure: **Principal Component Analysis** on many expectations to identify household perceived sources of macro dynamics
  - 1st component reflects supply-side dynamics: high expected inflation is associated with low economic growth (inflation is bad for the economy)
  - 2nd component reflective of demand-side dynamics: high expected inflation is associated with high economic growth (inflation is good for the economy)

What We Do & What We Find: Overview of Results

- Contractionary monetary policy: Impulse responses show negative effect on expected economic growth and positive short-run effect on expected inflation
- Imposing no structure: Householdas disagree, but expectations are correlated
  - Households tend to expect lower inflation, lower unemployment in periods of higher forecasts for economic growth
- Imposing minimal structure: **Principal Component Analysis** on many expectations to identify household perceived sources of macro dynamics
  - 1st component reflects supply-side dynamics: high expected inflation is associated with low economic growth (inflation is bad for the economy)
  - 2nd component reflective of demand-side dynamics: high expected inflation is associated with high economic growth (inflation is good for the economy)
- 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: 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

Outline

Data: Consumer Expectation Survey

The Effects of Monetary Policy on Expectations

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

Outline

Data: Consumer Expectation Survey

The Effects of Monetary Policy on Expectations

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

Data: Consumer Expectation Survey (CES)

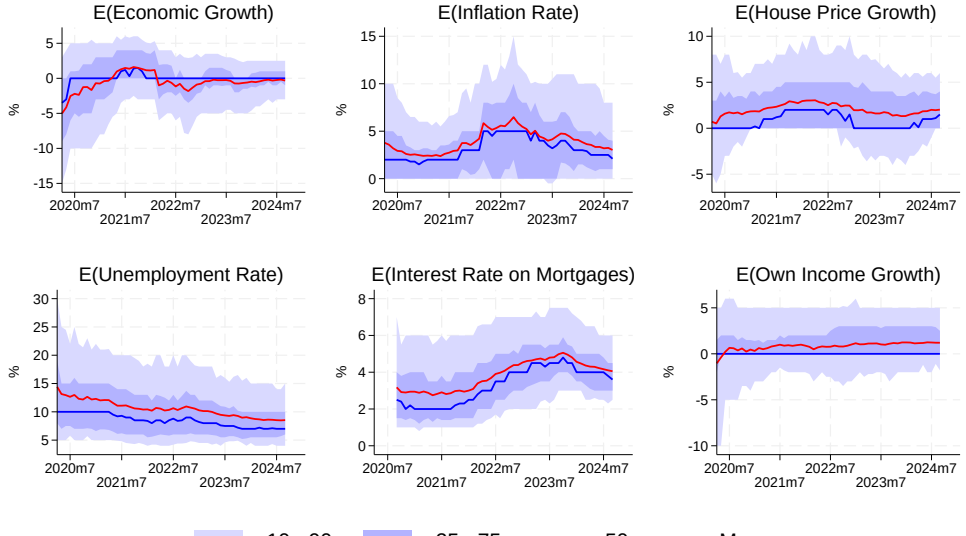
- The CES is an online panel survey of euro area consumer expectations
- It covers the 6 largest countries of the euro area, April 2020 - September 2024
- Sample size is approximately 10,000 households per month
- Upon entry into the panel, households are asked background information (such as demographic characteristics)

Data: Consumer Expectation Survey (CES)

- The CES is an online panel survey of euro area consumer expectations
- It covers the 6 largest countries of the euro area, April 2020 - September 2024
- Sample size is approximately 10,000 households per month
- 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 E(Inflation)



Outline

Data: Consumer Expectation Survey

The Effects of Monetary Policy on Expectations

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

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 using externally identified surprises and impulse responses on the panel of household expectations
  - Economic growth, 1Y and 3Y inflation, house price growth, unemployment rate, interest rate on mortagages and savings, own income growth, own spending growth

Response of expectations to identified MP surprises

- We estimate standard panel LPs at montly frequency
- Time frame: April 2020 - January 2024
- Measure of MP shock: High frequency surprises of the 1Y OIS around ECB meetings as in Altavilla, Brugnolini, Gürkaynak, Motto (2019).

Response of expectations to identified MP surprises

- We estimate standard panel LPs at montly frequency
- Time frame: April 2020 - January 2024
- Measure of MP shock: High frequency surprises of the 1Y OIS around ECB meetings as in Altavilla, Brugnolini, Gürkaynak, Motto (2019).

$$y^i_{t+hor} - y^i_{t-1} = \tag{1}$$

where

- y^i is expectation of household i of a specific variable: inflation, output growth, unemployment rate, mortgage interest rate...

Response of expectations to identified MP surprises

- We estimate standard panel LPs at montly frequency
- Time frame: April 2020 - January 2024
- Measure of MP shock: High frequency surprises of the 1Y OIS around ECB meetings as in Altavilla, Brugnolini, Gürkaynak, Motto (2019).

$$y^i_{t+hor} - y^i_{t-1} = \alpha_i \tag{1}$$

where

- y^i is expectation of household i of a specific variable: inflation, output growth, unemployment rate, mortgage interest rate...

Response of expectations to identified MP surprises

- We estimate standard panel LPs at montly frequency
- Time frame: April 2020 - January 2024
- Measure of MP shock: High frequency surprises of the 1Y OIS around ECB meetings as in Altavilla, Brugnolini, Gürkaynak, Motto (2019).

$$y^i_{t+hor} - y^i_{t-1} = \alpha_i + \boldsymbol{\beta_{hor}} \epsilon^{MP}_t \tag{1}$$

where

- y^i is expectation of household i of a specific variable: inflation, output growth, unemployment rate, mortgage interest rate...
- ϵ^{MP} change in 1Y Overnight Interest Swaps around policy announcements
- $\boldsymbol{\beta_{hor}}$: pp change at horizon hor to shock that increases the nominal interest rate by 25 basis points (empirical IRF to monetary tightening)

Response of expectations to identified MP surprises

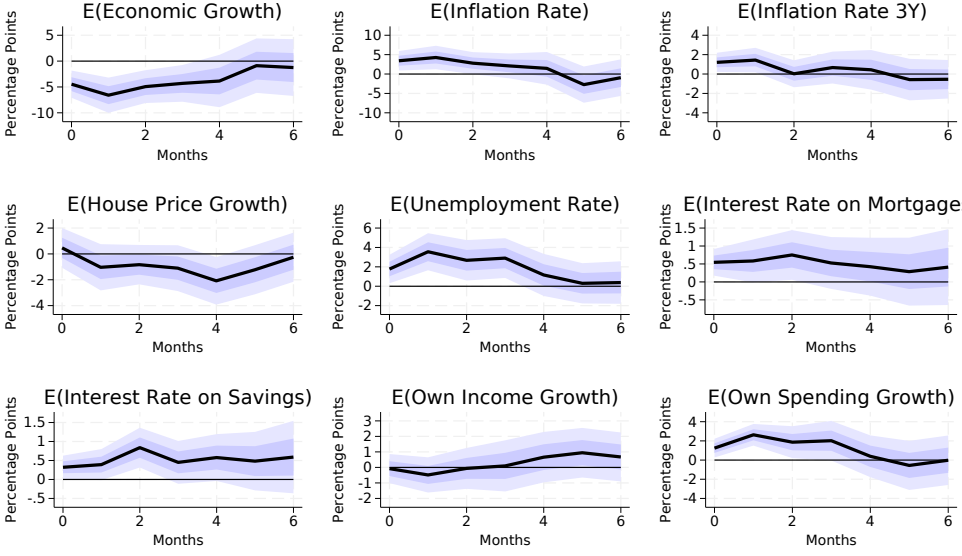
- We estimate standard panel LPs at montly frequency
- Time frame: April 2020 - January 2024
- Measure of MP shock: High frequency surprises of the 1Y OIS around ECB meetings as in Altavilla, Brugnolini, Gürkaynak, Motto (2019).

$$y^i_{t+hor} - y^i_{t-1} = \alpha_i + \boldsymbol{\beta_{hor}} \epsilon^{MP}_t + \sum_{k=1}^{2} \gamma_{hor,k} X^i_{t-k} + u^i_{hor,t} \tag{1}$$

where

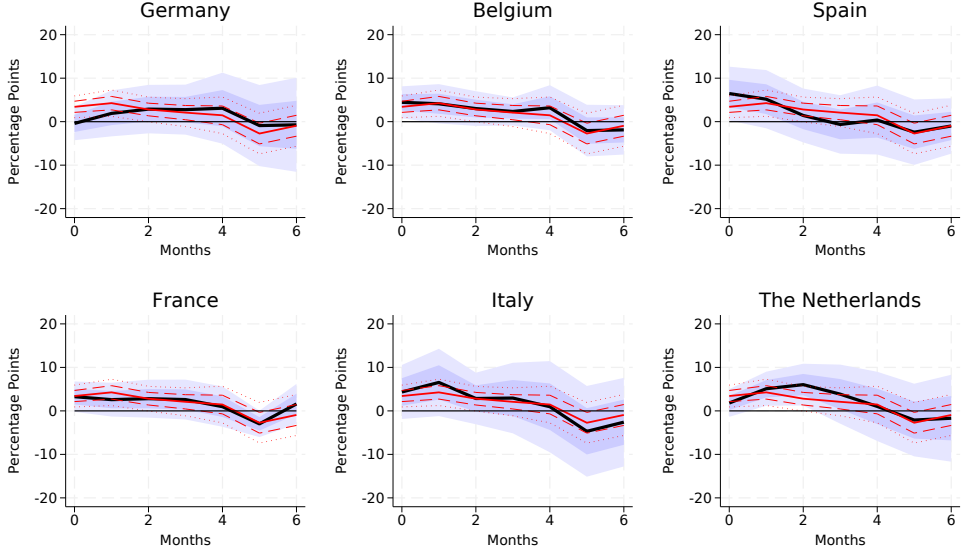
- y^i is expectation of household i of a specific variable: inflation, output growth, unemployment rate, mortgage interest rate...
- ϵ^{MP} change in 1Y Overnight Interest Swaps around policy announcements
- $\boldsymbol{\beta_{hor}}$: pp change at horizon hor to shock that increases the nominal interest rate by 25 basis points (empirical IRF to monetary tightening)
- X includes ϵ^{MP}, interest rate, euro area industrial production and inflation

Tightening MP Decreases E(Ec. Growth) but Increases $E(\pi)$...



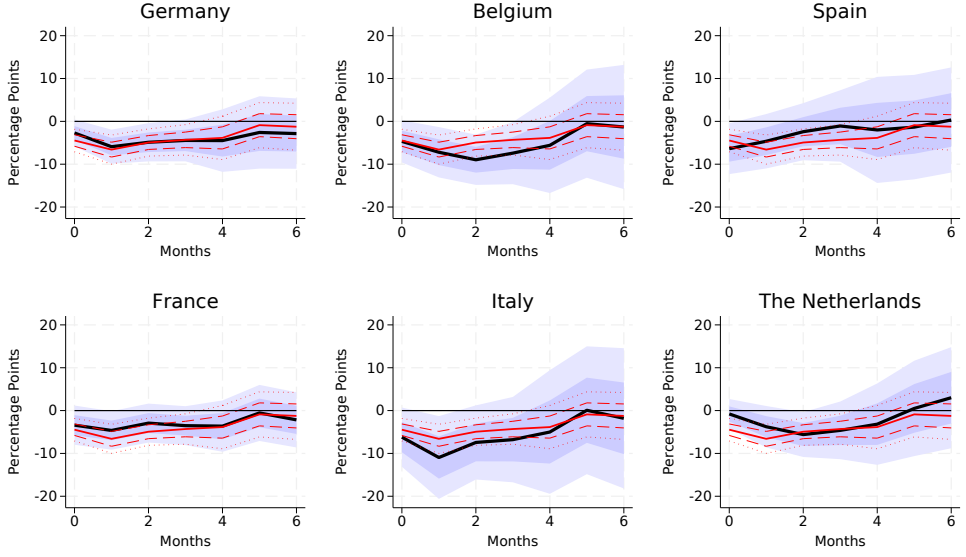
. . . which is qualitatively robust across countries!

Figure: $E(\pi)$ by countries



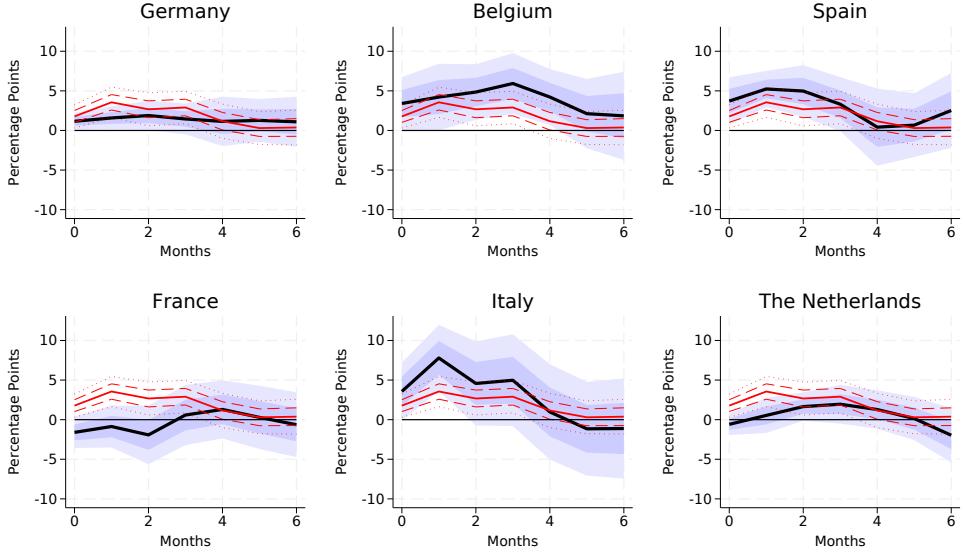
. . . which is qualitatively robust across countries!

Figure: E(Economic Growth) by countries



. . . which is qualitatively robust across countries!

Figure: E(Unemployment Rate) by countries



Additional Results & Robustness

- Cleaning from information effects Jarocinski-Karadi
- Responses by household characteristics and demographics
  - Age, gender, housing tenure status, education, employment situation, liquidity, income, financial literacy, attention to the ECB
- Using an aggregated euro area survey relying on a different set of households European Commission

So... **what is going on??**

Outline

Data: Consumer Expectation Survey

The Effects of Monetary Policy on Expectations

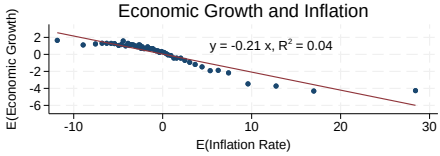
Co-movement Between Expectations and disagreement

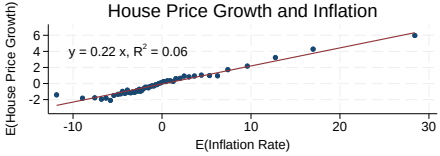
A Cross-Sectional Principal Component Analysis of Expectations
- Main Results
- Additional Results and Robustness

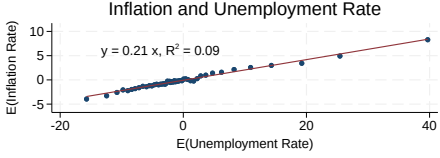
A Factor Structure of Expectations

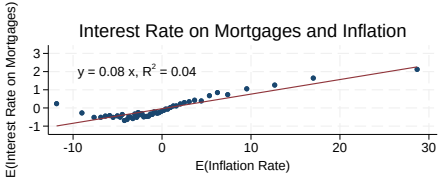
Conclusion

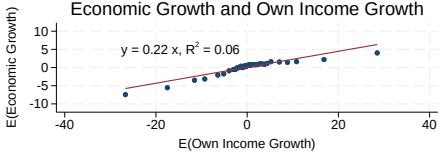
Household Expectations Are Correlated

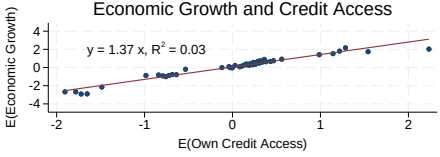












Optimists and pessimists are persistently so

	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
	Mid_{t+1}	0.18	0.72	0.17	Mid_{t+3}	0.2	0.7	0.18
	$High_{t+1}$	0.11	0.18	0.78	$High_{t+3}$	0.12	0.2	0.76
		Low_t	Mid_t	$High_t$		Low_t	Mid_t	$High_t$
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

Optimists and pessimists are persistently so

Persistence t to $t+1$

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

Persistence t to $t+3$

		Low_t	Mid_t	$High_t$
E(Economic Gr.)	Low_{t+3}	0.69	0.1	0.05
	Mid_{t+3}	0.2	0.71	0.18
	$High_{t+3}$	0.12	0.19	0.76
E(Inflation 1yr)	Low_{t+3}	0.68	0.1	0.05
	Mid_{t+3}	0.2	0.7	0.18
	$High_{t+3}$	0.12	0.2	0.76
E(Inflation 3yr)	Low_{t+3}	0.74	0.09	0.05
	Mid_{t+3}	0.16	0.72	0.18
	$High_{t+3}$	0.1	0.19	0.77

Optimists and pessimists are persistently so

Persistence t to $t+1$

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

Persistence t to $t+3$

		Low_t	Mid_t	$High_t$
E(Economic Gr.)	Low_{t+3}	0.69	0.1	0.05
	Mid_{t+3}	0.2	0.71	0.18
	$High_{t+3}$	0.12	0.19	0.76
E(Inflation 1yr)	Low_{t+3}	0.68	0.1	0.05
	Mid_{t+3}	0.2	0.7	0.18
	$High_{t+3}$	0.12	0.2	0.76
E(Inflation 3yr)	Low_{t+3}	0.74	0.09	0.05
	Mid_{t+3}	0.16	0.72	0.18
	$High_{t+3}$	0.1	0.19	0.77

Outline

Data: Consumer Expectation Survey

The Effects of Monetary Policy on Expectations

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

Uncovering the Driving Forces of Expectations

- Principal Component Analysis is a technique to reduce the dimensionality of a dataset while preserving maximum amount of information Mathematical Background
  - The idea is to extract components that can explain most of the joint variance and have meaningful economic interpretation

Uncovering the Driving Forces of Expectations

- Principal Component Analysis is a technique to reduce the dimensionality of a dataset while preserving maximum amount of information Mathematical Background
  - The idea is to extract components that can explain most of the joint variance and have meaningful economic interpretation
- PCA linearly transforms correlated variables to fewer orthogonal variables: the principal component scores PCA: A Simple Example

Uncovering the Driving Forces of Expectations

- Principal Component Analysis is a technique to reduce the dimensionality of a dataset while preserving maximum amount of information Mathematical Background
  - The idea is to extract components that can explain most of the joint variance and have meaningful economic interpretation
- PCA linearly transforms correlated variables to fewer orthogonal variables: the principal component scores PCA: A Simple Example
- We use expectations for a range of aggregate and individual level variables and choose 2 principal components that explain around 40% of the variance
  - Each household is now characterized by two variables (the scores) that summarize the information of the ten expectations

Loadings of The First Two Principal Components

	Component 1	Component 2
E(Economic Growth)	0.26	0.24
E(Inflation Rate)	-0.54	0.17
E(Inflation Rate 3Y)	-0.54	0.14
E(House Price Growth)	-0.28	0.26
E(Unemployment Rate)	-0.26	-0.33
E(Interest Rate on Mortgages)	-0.23	-0.56
E(Interest Rate on Savings)	-0.08	-0.58
E(Own Income Growth)	0.05	0.11
E(Own Spending Growth)	-0.37	0.24
Observations	351627	351627
% Variance Explained	23.0	15.4

Loadings of The First Two Principal Components

	Component 1	Component 2
E(Economic Growth)	0.26	0.24
E(Inflation Rate)	-0.54	0.17
E(Inflation Rate 3Y)	-0.54	0.14
E(House Price Growth)	-0.28	0.26
E(Unemployment Rate)	-0.26	-0.33
E(Interest Rate on Mortgages)	-0.23	-0.56
E(Interest Rate on Savings)	-0.08	-0.58
E(Own Income Growth)	0.05	0.11
E(Own Spending Growth)	-0.37	0.24
Observations	351627	351627
% Variance Explained	23.0	15.4

Loadings of The First Two Principal Components

	Component 1	Component 2
E(Economic Growth)	0.26	0.24
E(Inflation Rate)	-0.54	0.17
E(Inflation Rate 3Y)	-0.54	0.14
E(House Price Growth)	-0.28	0.26
E(Unemployment Rate)	-0.26	-0.33
E(Interest Rate on Mortgages)	-0.23	-0.56
E(Interest Rate on Savings)	-0.08	-0.58
E(Own Income Growth)	0.05	0.11
E(Own Spending Growth)	-0.37	0.24
Observations	351627	351627
% Variance Explained	23.0	15.4

- **PC1**: Econ Growth +, Inflation - $\Longrightarrow$ Supply-Side /inflation "bad"

Loadings of The First Two Principal Components

	Component 1	Component 2
E(Economic Growth)	0.26	0.24
E(Inflation Rate)	-0.54	0.17
E(Inflation Rate 3Y)	-0.54	0.14
E(House Price Growth)	-0.28	0.26
E(Unemployment Rate)	-0.26	-0.33
E(Interest Rate on Mortgages)	-0.23	-0.56
E(Interest Rate on Savings)	-0.08	-0.58
E(Own Income Growth)	0.05	0.11
E(Own Spending Growth)	-0.37	0.24
Observations	351627	351627
% Variance Explained	23.0	15.4

- **PC1**: Econ Growth +, Inflation - $\Longrightarrow$ Supply-Side /inflation "bad"
- **PC2**: Econ Growth +, Inflation + $\Longrightarrow$ Demand-Side

Loadings of The First Two Principal Components

	Component 1	Component 2
E(Economic Growth)	0.26	0.24
E(Inflation Rate)	-0.54	0.17
E(Inflation Rate 3Y)	-0.54	0.14
E(House Price Growth)	-0.28	0.26
E(Unemployment Rate)	-0.26	-0.33
E(Interest Rate on Mortgages)	-0.23	-0.56
E(Interest Rate on Savings)	-0.08	-0.58
E(Own Income Growth)	0.05	0.11
E(Own Spending Growth)	-0.37	0.24
Observations	351627	351627
% Variance Explained	23.0	15.4

- **PC1**: Econ Growth +, Inflation - $\Longrightarrow$ Supply-Side /inflation "bad"
- **PC2**: Econ Growth +, Inflation + $\Longrightarrow$ Demand-Side
- 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)	0.23	0.12	0.29	0.36	0.25	0.31	0.28	0.18
E(Inflation Rate)	-0.54	0.17	-0.54	0.18	-0.54	0.16	-0.55	0.18
E(Inflation Rate 3Y)	-0.54	0.12	-0.53	0.17	-0.54	0.13	-0.53	0.14
E(House Price Growth)	-0.32	0.17	-0.25	0.38	-0.29	0.31	-0.28	0.22
E(Unemployment Rate)	-0.25	-0.24	-0.29	-0.39	-0.26	-0.36	-0.27	-0.29
E(Interest Rate on Mortgages)	-0.21	-0.63	-0.25	-0.45	-0.23	-0.54	-0.23	-0.58
E(Interest Rate on Savings)	-0.11	-0.64	-0.06	-0.43	-0.06	-0.52	-0.09	-0.62
E(Own Income Growth)	-0.01	0.06	0.10	0.22	0.05	0.17	0.06	0.05
E(Own Spending Growth)	-0.38	0.21	-0.35	0.27	-0.38	0.22	-0.36	0.24
Observations	178473	178473	173154	173154	145190	145190	206437	206437
% Variance Explained	23.1	16.3	23.0	14.7	22.7	15.4	23.2	15.4

Similar Results by Income and Housing Status

	Below Median Income		Above Median Income		Homeowner		Renter	
	PC1	PC2	PC1	PC2	PC1	PC2	PC1	PC2
E(Economic Growth)	0.26	0.17	0.26	0.28	0.27	0.26	0.26	0.21
E(Inflation Rate)	-0.54	0.20	-0.55	0.15	-0.55	0.19	-0.53	0.16
E(Inflation Rate 3Y)	-0.53	0.14	-0.54	0.12	-0.54	0.16	-0.52	0.09
E(House Price Growth)	-0.29	0.23	-0.27	0.26	-0.24	0.30	-0.36	0.17
E(Unemployment Rate)	-0.27	-0.28	-0.25	-0.38	-0.28	-0.31	-0.23	-0.34
E(Interest Rate on Mortgages)	-0.25	-0.59	-0.20	-0.54	-0.24	-0.54	-0.20	-0.60
E(Interest Rate on Savings)	-0.10	-0.62	-0.04	-0.56	-0.11	-0.56	-0.00	-0.61
E(Own Income Growth)	0.06	0.05	0.04	0.12	0.07	0.12	0.02	0.12
E(Own Spending Growth)	-0.35	0.23	-0.39	0.22	-0.36	0.26	-0.39	0.17
Observations	170625	170625	181002	181002	249726	249726	101901	101901
% Variance Explained	23.2	15.1	22.7	15.7	22.7	15.4	23.7	15.0

Similar Results by Financial Literacy and ECB Attention

Attention

	Low Financial Literacy		High Financial Literacy		Didn't Hear About ECB		Heard About ECB	
	PC1	PC2	PC1	PC2	PC1	PC2	PC1	PC2
E(Economic Growth)	0.23	0.08	0.29	0.34	0.31	0.17	0.28	0.25
E(Inflation Rate)	-0.54	0.18	-0.54	0.18	-0.55	0.15	-0.52	0.22
E(Inflation Rate 3Y)	-0.55	0.10	-0.52	0.18	-0.52	0.11	-0.52	0.15
E(House Price Growth)	-0.35	0.15	-0.23	0.34	-0.26	0.22	-0.29	0.25
E(Unemployment Rate)	-0.24	-0.23	-0.29	-0.36	-0.24	-0.31	-0.28	-0.31
E(Interest Rate on Mortgages)	-0.20	-0.65	-0.25	-0.45	-0.20	-0.60	-0.25	-0.55
E(Interest Rate on Savings)	-0.07	-0.66	-0.09	-0.48	-0.03	-0.63	-0.07	-0.59
E(Own Income Growth)	-0.01	-0.05	0.09	0.21	0.08	0.04	0.06	0.14
E(Own Spending Growth)	-0.37	0.13	-0.36	0.30	-0.41	0.19	-0.38	0.21
Observations	130055	130055	219315	219315	127315	127315	148412	148412
% Variance Explained	22.8	15.6	23.4	14.9	24.5	14.5	23.4	14.7

Additional Results & Robustness

- PCA residuals are not explained by household characteristics Table
- Using within individual variation: Table
  - residuals of expectations from individual-time FE regressions 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
- PCA using a smaller set of expectations fails to capture structure described above 12 vars 7 vars 6 vars 3 vars

Outline

Data: Consumer Expectation Survey

The Effects of Monetary Policy on Expectations

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 $\boldsymbol{X}_t$

$$x_{i,t} = \lambda_i' F_t + e_{i,t} \qquad i = 1, \ldots, E \times H \tag{2}$$

  - 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 $\hat{F}_t$.

Factor Structure of Expectations

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

$$x_{i,t} = \lambda_i' F_t + e_{i,t} \qquad i = 1, \ldots, E \times H \tag{2}$$

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

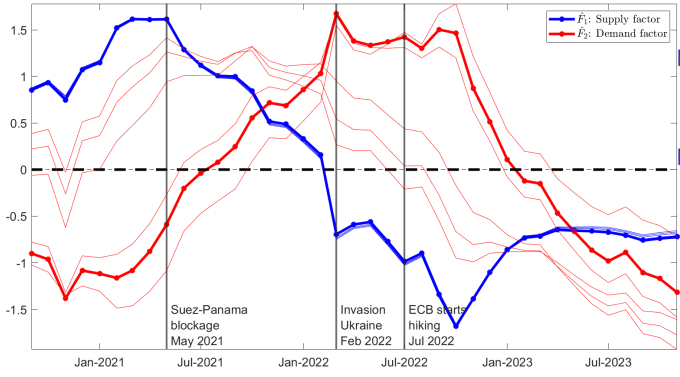
- Factors are estimated as the first 2 principal components of $\boldsymbol{X}_t$, which are identified only up to a rotation of orthonormal matrix 2×2 Q. Get $\hat{F}_t$.

- $\hat{F}_t$ 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 $\hat{\lambda}_i$

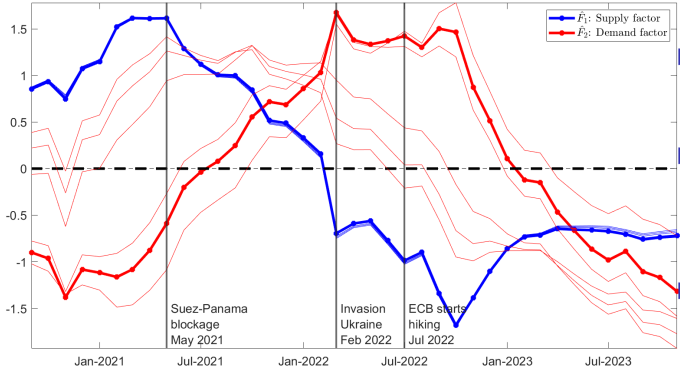
- Sign restriction: retain $\hat{\lambda}_i$ if first factor loads $(+)$ on $\mathbb{E}_h Y$ and (-) on $\mathbb{E}_h \pi$; second factor loads $(+)$ on $\mathbb{E}_h Y$ and $(+)$ on $\mathbb{E}_h \pi$. Repeat recursively.

Evolution of Perceived Sources of Fluctuations



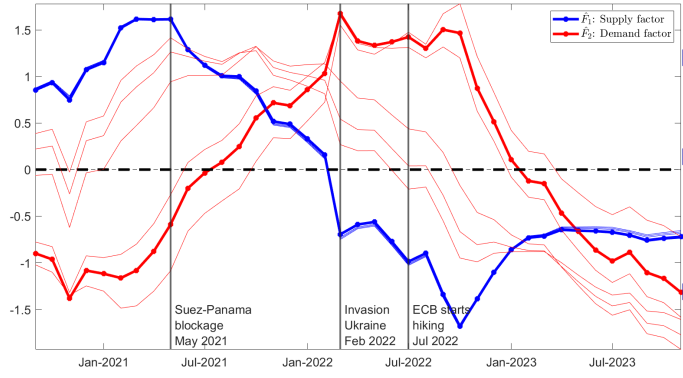
- ↑ Supply Factor: ↑ $\mathbf{E}Y$, ↓ $\mathbf{E}\pi$
- ↑ Demand Factor: ↑ $\mathbf{E}Y$, ↑ $\mathbf{E}\pi$
- ↑ levels of factors: more expansionary D & S

Evolution of Perceived Sources of Fluctuations



- ↑ Supply Factor: ↑ $\mathbf{E}Y$, ↓ $\mathbf{E}\pi$
- ↑ Demand Factor: ↑ $\mathbf{E}Y$, ↑ $\mathbf{E}\pi$
- ↑ levels of factors: more expansionary D & S
- Since start of war, S strongly inflationary and D mildly inflationary

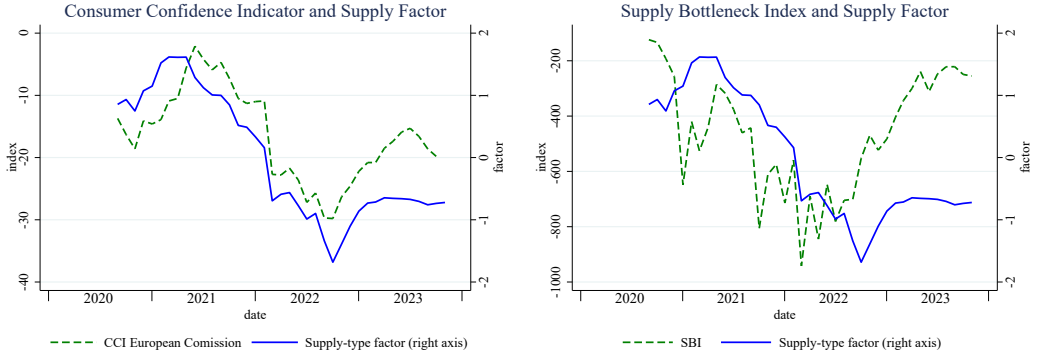
Evolution of Perceived Sources of Fluctuations



- ↑ Supply Factor: ↑ $\mathbf{E}Y$, ↓ $\mathbf{E}\pi$
- ↑ Demand Factor: ↑ $\mathbf{E}Y$, ↑ $\mathbf{E}\pi$
- ↑ levels of factors: more expansionary D & S
- Since start of war, S strongly inflationary and D mildly inflationary

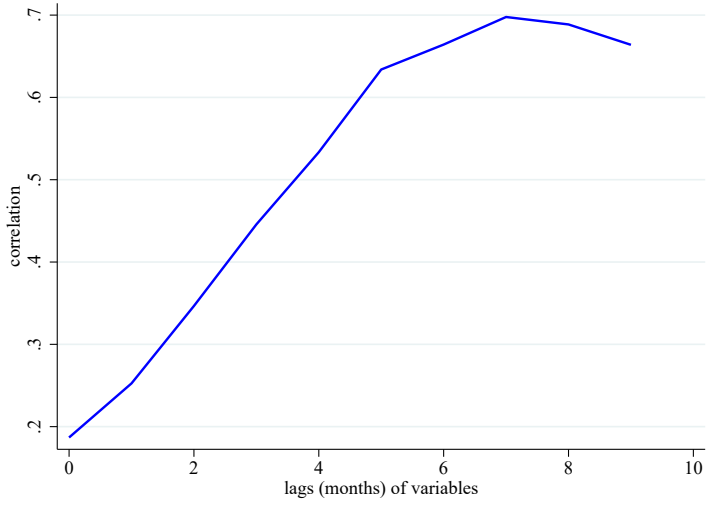
- Results are (surprisingly?) similar by age and education groups

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



Conclusion

- Following a tightening of monetary policy, households expect worse economic outlook accompanied by higher inflation
- We argue the mental model of how variables comove shape their conditional joint response to MP
- Household expectations are correlated, and PCA shows supply-side forces of business cycle fluctuations dominate demand-side ones
- 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

Appendix

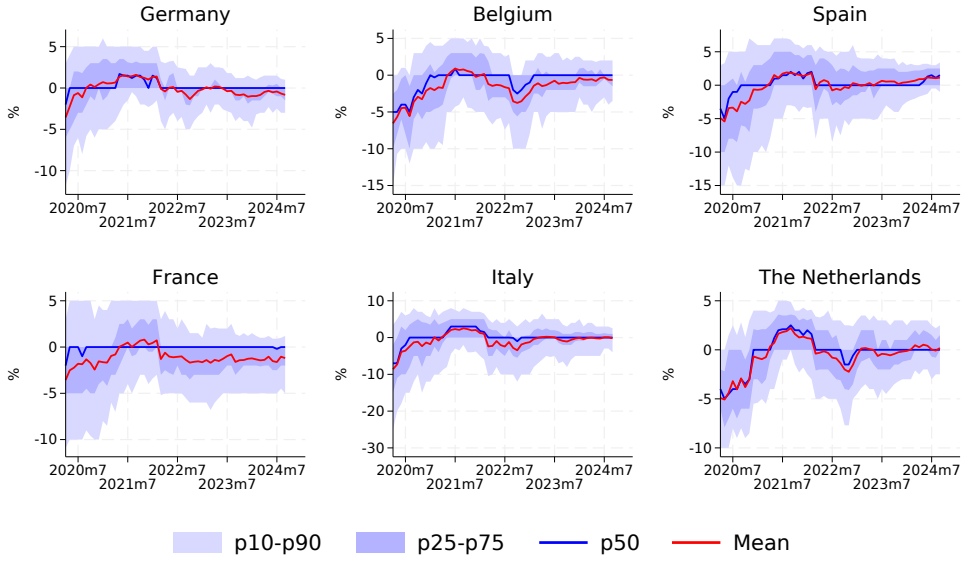
Descriptive Statistics (April2020-September2024) Back

	Mean	p10	Median	p90	N
Age	53.59	26.00	57.00	80.00	373,806
Disposable Income	37,102.92	17,500.00	35,000.00	67,500.00	373,806
Nondurable Spending	18,854.43	8,040.00	17,640.00	31,440.00	106,756
Spent on Durables (0-1)	0.17	0.00	0.00	1.00	109,984
Precautionary Savings	8,713.56	800.00	5,000.00	21,000.00	112,657
E(Economic Growth)	-0.47	-5.50	0.00	5.00	373,806
E(Inflation Rate)	3.94	0.00	3.00	10.00	373,806
E(Inflation Rate 3Y)	2.92	0.00	2.00	8.00	373,806
E(House Price Growth)	2.06	-1.50	1.00	8.00	373,806
E(Unemployment Rate)	10.60	4.50	8.50	20.00	373,806
E(Interest Rate on Mortgages)	3.79	1.20	3.50	6.70	351,627
E(Own Income Growth)	0.83	-2.90	0.00	5.00	373,806
E(Own Spending Growth)	2.54	0.00	0.00	10.00	373,806
E(Own Durable Spending)	0.29	0.00	0.00	1.00	373,806
E(Own Credit Access)	2.85	2.00	3.00	4.00	373,806
E(Own Financial Situation)	2.87	2.00	3.00	4.00	373,806

- 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

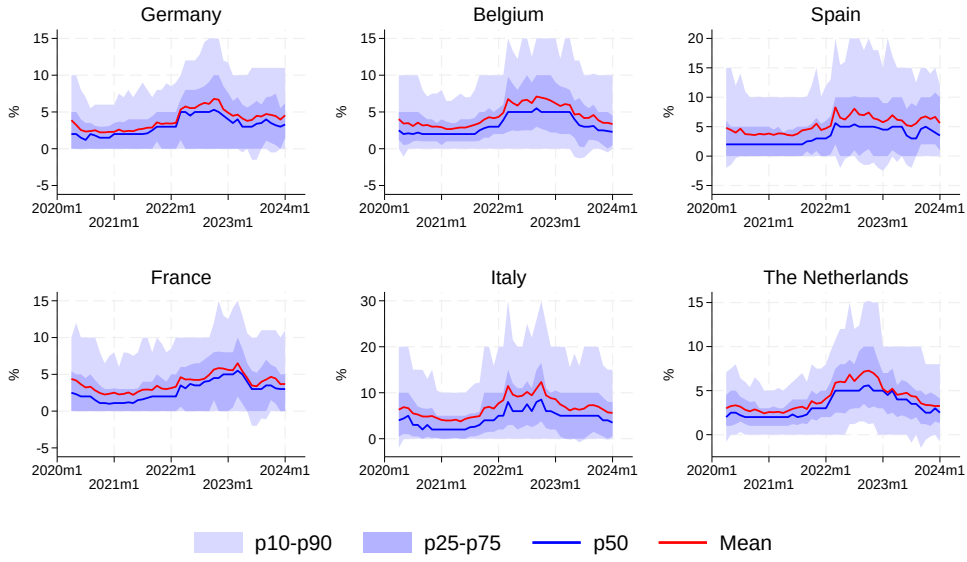
Distribution of E(Economic Growth) by Country

Back

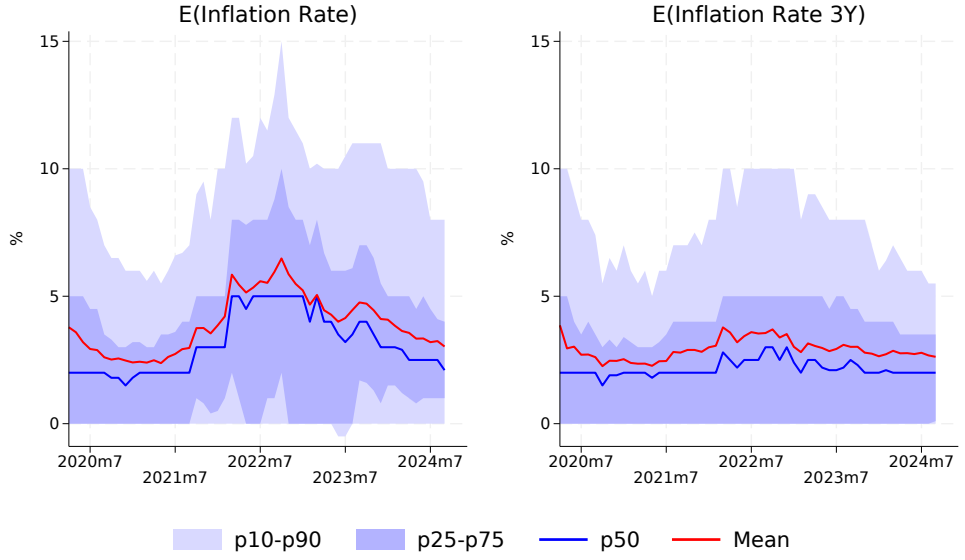


Distribution of E(12M Inflation) by Country

Back



Distributions of E(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:

$$s_{h,k} = \boldsymbol{x}_h \cdot \boldsymbol{w}_k \qquad h = 1, \ldots, H; \;\; k = 1, \ldots, K \tag{3}$$

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:

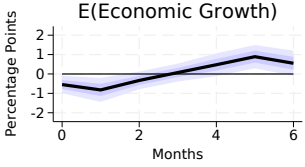
$$s_{h,1} = x_h^\pi \cdot w_1^\pi + x_h^Y \cdot w_1^Y + x_h^U \cdot w_1^U$$

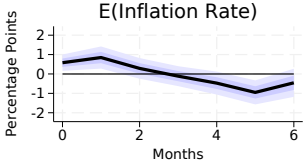
$$s_{h,2} = x_h^\pi \cdot w_2^\pi + x_h^Y \cdot w_2^Y + x_h^U \cdot w_2^U$$

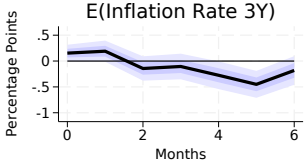
- We have reduced the dimension of our data from $H \times 3$ to $H \times 2$ while retaining most of the original variation.

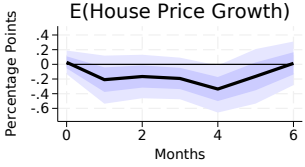
Results using Jarocinski-Karadi shocks

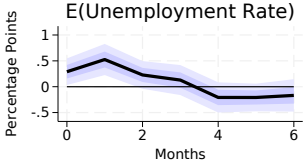
Back

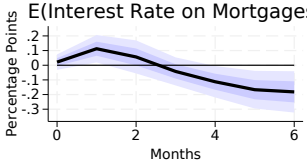


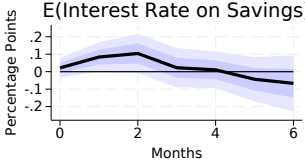


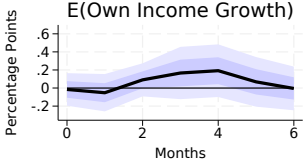


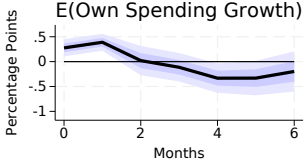






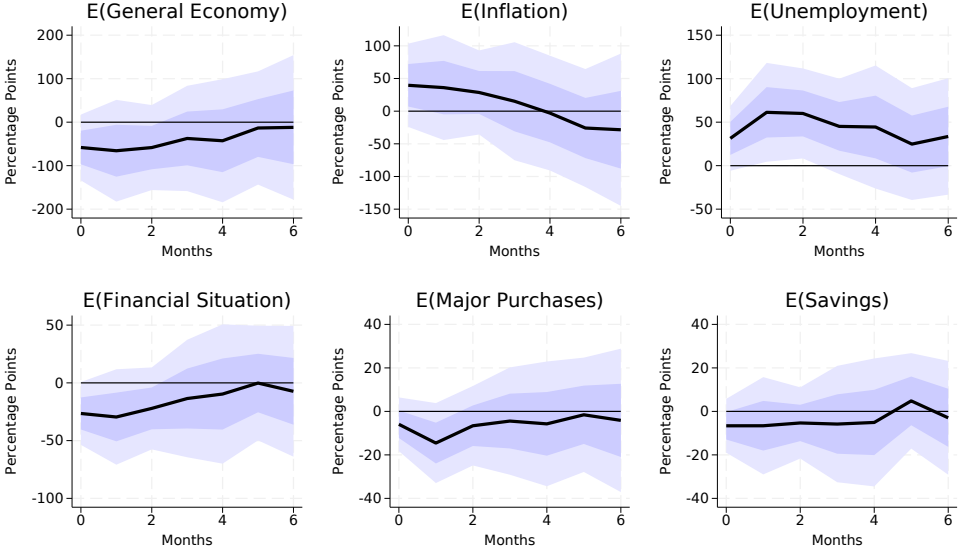






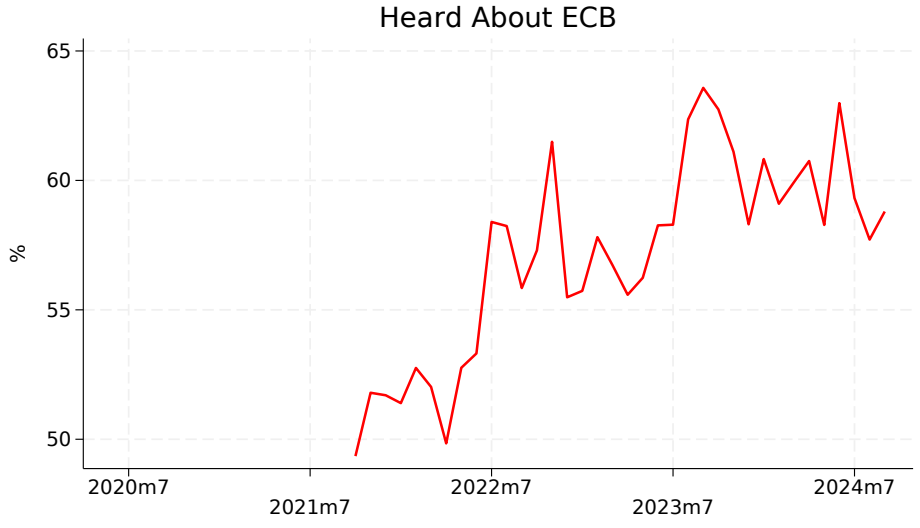
Results from the European Commission household survey

Back



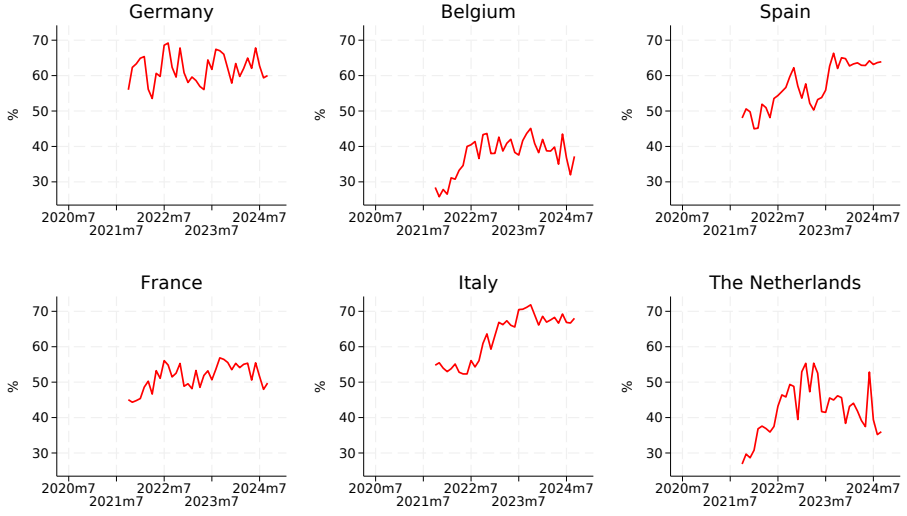
Attention to the ECB Over Time

Back



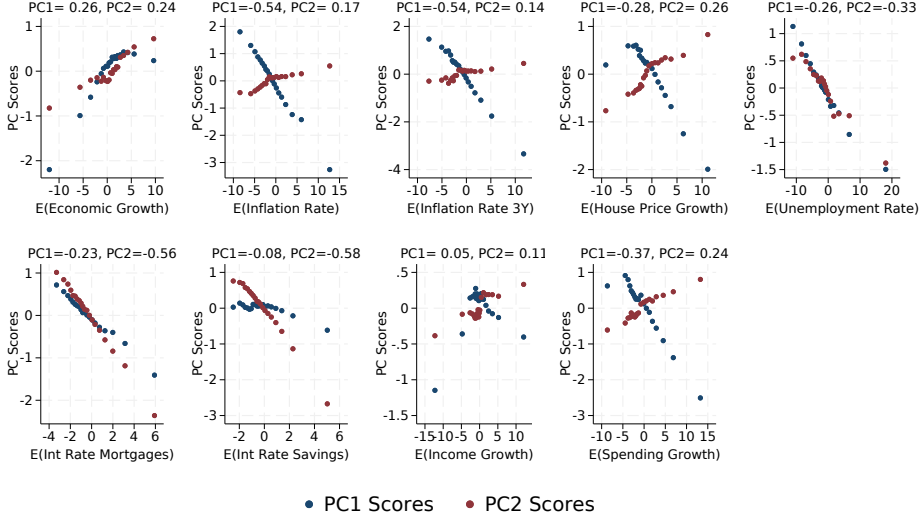
Attention to the ECB by Country

Back



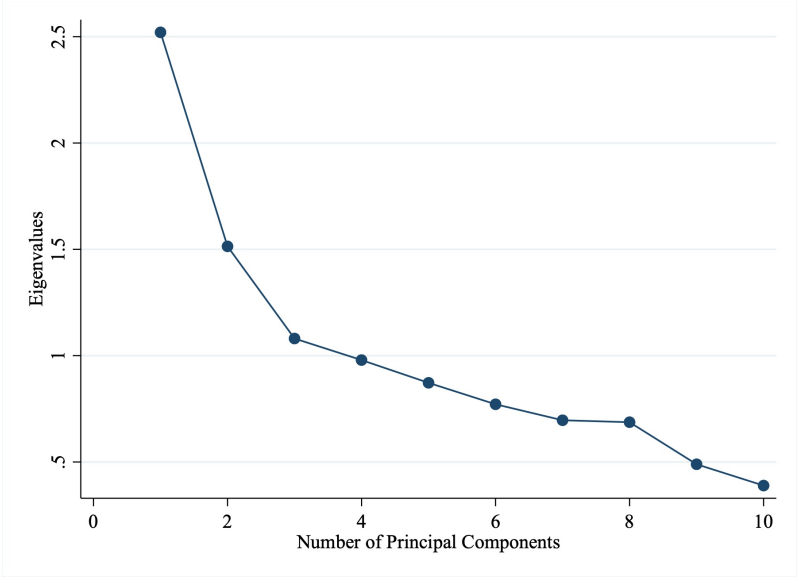
Perceived Sources of Fluctuations and Expectations

Back



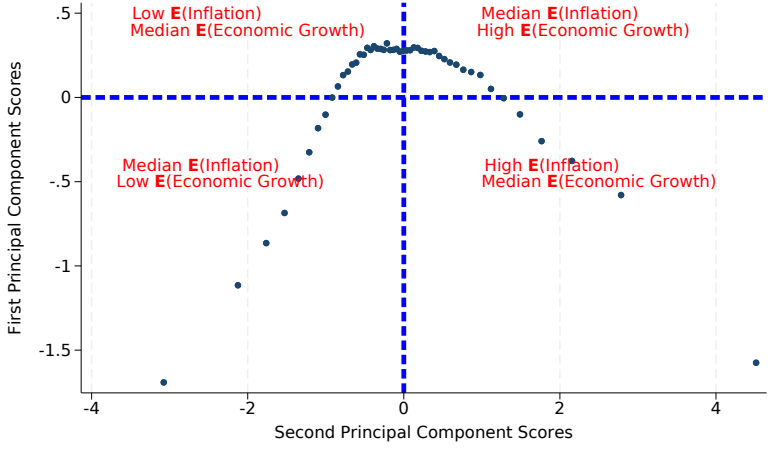
Scree Plot

Back



Scores Summarize Distribution of Expectations

Back



PCA Residuals and Household Characteristics

Back

	PCA Residuals
Age 35-49	0.27***
	(0.03)
Age 50-64	0.22***
	(0.04)
Age 65+	0.09
	(0.06)
Education: Primary	0.11**
	(0.06)
Education: Tertiary	-0.22***
	(0.03)
Male	-1.02***
	(0.03)
Mortgaged Homeowner	0.18***
	(0.03)
Renter	0.41***
	(0.04)
Working full	0.03
	(0.04)
Working part	0.45***
	(0.05)
Income	-0.59***
	(0.03)
Has Liquidity	-0.91***
	(0.04)
High Financial Literacy	-0.20***
	(0.03)
Heard About ECB	0.13***
	(0.03)
Observations	274112
R^2	0.176

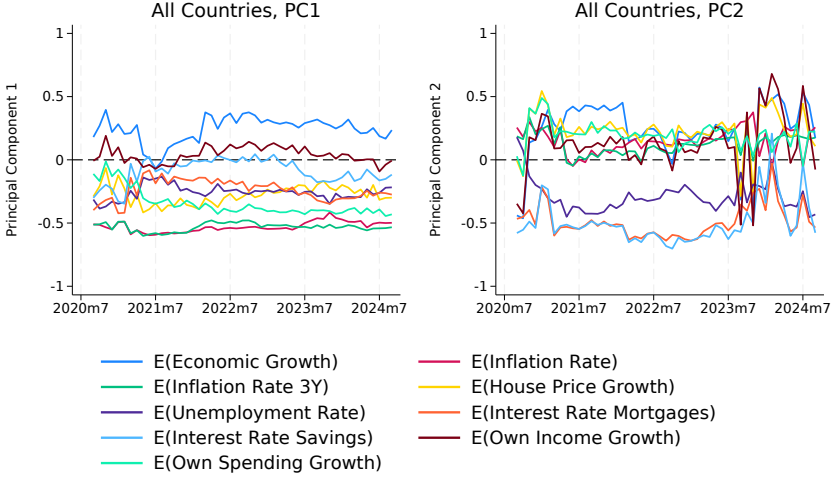
PCA Controlling for Individual Fixed Effects

Back

	Component 1	Component 2
E(Economic Growth)	0.16	0.13
E(Inflation Rate)	-0.57	0.16
E(Inflation Rate 3Y)	-0.57	0.13
E(House Price Growth)	-0.34	0.17
E(Unemployment Rate)	-0.21	-0.15
E(Interest Rate on Mortgages)	-0.16	-0.67
E(Interest Rate on Savings)	-0.14	-0.66
E(Own Income Growth)	-0.06	0.03
E(Own Spending Growth)	-0.34	0.09
Observations	351627	351627
% Variance Explained	18.2	15.5

Loadings Are Quite 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)	0.21	0.32	0.31	0.16	0.18	0.25	0.33	0.01	0.30	0.29	0.21	0.54
E(Inflation Rate)	-0.53	0.08	-0.52	0.18	-0.52	0.17	-0.54	0.11	-0.53	0.26	-0.57	0.10
E(Inflation Rate 3Y)	-0.51	0.03	-0.50	0.14	-0.54	0.12	-0.55	0.00	-0.51	0.27	-0.54	0.14
E(House Price Growth)	-0.35	0.11	-0.33	-0.02	-0.37	0.25	-0.31	-0.01	-0.17	0.37	-0.29	0.33
E(Unemployment Rate)	-0.14	-0.48	-0.21	-0.32	-0.27	-0.19	-0.19	-0.09	-0.32	-0.34	-0.18	-0.50
E(Interest Rate on Mortgages)	-0.13	-0.59	-0.20	-0.62	-0.25	-0.60	-0.08	-0.68	-0.32	-0.43	-0.11	-0.44
E(Interest Rate on Savings)	0.18	-0.53	-0.00	-0.63	-0.11	-0.63	-0.02	-0.70	-0.20	-0.42	-0.02	-0.14
E(Own Income Growth)	-0.05	0.12	0.04	0.00	-0.01	0.07	0.08	-0.14	0.13	0.17	0.09	0.31
E(Own Spending Growth)	-0.47	0.03	-0.43	0.19	-0.35	0.18	-0.39	0.07	-0.28	0.36	-0.46	0.12
Observations	71539	71539	24199	24199	77021	77021	70467	70467	82084	82084	26317	26317
% Variance Explained	23.0	15.5	28.1	13.3	24.6	15.4	22.7	15.4	23.0	15.1	24.2	14.3

Principal Components With 12 Expectations

Back

	Component 1	Component 2
E(Economic Growth)	0.29	0.19
E(Inflation Rate)	-0.47	0.21
E(Inflation Rate 3Y)	-0.44	0.29
E(House Price Growth)	-0.19	0.35
E(Unemployment Rate)	-0.22	0.06
E(Interest Rate on Mortgages)	-0.17	0.20
E(Interest Rate on Savings)	-0.00	0.25
E(Own Income Growth)	0.20	0.52
E(Own Spending Growth)	-0.31	0.22
E(Own Financial Situation)	0.40	0.40
E(Own Credit Access)	0.31	0.32
E(Own Durable Spending)	0.01	0.16
Observations	351627	351627
% Variance Explained	19.6	12.8

Principal Components With 7 Expectations

Back

	Component 1	Component 2
E(Economic Growth)	0.30	0.12
E(Inflation Rate)	-0.55	0.28
E(Inflation Rate 3Y)	-0.56	0.24
E(House Price Growth)	-0.29	0.28
E(Unemployment Rate)	-0.32	-0.24
E(Interest Rate on Mortgages)	-0.29	-0.57
E(Interest Rate on Savings)	-0.14	-0.62
Observations	351627	351627
% Variance Explained	27.1	19.2

Principal Components With 6 Expectations

Back

	Component 1	Component 2
E(Economic Growth)	0.41	0.26
E(Inflation Rate)	-0.41	-0.52
E(House Price Growth)	-0.17	-0.36
E(Unemployment Rate)	-0.47	-0.11
E(Interest Rate on Mortgages)	-0.53	0.39
E(Interest Rate on Savings)	-0.37	0.61
Observations	351627	351627
% Variance Explained	25.8	20.6

Principal Components With 3 Expectations

Back

	Component 1	Component 2
E(Economic Growth)	0.70	0.20
E(Inflation Rate)	-0.71	0.08
E(Interest Rate on Savings)	0.08	-0.98
Observations	351627	351627
% Variance Explained	39.9	33.6