EUROPEAN CENTRAL BANK

EUROSYSTEM

Macroeconomic Experiences and Risk-Taking of Euro Area Households

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The views expressed here are our own and not necessarily those of the ECB, the Eurosystem or the Bank of Canada.

Motivation

- **Do macroeconomic experiences shape economic behaviour like risk-taking?**
  - Standard economic models assume stable preferences
  - General wisdom "Once bitten, twice shy."
- **Do experiences decay?**
  - Standard economic models assume agents include all available information
  - General wisdom "The old forget. The young don't know."

Motivation

2008

1929

Motivation

- **Malmendier and Nagel (*QJE*, 2011)**
  - Use U.S. SCF from 1960 to 2007
  - Having experienced lower stock market returns makes households
    - Less likely to take financial risks
    - Less likely to participate in the stock market (10% difference between P90 and P10)
    - Invest a lower fraction of their liquid assets in stocks (if they participate)
  - Having experienced lower bond market returns makes households less likely to hold bonds
  - Effects fade away (7.7% for previous year, 3.9% after 10 years, 1.5% after 30 years)
  - Model controls for age, year effects and household characteristics
- **We follow M&N, using euro area data and exploring the effect of disastrous events.**

Literature

- **Experiences of inflation**
  - Blanchflower (2007): high inflation over adult lifetime lowers happiness
  - Lombardelli and Saleheen (2003), Malmendier and Nagel (2009): inflation expectations vary positively with inflation experience
  - Ehrmann and Tzamourani (2012): high inflation experiences increase inflation aversion; memories of hyperinflation are there to last, less drastic inflation experiences erode after 10 years
- **Experiences of recessions**
  - Alesina and Giuliano (2011), Giuliano and Spilimbergo (2009): growing up during recessions is correlated with a belief that success in life is more dependent on luck than on effort, thus generating a more favourable attitude towards government redistribution

Literature

- **Experiences of financial market performance**
  - Kaustia and Knuepfer (2008): personal IPO investment outcomes affect future future IPO subscriptions
  - Choi et al. (2009): investors over-extrapolate from their personal experience when making savings decisions
- **Experiences of rare events (like the financial crisis)**
  - Friedman and Schwartz (1963): pessimism created by Great Depression had persistent effects on markets
  - Cogley and Sargent (2008): learning with a pessimistic prior can explain market price of risk and equity premium
  - Necker and Ziegelmeyer (2013): suffering a wealth shock affects risk-taking via return expectations
  - Hertwig et al. (2004): decisions from experience tend to underweight the probability of rare events, due to
    - A lack of sampled observations
    - Overweighting of recently sampled information

Literature

- **Experiences of socio-economic nature**
  - Dohmen et al. (2011): parental educational background affects willingness to take risks
  - Guiso et al. (2004): In high-social-capital areas in Italy (measured by electoral turnout and blood donations), more households invest in stocks; for movers, social capital in the area of birth remains relevant
  - Alesina and Fuchs-Schündeln (2007): persistent effects of communism on attitudes toward market capitalism and the role of the state in providing social services, insurance, and redistribution

The data

- **Household-level data from the Eurosystem Household Finance and Consumption Survey (HFCS)**
  - Risk aversion and portfolio choice decisions – LHS
  - Control variables – RHS

- **Macroeconomic data from Global Financial Data (plus others)**
  - Experiences of the household (e.g. returns) - RHS

The data - HFCS

- Cross-country survey collecting household-level data in 15 euro area countries (all except Ireland and Estonia)
- Focus on **wealth** (real and financial assets, liabilities), but also covering consumption/savings, income, employment, pension entitlements, intergenerational transfers, etc.
- Representative sample: **62,000 households**
- **Reference year** for most (11) country surveys: **2010**
- Complete dataset for balance sheet variables (**multiple imputation**)
- Final estimation weights ensure that figures are **representative** of the population (at country and euro area level)

The data - information used from HFCS

- **Risk aversion**
  - "Which of the following statements comes closest to describing the amount of financial risk that you (and your husband/wife/partner) are willing to take when you save or make investments?"

  1. Take substantial financial risks expecting to earn substantial returns
  2. Take above average financial risks expecting to earn above average returns
  3. Take average financial risks expecting to earn average returns
  4. Not willing to take any financial risk

$\Rightarrow$ FI and FR missing, not fully imputed

The data - information used from HFCS

- **Further than the effect on risk aversion, in analogy to M&N, we also look at**
  - **Stock market participation**
    - Direct holdings plus mutual funds predominantly investing in equity
  - **Bond market participation**
    - Direct holdings plus mutual funds predominantly investing in bonds
  - **Share of stock/bond holdings in liquid assets**
    - Liquid assets: deposits, mutual funds, bonds, stocks, managed accounts

The data - information used from HFCS

- **Controls (following M&N; reference person according to Canberra definition)**
  - Log income, log income^2
  - Number of children, Number of children^2
  - Log liquid assets, log liquid assets^2
  - Retired
  - College, high school
  - Age, age^2
  - Married
  - Working in the financial sector
  - Country fixed effects

The data – household experiences

- **Source: Global Financial Data (+ Bank of Greece)**
- **Coverage period: 1930-2010**
  - We assign 1930 as birth year for reference persons born before 1930
- **We exclude CY, MT, SK and SI**
- **Information used**
  - Real stock market return, p.a. (deflated using CPI)
  - Real bond market return, p.a. (deflated using CPI)
  - Number of stock market "crashes" experienced (≤-20% nominal return p.a., derived variable)
    - Covers also protracted declines
- **Political variables (like wars, political unrest) did not lead to notable results**

The data – household experiences

- **We build "experienced" returns over the lifetime of the reference person**
  - Starting from birth, until year prior to survey
  - Assumptions
    - Reference person is the most relevant
    - Even non-participants "experience" the returns
    - Experience relates to the national returns (reference person did not live abroad and did not follow a diversified portfolio)
- **Lifetime experiences vary across age and country**
  - Identification device, in contrast to M&N, which used variation across different waves

The data – household experiences

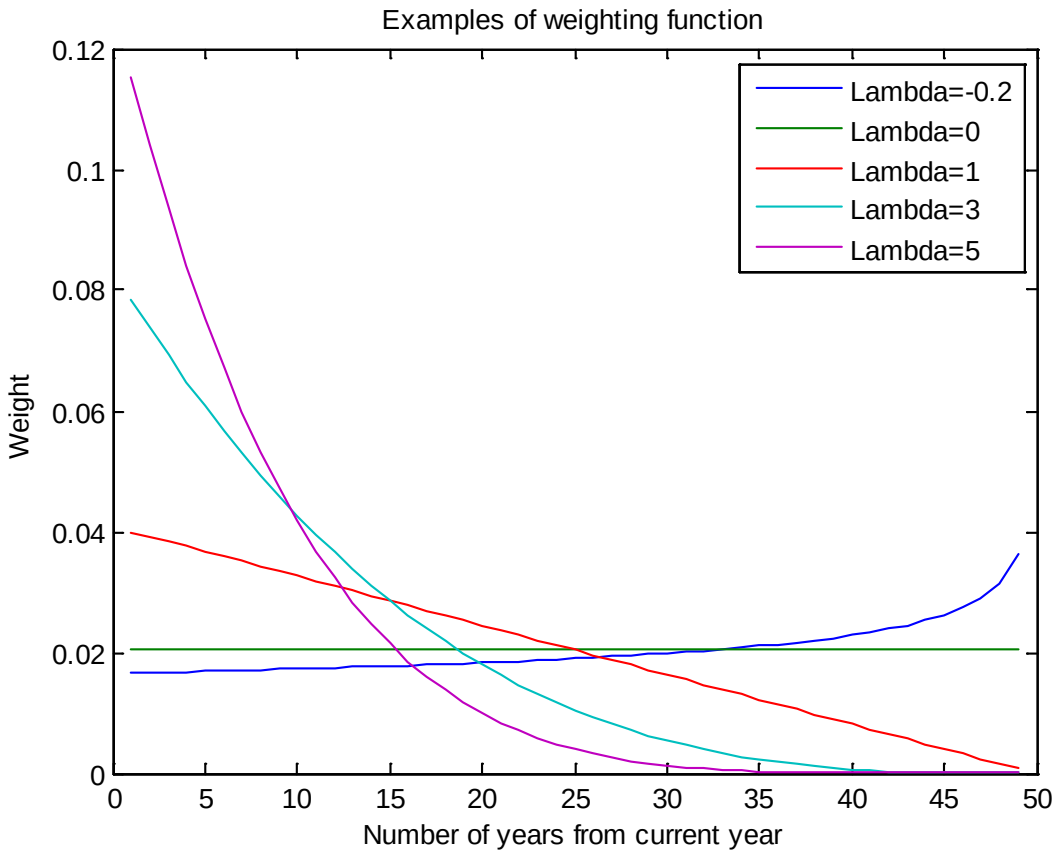
- **Build life-time experienced return: weighting parameter (λ)**
- **Allow for constant, increasing or decreasing patterns and different rates of change**

$$LR_{ic}(\lambda) = \sum_{k=1}^{age_i - 1} w_i(k, \lambda) R^c_{T-k} ,$$

$$\text{where} \quad w_i(k, \lambda) = \frac{(age_i - k)^\lambda}{\sum_{k=1}^{age_i - 1} (age_i - k)^\lambda}$$

The data – household experiences

- **Examples for the weighting function for a 50-year old reference person**



The data - summary statistics

Experienced average real stock return (λ=4.5)

Country	Mean	Std. deviation	p10	Median	p90	Observations
Austria	10.62	0.37	10.09	10.65	11.16	2380
Belgium	6.85	1.12	5.11	7.16	8.05	2327
Germany	8.06	0.15	7.84	8.06	8.26	3565
Spain	7.93	1.65	5.64	8.52	9.41	6197
Finland	12.95	2.81	8.28	14.07	15.57	10989
France	7.48	1.26	5.44	7.83	8.84	15006
Greece	8.84	3.83	3.19	10.15	12.73	2971
Italy	3.86	1.39	1.93	4.16	5.38	7951
Luxembourg	10.39	0.37	9.82	10.41	10.86	950
Netherlands	7.50	1.11	5.87	7.67	8.84	1301
Portugal	8.86	0.91	7.60	8.92	10.12	4404
Euro Area	7.32	2.27	4.24	7.94	9.33	58041

Experienced average real bond return (λ=4.5)

Country	Mean	Std. deviation	p10	Median	p90	Observations
Austria	4.01	0.35	3.43	4.09	4.38	2380
Belgium	4.57	0.53	3.71	4.74	5.12	2327
Germany	4.25	0.18	3.96	4.29	4.45	3565
Spain	3.72	0.41	3.10	3.93	4.09	6197
Finland	5.53	0.75	4.23	5.90	6.16	10989
France	4.94	0.60	3.91	5.18	5.49	15006
Greece	1.44	0.24	1.11	1.51	1.62	2971
Italy	4.27	0.78	3.16	4.52	5.01	7951
Luxembourg	2.24	0.23	1.90	2.27	2.53	789
Netherlands	4.21	0.32	3.74	4.30	4.54	1301
Portugal	4.60	0.27	4.34	4.67	4.87	4404
Euro Area	4.28	0.81	3.51	4.32	5.33	57880

- **Variation across and within countries; very little for bonds**

The data - summary statistics

Number of stock market crashes experienced

Country	Mean	Std. deviation	p10	Median	p90	Observations
Austria	3.39	2.55	1	3	8	2380
Belgium	4.96	1.49	3	5	7	2327
Germany	5.62	1.98	3	6	8	3565
Spain	6.68	2.06	4	6	10	6197
Finland	6.75	2.17	4	6	10	10989
France	7.82	2.49	5	7	12	15006
Greece	10.19	2.69	8	9	14	2971
Italy	10.97	2.49	8	11	14	7951
Luxembourg	4.40	1.82	3	4	8	950
Netherlands	5.06	1.31	3	5	7	1301
Portugal	11.62	2.01	9	12	13	4404
Euro Area	7.37	3.14	3	7	12	58041

- **Variation across and within countries**
- **1929 not in the sample, all households experienced 2008**

The data - summary statistics

Self-assesed risk aversion

Country	Mean	Std. deviation	p10	Median	p90	Observations
Austria	3.52	0.71	3	4	4	2340
Belgium	3.67	0.60	3	4	4	2307
Germany	3.61	0.56	3	4	4	3467
Spain	3.81	0.47	3	4	4	6197
Finland	.	.	.	.	.	0
France	.	.	.	.	.	0
Greece	3.69	0.66	3	4	4	2971
Italy	3.30	0.79	2	3	4	7951
Luxembourg	3.72	0.53	3	4	4	950
Netherlands	3.69	0.52	3	4	4	1253
Portugal	3.90	0.38	4	4	4	4365
Euro Area	3.59	0.64	3	4	4	31801

- **Little variation overall**
- **High risk aversion (mean for US in M&N: 3.2)**
- **Data not collected in Finland and France**

The data - summary statistics

Stock market participation

Country	Mean	Std. deviation	p10	Median	p90	Observations
Austria	0.08	0.28	0	0	0	2380
Belgium	0.20	0.40	0	0	1	2327
Germany	0.16	0.37	0	0	1	3565
Spain	0.11	0.31	0	0	1	6197
Finland	0.22	0.41	0	0	1	10989
France	0.16	0.37	0	0	1	15006
Greece	0.03	0.17	0	0	0	2971
Italy	0.06	0.23	0	0	0	7951
Luxembourg	0.18	0.39	0	0	1	950
Netherlands	0.15	0.36	0	0	1	1301
Portugal	0.05	0.22	0	0	0	4404
Euro Area	0.13	0.34	0	0	1	58041

Bond market participation

Country	Mean	Std. deviation	p10	Median	p90	Observations
Austria	0.04	0.18	0	0	0	2380
Belgium	0.07	0.26	0	0	0	2327
Germany	0.05	0.22	0	0	0	3565
Spain	0.01	0.12	0	0	0	6197
Finland	0.01	0.09	0	0	0	10989
France	0.02	0.13	0	0	0	15006
Greece	0.00	0.07	0	0	0	2971
Italy	0.15	0.35	0	0	1	7951
Luxembourg	0.04	0.21	0	0	0	950
Netherlands	0.06	0.24	0	0	0	1301
Portugal	0.00	0.06	0	0	0	4404
Euro Area	0.05	0.23	0	0	0	58041

- **Low participation (mean for US in M&N: 0.34/0.38)**

Summary statistics

Share of liquid assets invested in stocks

Country	Mean	Std. deviation	p10	Median	p90	Observations
Austria	0.18	0.25	0.00	0.05	0.55	209
Belgium	0.22	0.27	0.00	0.12	0.63	592
Germany	0.16	0.22	0.00	0.06	0.48	864
Spain	0.32	0.30	0.00	0.21	0.83	1441
Finland	0.34	0.30	0.03	0.23	0.84	2996
France	0.29	0.29	0.00	0.20	0.77	3546
Greece	0.34	0.32	0.00	0.28	0.91	84
Italy	0.28	0.28	0.00	0.21	0.74	518
Luxembourg	0.18	0.28	0.00	0.01	0.64	225
Netherlands	0.16	0.24	0.00	0.07	0.48	255
Portugal	0.26	0.28	0.00	0.14	0.75	238
Euro Area	0.23	0.27	0.00	0.13	0.69	10967

Share of liquid assets invested in bonds

Country	Mean	Std. deviation	p10	Median	p90	Observations
Austria	0.28	0.27	0.03	0.18	0.69	88
Belgium	0.42	0.30	0.07	0.35	0.90	219
Germany	0.31	0.26	0.04	0.23	0.81	328
Spain	0.46	0.32	0.05	0.38	0.95	200
Finland	0.27	0.26	0.02	0.16	0.68	116
France	0.24	0.22	0.02	0.16	0.61	456
Greece	0.47	0.33	0.06	0.57	0.95	12
Italy	0.54	0.27	0.18	0.56	0.89	1335
Luxembourg	0.33	0.27	0.05	0.22	0.82	60
Netherlands	0.34	0.29	0.03	0.26	0.79	99
Portugal	0.28	0.18	0.02	0.23	0.58	21
Euro Area	0.42	0.29	0.07	0.34	0.88	2935

Methodology

$$y_{ic} = \alpha + \beta LR_{ic}(\lambda) + \delta x_{ic} + \varepsilon_{ic}$$

- **Simultaneous estimation of β and λ**
- **Specifications**
  - Independent variable: experienced return or crash.
  - Dependent variable
    - risk aversion: **ordered probit**
    - stock holding: **probit**
    - share: **tobit**
  - Both independent variables + country grouping.

Stock market returns on risk aversion

- Experienced returns matter
- Large decay
  - Larger than M&N: 1.8
- Relevant controls:
  - Income
  - Liquid assets
  - Education
  - Age
  - Financial sector
  - Country fixed effects (benchmark is DE)

Self-reported risk aversion			
	Coefficient	Std. error	t-statistic
Experienced return	-4.97	1.45	-3.42
Weighting parameter	3.98	0.60	6.66
Log Income	0.20	0.09	2.18
Log Income squared	-0.01	0.01	-2.79
Children	0.04	0.04	1.02
Children squared	-0.00	0.01	-0.33
Log Liquid assets	0.12	0.02	8.10
Log Liquid assets squared	-0.01	0.00	-11.26
Retired	0.07	0.04	1.73
College	-0.32	0.04	-7.51
High School	-0.20	0.04	-5.24
Age	0.02	0.01	2.39
Age squared	-0.00	0.00	-0.32
Married	0.04	0.03	1.10
Financial sector	-0.23	0.06	-4.08
Austria	-0.02	0.06	-0.40
Belgium	0.20	0.05	3.79
Spain	0.43	0.05	8.48
Greece	0.08	0.08	0.96
Italy	-0.94	0.07	-12.90
Luxembourg	0.58	0.07	8.19
Netherlands	0.20	0.06	3.43
Portugal	0.71	0.06	12.52

Stock market returns on risk aversion

- Effect of experience is economically large
  - A 1% higher experienced stock return makes HHs 1.4 p.p. less likely to be very risk averse
  - 8 p.p. difference along the interdecile range
  - Very similar to M&N (8.8 p.p)

Self-reported risk aversion

	Coefficient	Std. error	t-statistic
Experienced return	-4.966	1.452	-3.420
Weighting parameter	3.979	0.598	6.657

Average Marginal Effect

	Coefficient	Std. error	t-statistic
Risk aversion = 1 (low)	0.001	0.000	3.140
Risk aversion = 2	0.004	0.001	3.241
Risk aversion = 3	0.009	0.003	3.261
Risk aversion = 4 (high)	-0.014	0.004	-3.264

Average of fitted probability at 90th pct. minus prob at 10th pct.

	Coefficient	Std. error	t-statistic
Risk aversion = 1 (low)	0.006	0.000	27.150
Risk aversion = 2	0.024	0.001	29.125
Risk aversion = 3	0.049	0.002	29.674
Risk aversion = 4 (high)	-0.079	0.003	-29.558

Stock market returns on stock holding

- Experienced returns matter
- Large decay
  - Larger than M&N: 1.9
- Relevant controls:
  - Liquid assets
  - Education
  - Age
  - Financial sector
  - Country fixed effects (benchmark is DE)

Stock market participation			
	Coefficient	Std. error	t-statistic
Experienced return	15.17	3.76	4.04
Weighting parameter	5.33	1.41	3.77
Log Income	-0.14	0.31	-0.46
Log Income squared	0.01	0.01	0.95
Children	-0.01	0.04	-0.20
Children squared	-0.00	0.01	-0.14
Log Liquid assets	0.30	0.12	2.38
Log Liquid assets squared	0.01	0.01	1.25
Retired	-0.04	0.05	-0.79
College	0.39	0.05	8.09
High School	0.21	0.04	4.62
Age	0.01	0.01	0.47
Age squared	-0.00	0.00	-1.52
Married	-0.03	0.04	-0.71
Financial sector	0.66	0.08	8.21
Austria	-1.01	0.12	-8.59
Belgium	0.20	0.09	2.19
Spain	0.13	0.17	0.77
Finland	-0.20	0.35	-0.58
France	0.33	0.08	3.91
Greece	-0.45	0.34	-1.32
Italy	0.20	0.14	1.50
Luxembourg	-0.74	0.14	-5.46
Netherlands	0.09	0.10	0.91
Portugal	-0.34	0.10	-3.51
Pseudo R squared		0.31	

Stock market returns on stock holding

- Effect of experience is economically large
  - 11.5% difference of fitted probabilities along the interdecile range of experienced returns
  - Comparable to M&N (10%)

Stock market participation

	Coefficient	Std. error	t-statistic
Experienced return	15.169	3.759	4.035
Weighting parameter	5.335	1.413	3.775
Average Marginal Effect	0.023	0.004	5.888
Fitted prob at p90 - p10	0.115	0.002	52.169

Stock market returns on stock shares

- Experienced returns also affect the share of assets invested in stocks
  - Even larger decay parameter(HH has already overcome the participation decision)

Share of liquid assets invested in stock

	Coefficient	Std. error	t-statistic
Experienced return	3.20	1.49	2.15
Weighting parameter	8.35	3.72	2.24
Log Income	0.07	0.22	0.30
Log Income squared	0.00	0.01	0.07
Children	-0.01	0.02	-0.70
Children squared	0.00	0.01	0.67
Log Liquid assets	0.23	0.06	4.09
Log Liquid assets squared	-0.00	0.00	-0.85
Retired	-0.01	0.02	-0.29
College	0.19	0.03	7.05
High School	0.14	0.02	5.85
Age	0.01	0.01	1.69
Age squared	-0.00	0.00	-2.26
Married	-0.01	0.02	-0.34
Financial sector	0.23	0.03	6.68
Austria	-0.32	0.06	-5.26
Belgium	0.14	0.05	2.79
Spain	0.31	0.10	3.02
Finland	0.35	0.14	2.53
France	0.30	0.04	7.14
Greece	0.11	0.16	0.67
Italy	0.09	0.07	1.26
Luxembourg	-0.26	0.06	-3.94
Netherlands	0.07	0.06	1.30
Portugal	0.03	0.04	0.66
Pseudo R squared		0.28	

Stock market returns on stock shares

- Effect is economically significant
  - 4 % difference of fitted probabilities along the interdecile range of experienced returns
  - Comparable to M&N (5-8%)

Share of liquid assets invested in stock

	Coefficient	Std. error	t-statistic
Experienced return	3.201	1.486	2.154
Weighting parameter	8.345	3.724	2.241
Fitted prob at p90 - p10	0.040	0.003	12.668

Stock market crashes on risk aversion

- Effect of stock market crashes is significant.

Self-reported risk aversion			
	Coefficient	Std. error	t-statistic
Crash	0.12	0.05	2.49
Crash squared	-0.01	0.00	-2.61
Log Income	0.20	0.09	2.19
Log Income squared	-0.01	0.01	-2.77
Children	0.04	0.04	0.96
Children squared	-0.00	0.01	-0.28
Log Liquid assets	0.12	0.02	8.07
Log Liquid assets squared	-0.01	0.00	-11.26
Retired	0.08	0.04	1.92
College	-0.32	0.04	-7.34
High School	-0.20	0.04	-5.09
Age	0.00	0.01	0.62
Age squared	0.00	0.00	0.96
Married	0.04	0.03	1.10
Financial sector	-0.23	0.06	-3.99
Austria	-0.01	0.08	-0.14
Belgium	0.25	0.05	5.21
Spain	0.43	0.05	9.15
Greece	0.01	0.05	0.12
Italy	-0.77	0.07	-11.09
Luxembourg	0.49	0.06	7.96
Netherlands	0.30	0.07	4.26
Portugal	0.71	0.11	6.52
Pseudo R squared		0.11	

Stock market crashes on risk aversion

- Effect of crashes is moderate.
  - One more crash experienced makes HHs 0.9 p.p. more likely to be very risk averse.
  - 3 p.p difference along the interdecile range.

Self-reported risk aversion

	Coefficient	Std. error	t-statistic
Crash	0.118	0.048	2.490
Crash squared	-0.009	0.003	-2.609

Average Marginal Effect

	Coefficient	Std. error	t-statistic
Risk aversion = 1 (low)	-0.000	0.000	-0.907
Risk aversion = 2	-0.002	0.002	-1.190
Risk aversion = 3	-0.006	0.004	-1.409
Risk aversion = 4 (high)	0.009	0.007	1.317

Average of fitted probability at 90th pct. minus prob at 10th pct.

	Coefficient	Std. error	t-statistic
Risk aversion = 1 (low)	-0.002	0.000	-10.866
Risk aversion = 2	-0.010	0.001	-11.463
Risk aversion = 3	-0.022	0.002	-11.817
Risk aversion = 4 (high)	0.034	0.003	11.657

Stock market crashes on stock holding

- Experience of crashes matters
- Non-linearity: decreasing effects after more than 10 crashes

Stock market participation

	Coefficient	Std. error	t-statistic
Crash	-0.31	0.07	-4.41
Crash squared	0.02	0.01	3.71
Log Income	-0.16	0.28	-0.58
Log Income squared	0.01	0.01	1.09
Children	-0.01	0.04	-0.23
Children squared	-0.00	0.01	-0.06
Log Liquid assets	0.29	0.12	2.34
Log Liquid assets squared	0.01	0.01	1.33
Retired	-0.07	0.05	-1.32
College	0.38	0.05	8.03
High School	0.19	0.04	4.46
Age	0.04	0.01	4.51
Age squared	-0.00	0.00	-4.24
Married	-0.03	0.04	-0.77
Financial sector	0.65	0.08	8.13
Austria	-1.01	0.12	-8.14
Belgium	-0.05	0.07	-0.67
Spain	-0.00	0.06	-0.03
Finland	0.47	0.05	9.57
France	0.27	0.05	5.72
Greece	-0.41	0.09	-4.80
Italy	-0.32	0.09	-3.69
Luxembourg	-0.47	0.08	-5.71
Netherlands	-0.31	0.10	-2.94
Portugal	-0.14	0.14	-1.00
Pseudo R squared		0.31	

Stock market crashes on stock holding

- Experience of crashes matters
  - 8.5% difference along the interdecile range of the number of crashes

Stock market participation			
	Coefficient	Std. error	t-statistic
Crash	-0.314	0.071	-4.411
Crash squared	0.020	0.005	3.710
Average Marginal Effect	-0.019	0.004	-4.301
Fitted prob at p10 - p90	0.085	0.001	70.077

Stock market crashes on stock shares

- Effect is not significant.

Share of liquid assets invested in stock			
	Coefficient	Std. error	t-statistic
Crash	0.02	0.01	1.57
Crash squared	-0.09	0.17	-0.55
Log Income	0.01	0.01	0.65
Log Income squared	-0.02	0.02	-0.93
Children	0.01	0.01	1.27
Children squared	-0.22	0.06	-3.71
Log Liquid assets	0.01	0.00	3.61
Log Liquid assets squared	0.03	0.02	1.20
Retired	0.03	0.02	1.29
College	0.04	0.02	1.81
High School	0.00	0.00	0.63
Age	-0.00	0.00	-0.36
Age squared	0.00	0.02	0.21
Married	0.02	0.03	0.63
Financial sector	0.06	0.06	1.09
Austria	0.06	0.03	2.42
Belgium	0.23	0.03	7.88
Spain	0.25	0.02	11.42
Finland	0.18	0.02	8.58
France	0.22	0.05	4.26
Greece	0.09	0.05	1.93
Italy	-0.01	0.04	-0.19
Luxembourg	0.04	0.05	0.77
Netherlands	0.05	0.07	0.74
Portugal	1.47	0.96	1.53
Pseudo R squared		0.14	

Experienced return + crash

- Weighting parameter increases: 5.33 to 5.80 (not significant).
- Coefficient on experienced return decreases: 15.17 to 13.17 (not significant).
- Marginal effect of crashes decreases from 0.019 to 0.008 (significant).

Stock market participation

	Coefficient	Std. error	t-statistic
Experienced return	13.17	2.78	4.73
Crash	-0.06	0.02	-2.52
Weighting parameter	5.80	0.89	6.51
Average Marginal Effect (return)	0.02	0.00	5.41
Fitted prob at p90 - p10 (return)	0.13	0.00	47.70
Log Income	-0.13	0.31	-0.42
Log Income squared	0.01	0.01	0.90
Children	-0.00	0.04	-0.09
Children squared	-0.00	0.01	-0.15
Log Liquid assets	0.29	0.12	2.33
Log Liquid assets squared	0.01	0.01	1.32
Retired	-0.05	0.05	-0.96
College	0.40	0.05	8.27
High School	0.21	0.04	4.77
Age	0.01	0.01	1.23
Age squared	-0.00	0.00	-2.08
Married	-0.03	0.04	-0.78
Financial sector	0.65	0.08	8.16
Austria	-1.10	0.12	-9.46
Belgium	0.19	0.08	2.31
Spain	0.17	0.11	1.51
France	-0.07	0.21	-0.33
Finland	0.37	0.06	5.63
Greece	-0.29	0.20	-1.45
Italy	0.34	0.15	2.29
Luxembourg	-0.72	0.11	-6.62
Netherlands	-0.00	0.10	-0.00
Portugal	-0.01	0.14	-0.09
Pseudo R squared		0.31	

Experienced crash index

- Crash coefficient negative and significant, but no interpretation.
- Huge increase in the weighting parameter: effect of 2008 crisis ?

Stock market participation

	Coefficient	Std. error	t-statistic
Experienced crash index	-3.47	0.80	-4.35
Weighting parameter	15.71	0.60	26.34
Average Marginal Effect	-0.01	0.00	-4.39
Fitted prob at p90 - p10	-0.07	0.00	-24.53
Log Income	-0.14	0.29	-0.48
Log Income squared	0.01	0.01	0.99
Children	-0.01	0.04	-0.27
Children squared	-0.00	0.01	-0.15
Log Liquid assets	0.29	0.12	2.36
Log Liquid assets squared	0.01	0.01	1.30
Retired	-0.04	0.05	-0.67
College	0.38	0.05	7.81
High School	0.19	0.04	4.25
Age	0.03	0.01	2.88
Age squared	-0.00	0.00	-3.68
Married	-0.03	0.04	-0.72
Financial sector	0.66	0.08	8.17
Austria	-0.64	0.07	-9.33
Belgium	0.21	0.08	2.52
Spain	0.47	0.11	4.39
Finland	0.78	0.08	9.68
France	0.44	0.07	6.37
Greece	0.29	0.18	1.58
Italy	-0.48	0.06	-8.43
Luxembourg	-0.39	0.08	-5.03
Netherlands	0.19	0.09	2.10
Portugal	-0.04	0.09	-0.44
Pseudo R squared		0.31	

Countries with higher impact of 2008 crisis

- Countries with 08/07 – 03/09 total return less than minus 45%: FI, FR, GR, IT and PT.
- Substantial increase in weighting parameter, from 5.33 to 10.90.
- Coefficient on experienced return becomes insignificant.

Stock market participation

	Coefficient	Std. error	t-statistic
Experienced return	1.81	1.57	1.16
Weighting parameter	10.90	1.12	9.69
Average Marginal Effect	0.00	0.00	1.26
Fitted prob at p90 - p10	0.02	0.00	10.31
Log Income	-0.04	0.59	-0.07
Log Income squared	0.01	0.03	0.51
Children	0.02	0.04	0.60
Children squared	-0.00	0.01	-0.47
Log Liquid assets	0.12	0.14	0.84
Log Liquid assets squared	0.02	0.01	2.47
Retired	-0.01	0.05	-0.16
College	0.22	0.05	4.66
High School	0.20	0.04	4.72
Age	0.04	0.01	5.46
Age squared	-0.00	0.00	-5.67
Married	-0.01	0.04	-0.41
Financial sector	0.74	0.09	8.42
Finland	0.75	0.06	12.15
France	0.52	0.07	7.52
Greece	-0.02	0.16	-0.10
Italy	-0.19	0.14	-1.43
Pseudo R squared		0.34	

Countries with smaller impact of 2008 crisis

- Countries with 08/07 – 03/09 total return more than minus 45%: AT, BE, DE, ES, LU and NL.
- Barely any changes from basic specification both in experienced return coefficient and weighting parameter.

Stock market participation

	Coefficient	Std. error	t-statistic
Experienced return	16.02	3.27	4.90
Weighting parameter	5.52	0.92	5.98
Average Marginal Effect	0.03	0.00	4.78
Fitted prob at p90 - p10	0.09	0.00	25.09
Log Income	-0.18	0.42	-0.43
Log Income squared	0.01	0.02	0.67
Children	-0.02	0.08	-0.30
Children squared	-0.00	0.03	-0.07
Log Liquid assets	0.42	0.19	2.24
Log Liquid assets squared	0.00	0.01	0.10
Retired	-0.08	0.09	-0.89
College	0.51	0.08	6.16
High School	0.23	0.08	2.77
Age	0.00	0.01	0.14
Age squared	-0.00	0.00	-1.01
Married	-0.04	0.06	-0.69
Financial sector	0.63	0.11	5.60
Austria	-1.01	0.12	-8.38
Belgium	0.24	0.11	2.25
Spain	0.16	0.15	1.12
Luxembourg	-0.70	0.12	-6.08
Netherlands	0.12	0.11	1.09
Pseudo R squared		0.29	

Robustness checks: experienced return

- Bonds instead of stock.
- Volatility: Markowitz risk-return model.
- Pensions: upper bound.
- Start date: importance of recent financial crisis.
- Excluding immigrants: hh experiencing returns of own country

- Placebo experiment.

Robustness checks: experienced return

		Experienced return (β)			Weighting parameter (λ)			Pseudo R-squared
		Coefficient	Std. error	t-statistic	Coefficient	Std. error	t-statistic	
(1)	Benchmark model	15.17	3.76	4.04	5.33	1.41	3.77	0.31
(2)	Explaining bond holdings with bond returns	27.78	14.92	1.86	3.99	0.33	12.18	0.36
(3)	Adding experienced volatility	16.78	3.79	4.42	5.09	0.93	5.45	0.31
(4)	Stock holdings include voluntary pension plans	15.22	2.74	5.56	5.31	0.50	10.58	0.24
(5)	Unweighted estimation	4.68	0.81	5.76	10.05	1.49	6.75	0.34
(6)	Adding experienced bond returns	10.85	2.31	4.69	6.11	0.25	24.88	0.31
(7)	Longer experience horizon (10 years before birth)	10.54	1.95	5.40	3.87	0.35	11.16	0.31
(8)	Shorter experience horizon (10 years after bith)	21.10	3.49	6.04	6.49	0.21	30.76	0.31
(9)	Adding risk aversion	13.34	2.84	4.70	5.83	0.49	11.84	0.35
(10)	Excluding immigrants	6.57	0.95	6.94	10.04	0.57	17.70	0.33
(11)	Placebo experiment	-0.35	0.62	-0.57	5.33	[fixed]	[fixed]	0.31
(12)	Countries with a mild 2008 stock market decline	16.02	3.27	4.90	5.52	0.92	5.98	0.29
(13)	Countries with a severe 2008 stock market decline	1.81	1.57	1.16	10.90	1.12	9.69	0.34

Robustness checks: stock market crashes

- Increasing the severity of the crisis.
- Placebo experiment.

		Coefficient	Std. error	t-statistic	Pseudo R squared
(1)	Benchmark model	-0.019	0.004	-4.301	0.31
(2)	Adding experienced stock returns	-0.011	0.004	-2.417	0.31
(3)	Adding the number of experienced booms	-0.017	0.004	-3.980	0.31
(4)	Crashes defined as below -40% annual returns	-0.062	0.012	-5.119	0.31
(5)	Stock holdings include voluntary pension plans	-0.075	0.006	-11.613	0.24
(6)	Unweighted estimation	-0.003	0.002	-1.282	0.34
(7)	Adding risk aversion	-0.014	0.005	-2.649	0.34
(8)	Excluding immigrants	-0.009	0.007	-1.361	0.36
(9)	Placebo experiment	-0.000	0.004	-0.124	0.31

Conclusions

- Macroeconomic experiences affect risk-taking behaviour and portfolio choice decisions of households
- Households which have experienced higher stock returns during their lifetime tend to be less risk averse and tend to invest more in stocks. The effects are economically significant
- The effect of lived experiences disappears with time, more recent experiences are more important than older ones
- The experience of disastrous events has a statistically and economically significant impact on the decision of holding stocks.

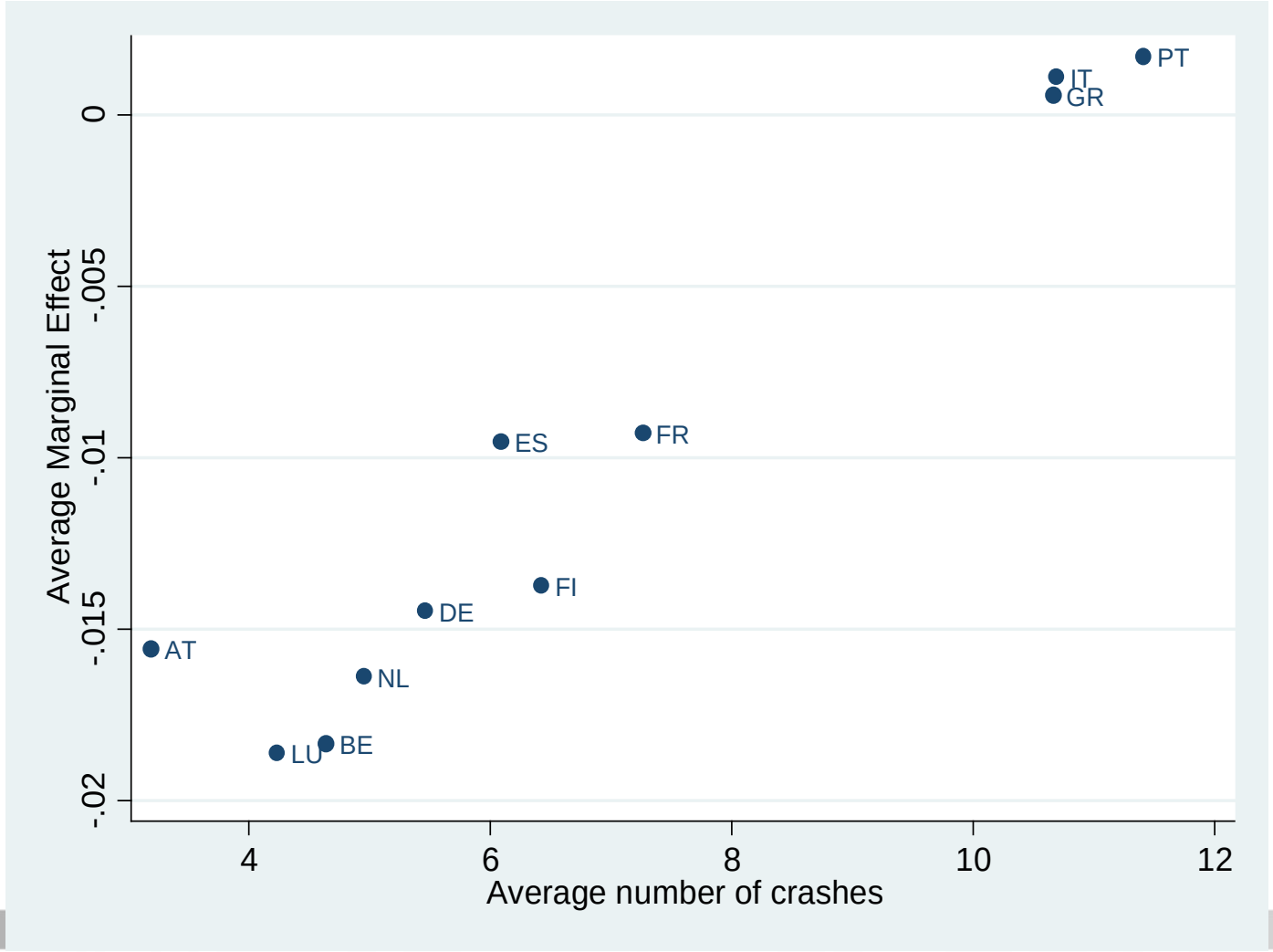
Annex

Stock market returns on stock holding

- Average marginal effects at the country level

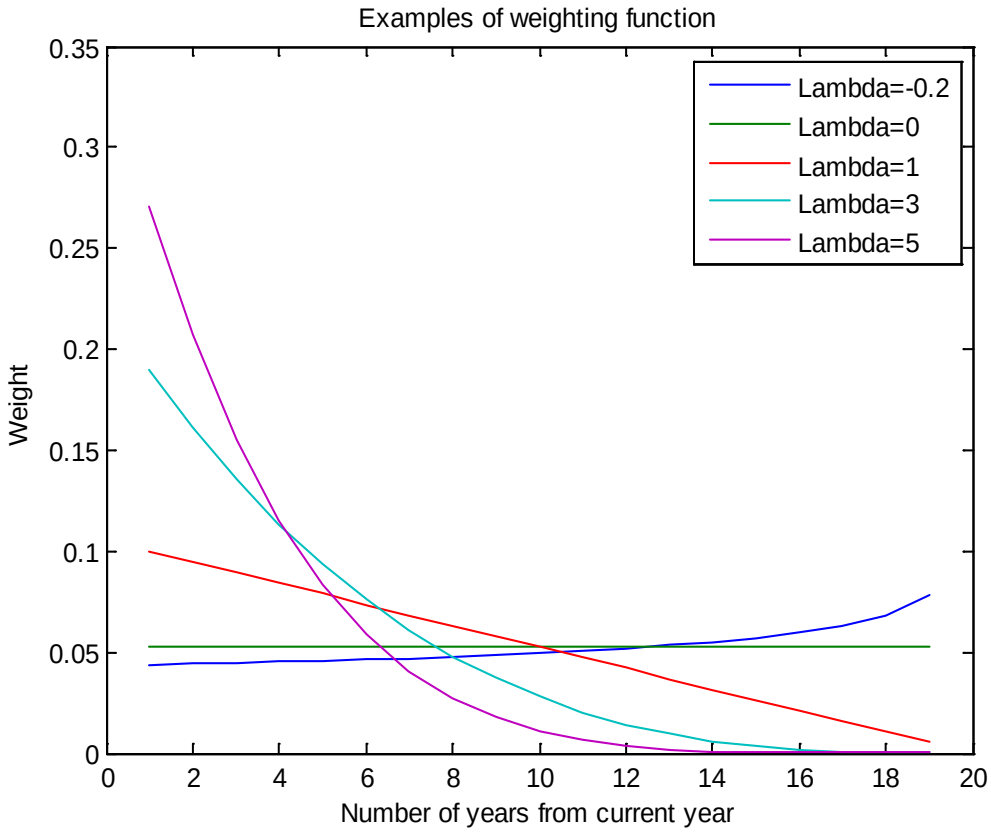
Stock market crashes on stock holding

- Average marginal effects at the country level



The data – household experiences

- **Examples for the weighting function for a 20-year old reference person**



Stock market returns correlations

- Nominal stock market returns are not highly correlated across countries.

	AT	BE	DE	ES	FI	FR	GR	IT	LU	NL	PT
AT	1.00	0.42	0.44	0.39	0.11	0.44	0.42	0.46	0.40	0.36	0.10
BE		1.00	0.47	0.49	0.42	0.58	0.18	0.46	0.75	0.57	0.14
DE			1.00	0.27	0.32	0.36	0.03	0.30	0.46	0.60	0.08
ES				1.00	0.40	0.46	0.28	0.45	0.37	0.37	0.28
FI					1.00	0.34	-0.05	0.12	0.50	0.39	0.17
FR						1.00	0.25	0.44	0.47	0.52	0.05
GR							1.00	0.39	-0.08	-0.06	0.02
IT								1.00	0.38	0.33	0.24
LU									1.00	0.51	0.25
NL										1.00	0.13
PT											1.00

Bond holdings

- Effect of bond returns on bond holdings disappears when we include the country fixed effects.

Country fixed effects

	Coefficient	Std. error	t-statistic
Experienced return	27.781	14.916	1.862
Weighting parameter	3.985	0.327	12.176

Country indicators

	Coefficient	Std. error	t-statistic
Experienced return	35.968	8.743	4.114
Weighting parameter	11.042	0.448	24.657

No country information

	Coefficient	Std. error	t-statistic
Experienced return	22.088	3.070	7.194
Weighting parameter	1.414	0.087	16.217

Country indicators: CPI inflation, unemployment, stock market capitalisation p.c., GDP p.c., gross public debt p.c., percentage of GDP spent on public pensions, average 2000-2010

Summary statistics

Experienced nominal average stock return (λ=4.5)

Country	Mean	Std. deviation	p10	Median	p90	Observations
Austria	12.90	0.22	12.62	12.89	13.26	2380
Belgium	9.08	1.37	7.02	9.32	10.70	2327
Germany	9.99	0.28	9.64	9.96	10.41	3565
Spain	12.01	2.22	8.95	12.46	14.48	6197
Finland	15.05	3.31	9.69	16.09	18.54	10989
France	9.61	1.67	7.08	9.86	11.71	15006
Greece	15.37	5.53	7.19	16.95	21.51	2971
Italy	6.94	2.06	4.13	7.12	9.52	7951
Luxembourg	12.97	0.49	12.29	12.92	13.67	950
Netherlands	9.61	1.31	7.73	9.76	11.26	1301
Portugal	12.69	1.92	10.04	12.89	15.30	4404
Euro Area	10.00	2.72	6.81	9.91	13.19	58041

Stock market crashes on stock shares

Share of liquid assets invested in stock			
	Coefficient	Std. error	t-statistic
Crash	0.021	0.013	1.573
Crash squared	-0.093	0.171	-0.548
Average Marginal Effect	0.021	0.013	1.573
Fitted prob at p10 - p90	-0.036	0.004	-8.903