Experience Effects

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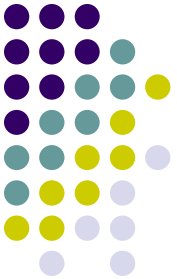
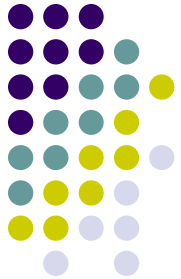
RSF Summer Camp, July 6, 2016



1. Do individuals' "macro/finance histories" (experiences) affect their risky choices – differently than information about the historical outcomes?
2. Application 1: Stocks and Bonds
3. Application 2: Inflation
4. Application 3: Housing – buy or rent?
5. Other applications: Managerial decision-making; consumption; earthquakes; institutional memory
6. Theoretical Underpinning
7. Can we fix it? De-biasing investors

Experience Effects



- **Traditional models of Decision-Making:**
  - Individuals have stable preferences.
  - Individuals rationally update beliefs.

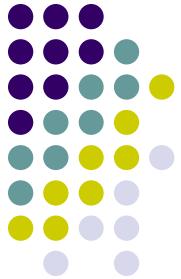
    ➔ Effect of "personally experienced outcomes" no different from information about these outcomes.

    ➔ Effect of "living through a depression" on financial investment no different than effect of reading about it; of "having experienced unemployment" on consumption no different than knowing your risk of future unemployment (controlling for wealth, income, age, time effects etc.).
- **Non-traditional models** (behavioral and experimental):
  - Personal experience affects behavior more strongly than information about outcomes

A famous example

"*I don't know about you, but my parents were depression babies, and as a result, avoided the stock market and all things risky like the plague.*"

The “Tale” of Depression Babies

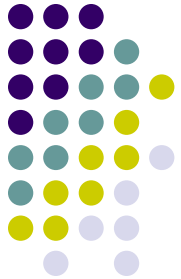


- Is it true?
  - Is it true beyond the Great Depression, e.g., for shocks like the recent Financial Crisis?
  - Will there be a lasting effect of having experienced a financial crisis or other macro-economic shock, even if wealth has been restored?
- Why is it true?
  - Change in risk attitudes (preference-based) or “mistake” = bias in expectations (beliefs-based)? Both?
- If belief-based, can we de-bias investors?
  - Can we convince investors that their expectations are biased, that it continues to be in their best interest to invest in the stock market, that they will realize this themselves in a few years, and that they may as well re-start now?

Availability and Personal Experience

- **Availability**: similarity-based hypothesis generation based on memory of prior cases (physician diagnostics, Weber et al., 1993); over- and underweighting of rare events in decisions from description versus experience (Hertwig et al., 2004)
  - See also Nisbett and Ross, 1980
  - Experience-weighted (esp. reinforcement) learning versus information (Camerer and Ho, EMA 1999)
- Learning from **personal interaction** (with other players) stronger than from observing other players' behavior (Simonsohn, Karlsson, Loewenstein, and Ariely, 2007)

Micro- and Macro-Expectations



- Long history of concerns about “rational beliefs” (Bayesian updating) in micro economics
  - Allais paradox, Ellsberg paradox
  - Savings behavior, loss aversion, ….
- Increasingly also (finally …) concerns about rational expectations (RE) assumption in macro economics and finance
  - Bubbles in stock prices, housing, and other assets
  - Credit cycles, investment cycles
  - Momentum, mean reversion, Investors chasing past performances

Expectations and Risk-Perception

- Acknowledgement that RE models fail to capture most prominent stylized facts in macro and finance, at least without painful addl. assumptions (e.g., Woodford *AnnR*)
  - Concern: “Adaptive learning” and “constant gain models” etc. are designed to fit the data without, not to get at true underlying expectations formation process
- Candidates: overinference (Barberis, Greenwood, Jin, Shleifer); natural expectations (Fuester, Laibson); and: experience effects!
- Micro data and experiments needed for
  1. model-based micro-underpinning and
  2. clean identification!

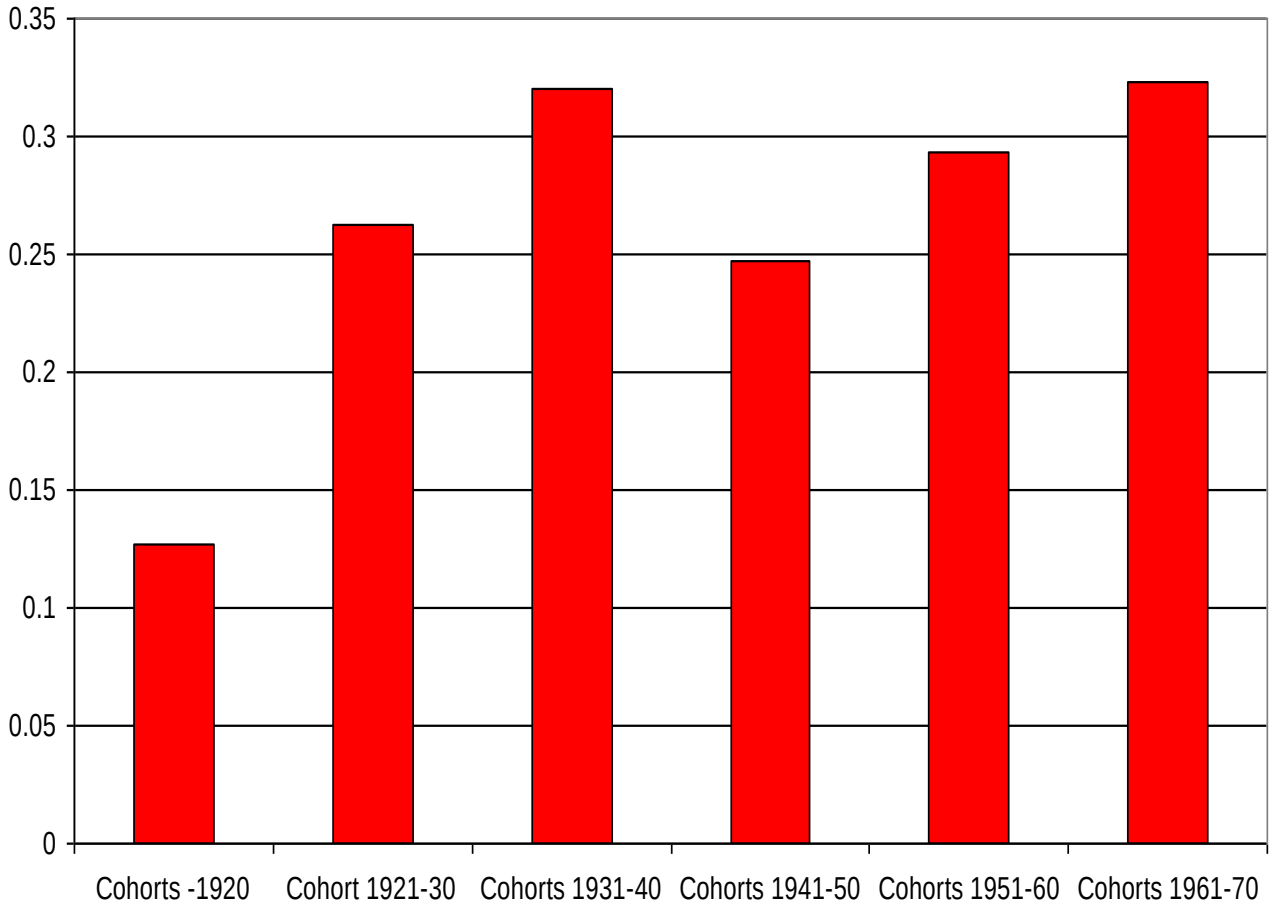
Application 1: Stocks and Bonds

("Depression Babies," joint with S. Nagel, QJE 2011)

- Measure individual investors' "**stock market experience**" over their lives so far and relate it to **stock market investment**
- Measure individual investors' "**bond market experience**" over their lives so far and relate it to **bond investment**

Illustration:

stock-market participation rates at age 36-45



How can we provide credible evidence?

- **Concerns**:

  age confounds, wealth confounds, time effects,
- **Solution**: long time series of data on stock market fluctuations and on individual investment decisions.
  - US Survey of Consumer Finances, with detailed data on asset holdings and demographics and starting 1947 (precursor survey).

Example: Age confound?

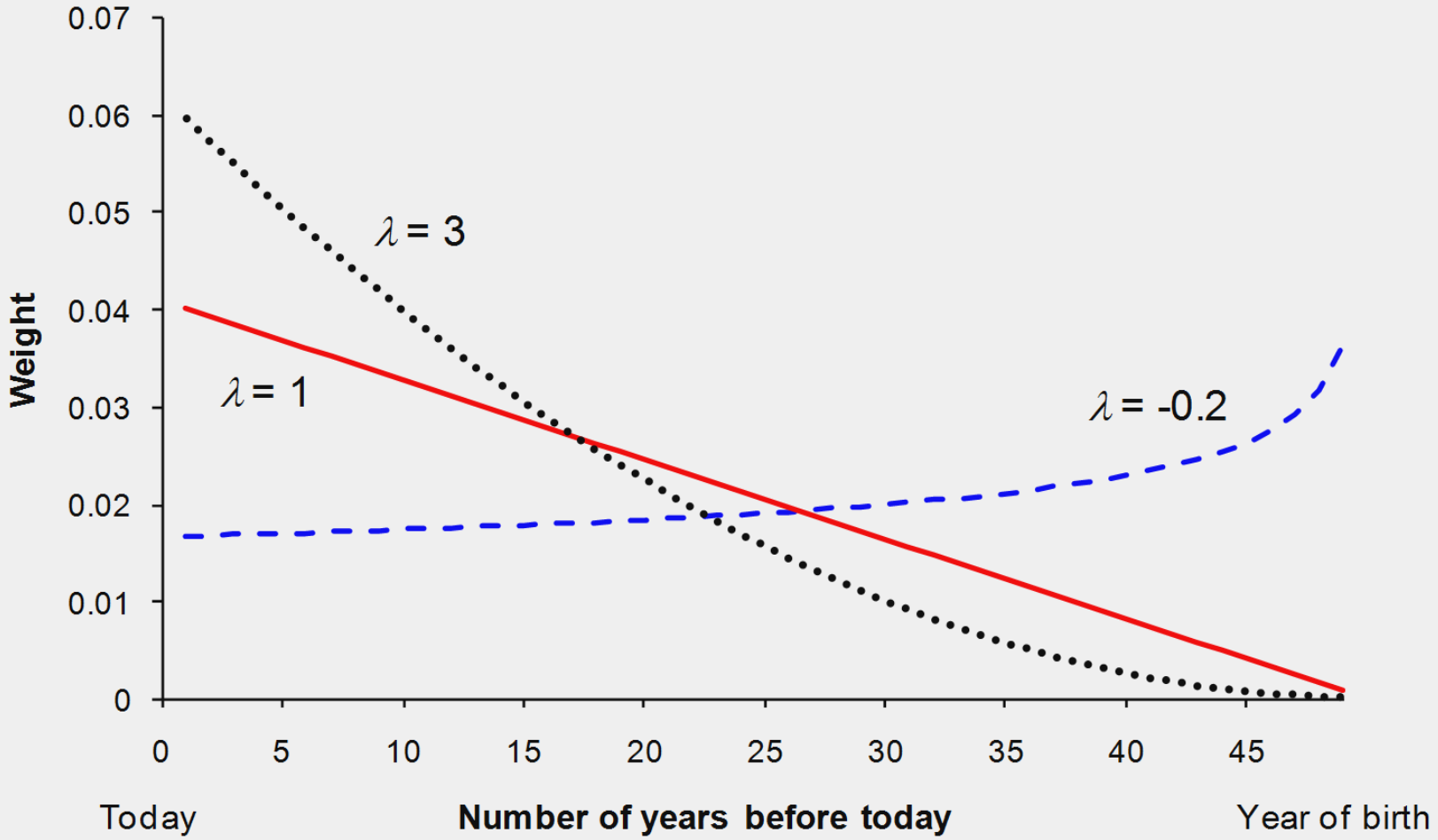
- Early 1980s: young households had lower stock-market participation, lower allocation to stocks, and reported higher risk aversion than older households.
  - Young households experienced the low 1970s stock returns.
  - Older households experienced the low 1970s stock returns, but also the high 1950s and 1960s returns.
- 1990s: pattern flipped: (then) young households had higher rates of stock-market participation, higher allocation to stocks, and lower reported risk aversion than older households.
  - Young households experienced the 1990s boom years and, hence, had higher life-time average returns than old households.
- Identification: from correlated changes in the age profile of life-time weighted average returns and risk-taking.

Estimation

- Relate investment choices (stock, bond) to past experiences.
  - Controls for income, wealth, age, ethnicity, education, marriage status, etc.
- We allow for past experiences (in one's life so far) to affect behavior in non-linear ways.

Weighting Function

- Illustration for 50-year old household



Findings

Weights on the past: roughly linearly declining

Cf. unconditional probability of being in lowest risk-tolerance category = 36.3%

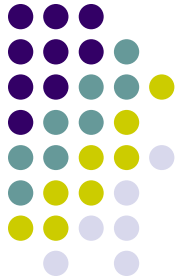
- **Elicited risk tolerance**
  - 1 = “not willing to take any financial risk”
  - 2 = “willing to take average financial risks expecting to earn average returns”
  - 3 = “… above av. financial risks .. above av. ret.”
  - 4 = “… substantial financial risks … substantial returns”

  Effect of moving from a bad to a good lifetime experience (10th to 90th percentile): – 10 pp!
- **Stock-market participation** (Stock holdings > $0)

  Effect of moving from a bad to a good experience: +14 pp
- **Bond-market participation** (Bond holdings > $0)

  Effect of moving from a bad to a good experience: +15 pp

Illustration: 2008 Financial Crisis



- Real return of S&P 500 index in 2008: -36%
  - Large negative returns strongly altered investors' (weighted) life-time average returns
  - Effect was strongest for young investors
- Compare to counterfactual of 8.2%
  - For a 30-year old:
    - Experienced returns 4 pp lower
    - Participation rate 10 pp lower
  - For a 60-year old:
    - Experienced returns 2 pp lower
    - Participation rate 5 pp lower

2008 Financial Crisis (*continued*)

- How long-lasting is the effect?
  - For a 30-year old, weight on 2008 return in 2009: 8.9%
  - … in 2019 (then 40-year old): 4.0%
  - … in 2039 (then 60-year old): 2.0%.
- After 30 years most of the effect faded away.

Aggregate Perspective

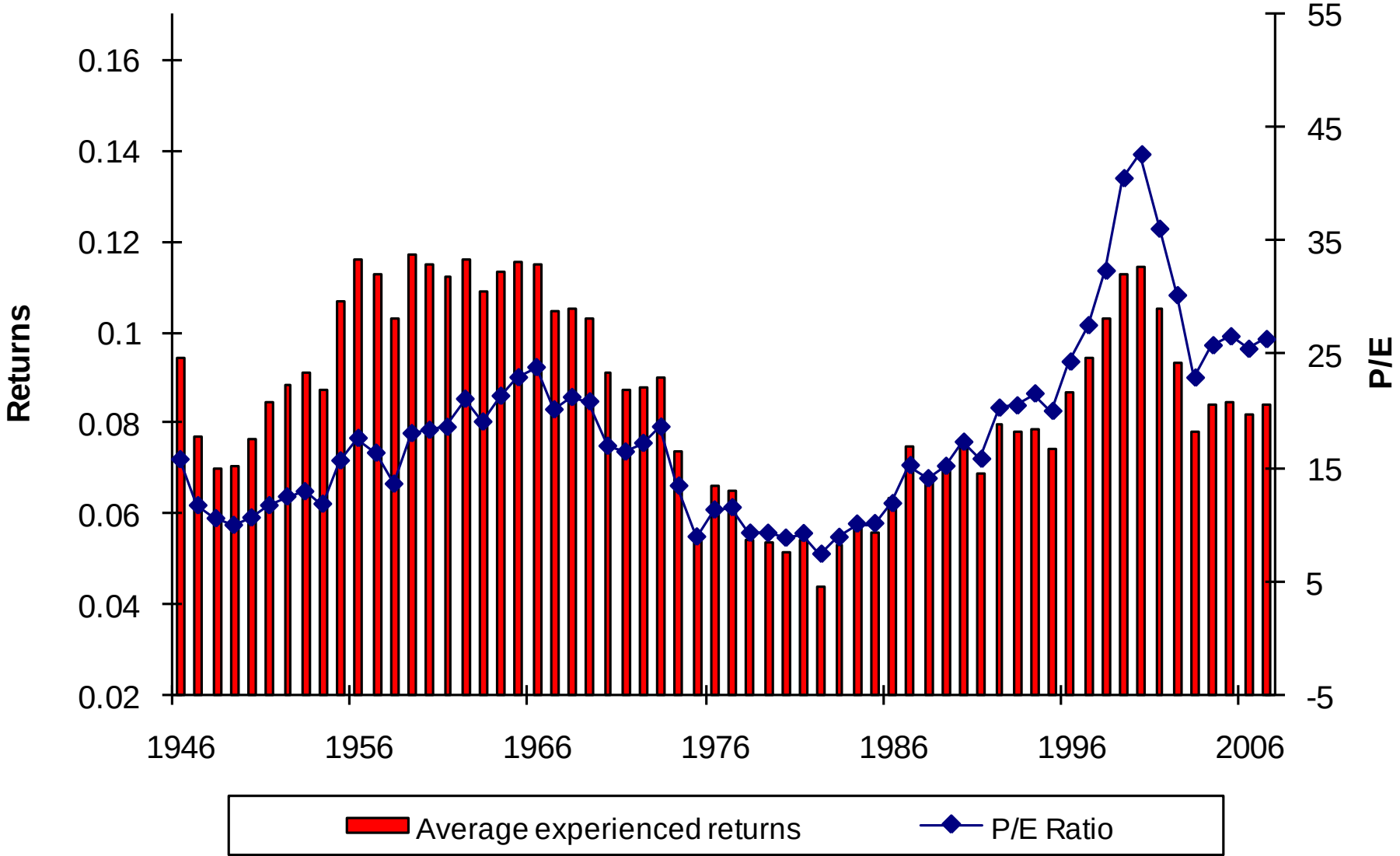
Do the experience-based changes in risky asset demand influence the dynamics of stock prices?

Exercise:

- Set roughly linearly declining weights
- Compute life-time (weighted) average return for each household and year
- Weight household-year observations with liquid assets of the household × SCF weight
- Relate to measure of stock market valuation:

  P/E ratio from Shiller (2005), which is negatively related to future stock-market returns

Aggregate experienced stock returns and stock market valuations



Insights so far:

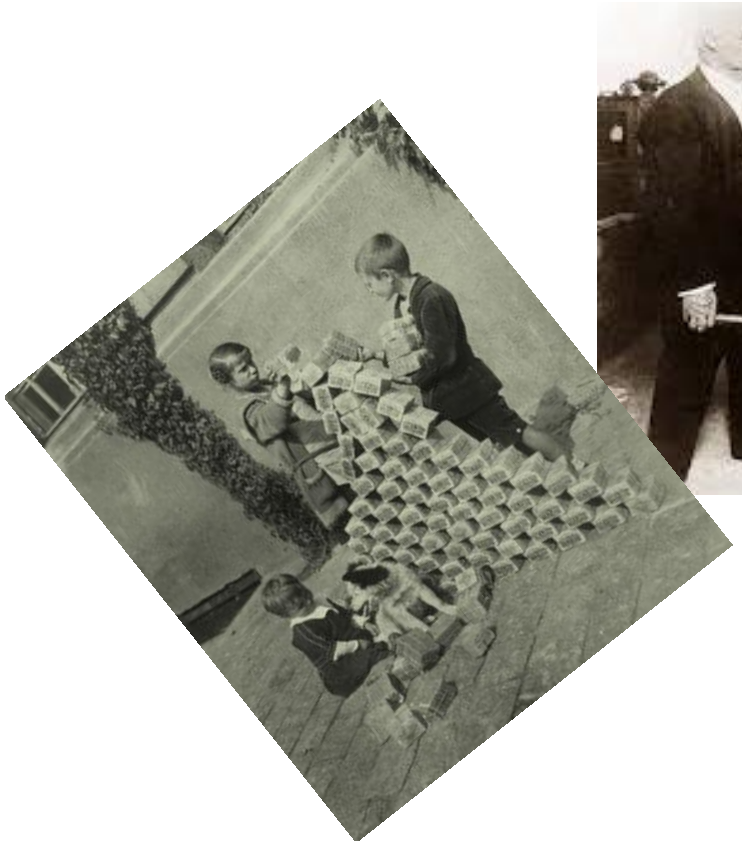
- Stock return experienced over an individuals' life affects risk attitudes and willingness to take stock risk. Bond return experience affects willingness to take bond risk.
  - More weight on relatively recent returns, but even very distant ones still have substantial effects.
  - Bigger impact on the young than the old.
- Departure from standard model (stable risk attitudes); source of heterogeneity
  - Systematic departure, unified framework for different measures.

Open Question: Preferences or Beliefs?

Application 2: Inflation Experience

("Learning from Inflation Experiences," with S. Nagel, QJE forthcoming)

- How do individuals form expectations about future inflation?
- **A "German" motivation**



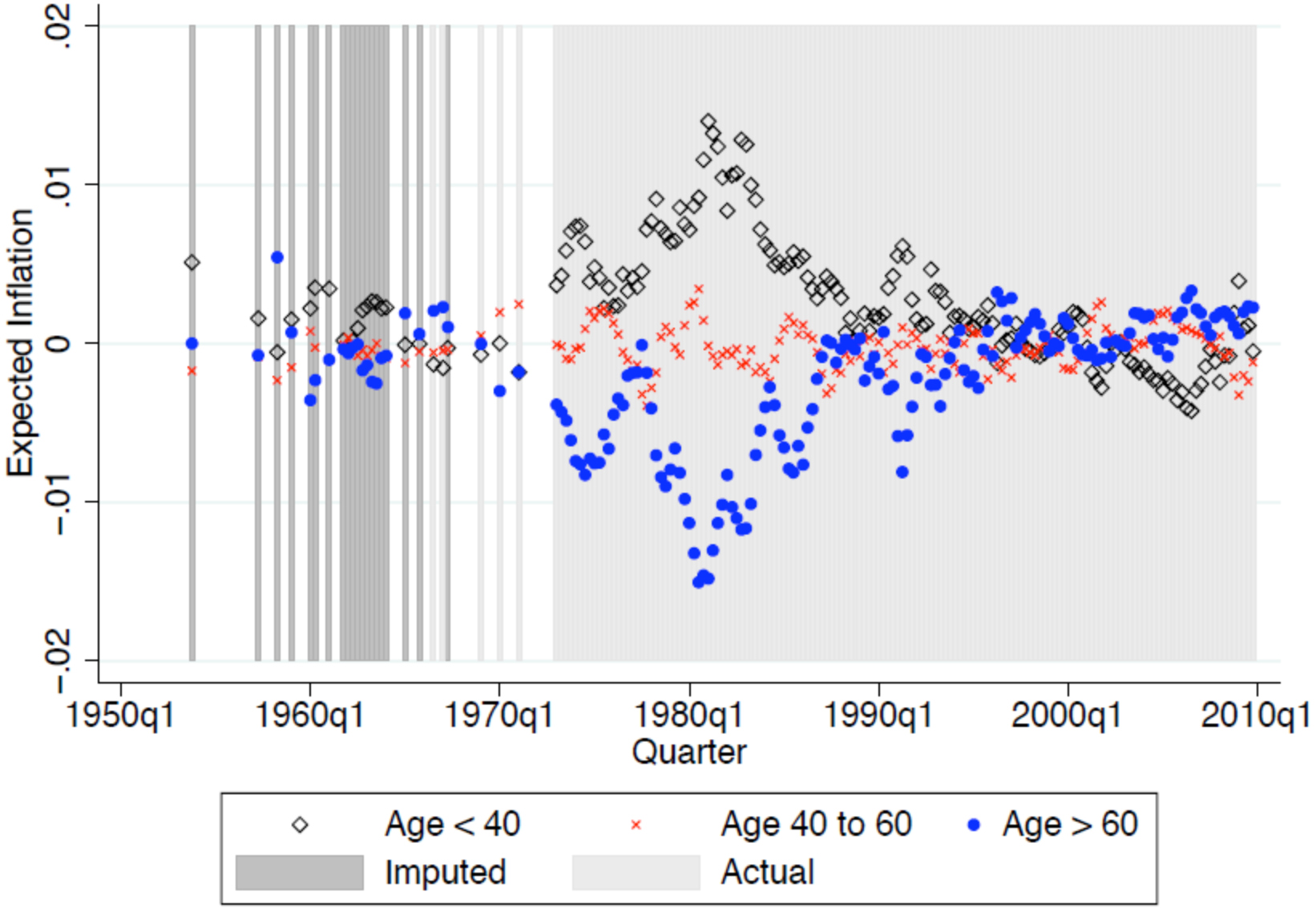
But not only in Germany …

- **Paul Volcker (1979)**: “An entire generation of young adults has grown up since the mid-1960s knowing only inflation, indeed an inflation that has seemed to accelerate inexorably. In the circumstances, it is hardly surprising that many citizens have begun to wonder whether it is realistic to anticipate a return to general price stability."
- **Ben Bernanke (2007)**: “A fuller understanding of the public's learning rules would improve the central bank's capacity to assess its own credibility, to evaluate the implications of its policy decisions and communications strategy, and perhaps to forecast inflation."

Research Question

- Do individuals' life-time experiences of inflation affect their subjective expectations about future inflation rates?
- Important both for monetary policy and for individual financial and consumption decisions.
  - Individual: mortgage decisions
- Little convergence on the best model to predict inflation expectations (see Mankiw, Reis, Wolfers [2003])
  - The stickiness" of inflation rate changes (Sims [1998]) and the empirical heterogeneity in the formation of expectations remain hard to reconcile with existing models.

Disagreement about 1-year inflation



Learning-from-Experience Hypothesis

- When forming inflation expectations, individuals put a higher weight on realizations experienced over their life-times than on other available historical data.
- Similar to adaptive learning: people learn following simple “rules of thumb” (e.g., Bray 1982; Marcet and Sargent 1989)
- Different from adaptive learning: twist that people learn (more) from data realized during their lifetimes.

Implications

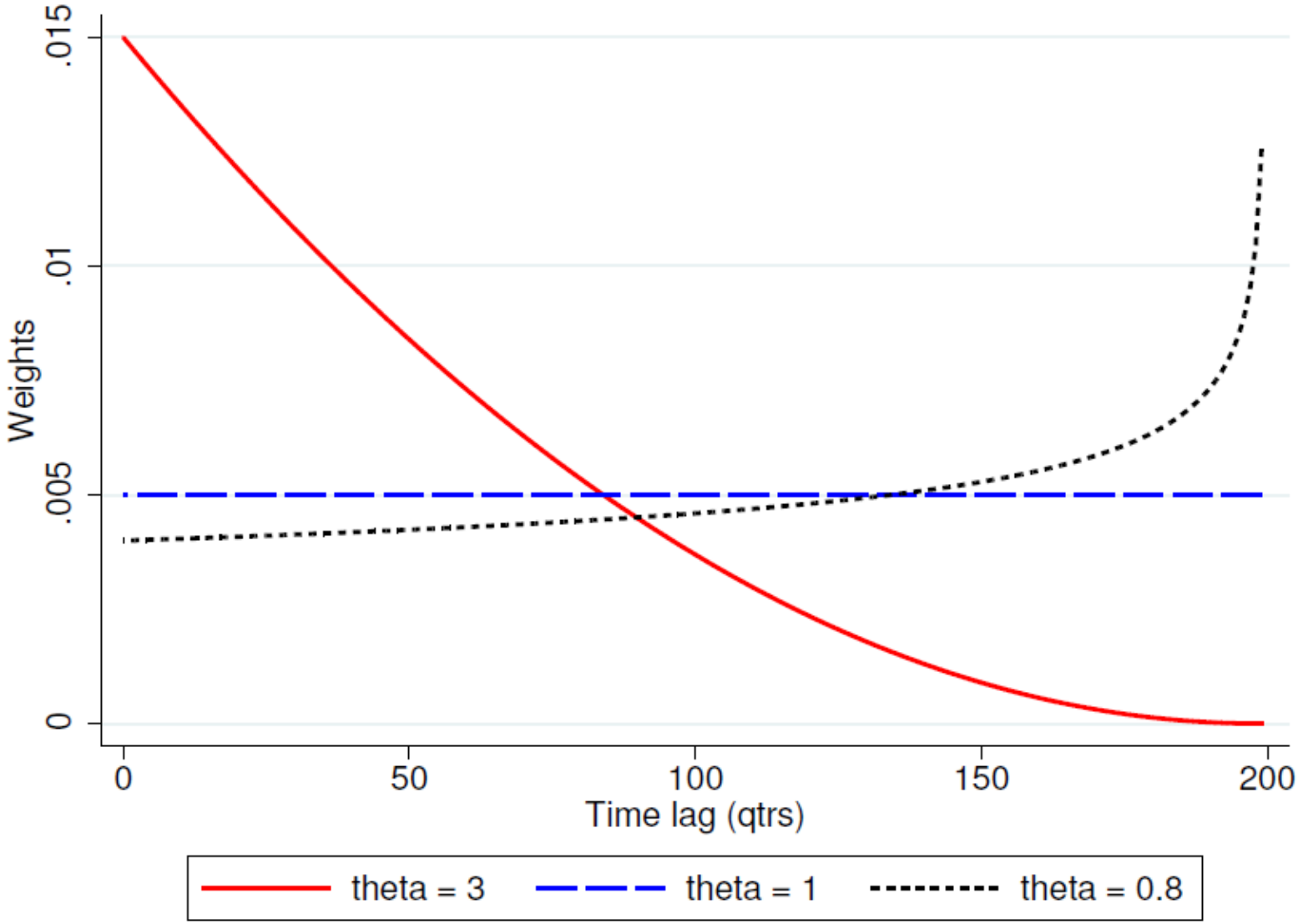
- Expectations history-dependent
- Expectations heterogeneous: Young individuals place more weight on recent inflation rates than older individuals.

Estimation

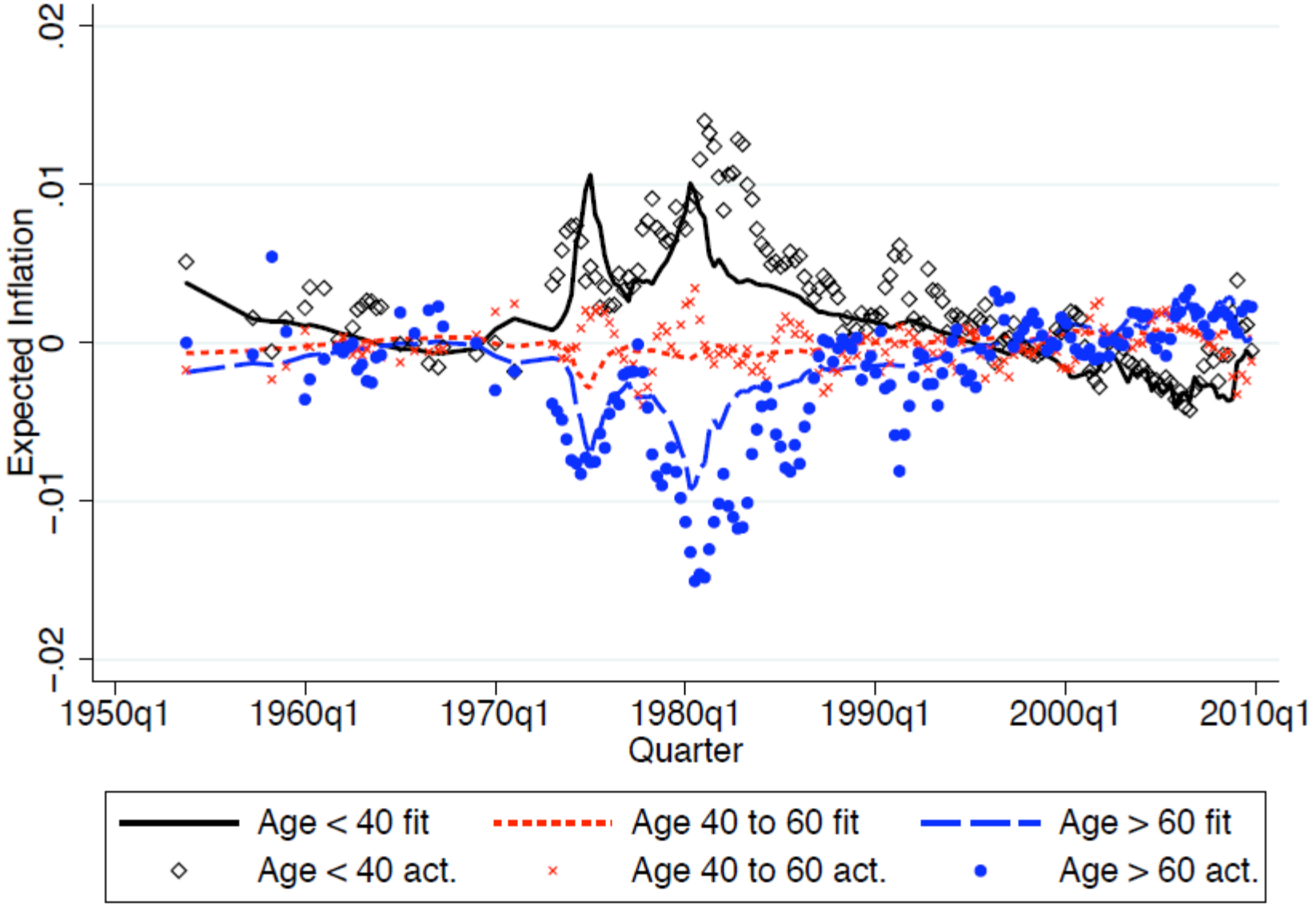
- 57 years of household-level microdata from the Michigan Survey of Consumers (MSC), starting in 1953
- Estimate adaptive learning-from-experience forecasting rules
- As in “Depression Babies” allow more recent and less recent experiences to matter differently → simultaneous estimation of weights

Illustration:

Weighting of past data for 50-yr (200-qtr) old individual



Fitted values



Results

- Positive relation between differences in experiences and differences in subjective expectations

  ↔ adaptive learning: all historical data

- Young individuals place more weight on recently experienced inflation than older individuals.
- Implication: periods of high surprise inflation like in the 1970s lead to substantial disagreement between young and old individuals about future inflation rates.
- Note: implicit weighting of past experiences again very similar to weighting pattern in stock market data!

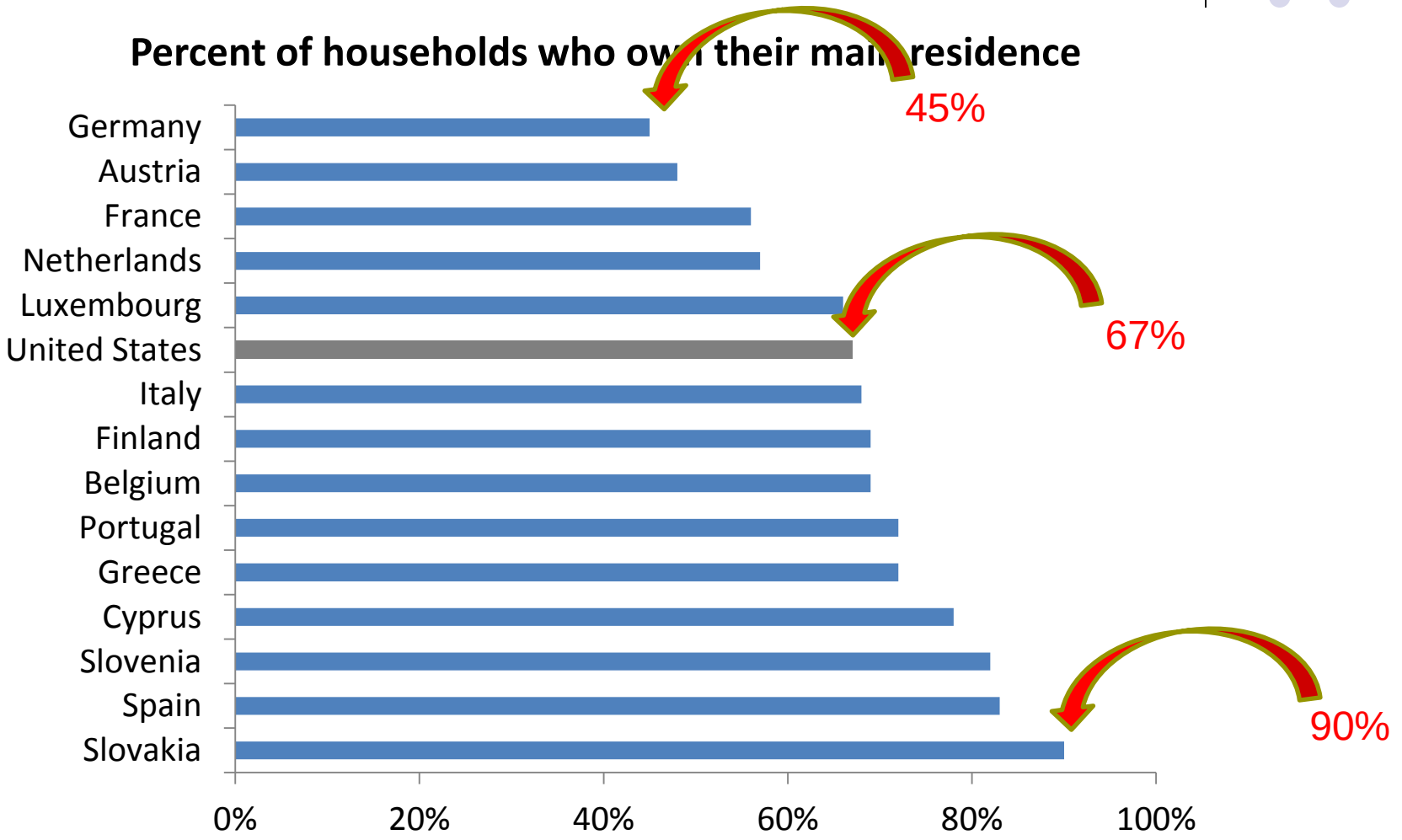
  Roughly linearly declining.

- Significant impact on individual financial decisions, namely, long-term nominal-rate borrowing and lending.

Rent or Buy? - The Role of Lifetime Experiences of Macroeconomic Shocks within and across Countries

(with Alex Steiny)

Homeownership rates in 2008-2011



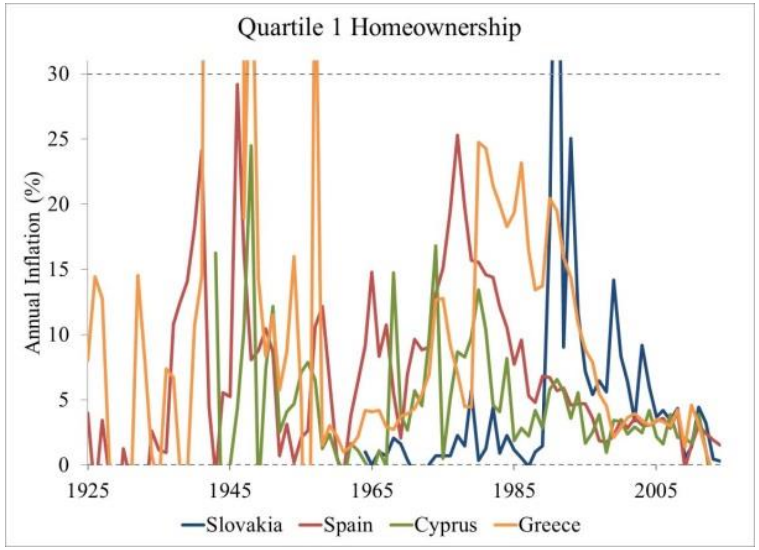
Sources: ECB Household Finance and Consumption Survey. US homeownership rate from 2010 Census.

What drives large differences?

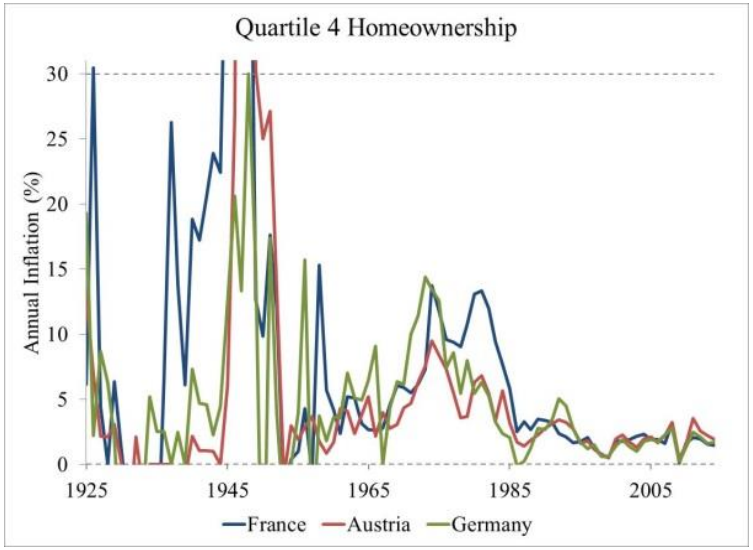
- Literature focuses on:
  - Household characteristics (age, family structure, employment status, income, wealth, access to mortgage debt; Drew and Herbert 2013)
  - Housing market factors (government policies encouraging renting vs. owning, maturity of mortgage markets, transaction costs, variations in housing supply; Earley 2004)
- **Our question**: Is homeownership higher in countries where a larger fraction of the population has lived through periods of higher inflation or increasing home prices?

Inflation for EU countries with …

… highest homeownership rates



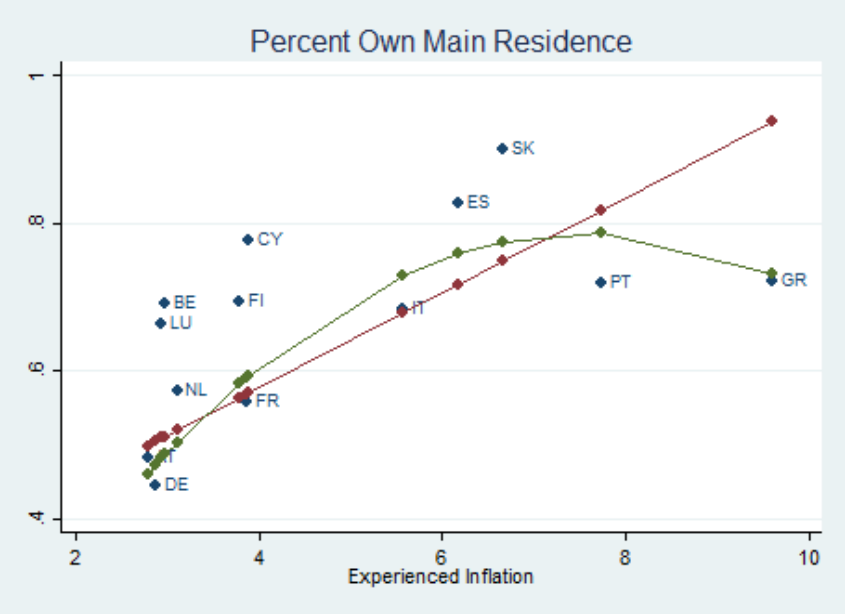
… lowest homeownership rates



Note: Inflation for chart capped above at 30% and below at 0%.
Source: ECB Household Finance and Consumption Survey (2008-2011 in 13 European countries).
Inflation from Reinhart and Rogoff series (2009) and Global Financial Data.

Country level: Inflation experience

- In the linear model, a 1pp increase in average experienced inflation predicts a 6pp increase in homeownership
- Adding squared inflation experience, results are similar until highest experienced inflation levels (around 8%)



Weighted to be representative of the population.

Country level: House price increases

- In the linear model, a 1pp increase in average experienced house price increases predicts a 4pp increase in probability of living in own house.
- Including squared experience, the effects are statistically insignificant

Weighted to be representative of the population. Excludes Austria, Cyprus, Greece, Portugal, and Slovakia.

Findings

- At the national level, macroeconomic experiences significantly predict homeownership rate
- At the household level, experiences of higher inflation and increasing home prices predict significantly higher odds of homeownership
  - Robust to inclusion of household characteristics and several housing market factors

➔ Next step: only individuals or even professionals, who are highly informed about inflation time series?

➔ "**The Making of Hawks and Doves**" (with S. Nagel and Zach Yan)

The Making of Hawks and Doves

Example from last year: discussion of the conflicting views among FOMC members on whether rates need to rise soon (Chair Janet Yellen and Vice Chair Stanley Fischer) or not (Federal Reserve Governor Lael Brainard):

> *I think these three players are all products of their experience. Yellen received her Ph.D in 1971. Fischer in 1969. Both experienced the Great Inflation first hand. Brainard earned her Ph.D in 1989. Her professional experience is dominated by the Great Moderation.*
>
> *– Tim Duy's Fed Watch (2015)*

Making of Hawks and Doves: Personal Experience of FOMC members

- Do differences personal experiences of inflation explain dissent in FOMC decisions?
  - In other words: Does experience bias affect only the general public, or does it affect central bankers?

Making of Hawks and Doves: Personal Experience of FOMC members

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  - In other words: Does experience bias affect only the general public, or does it affect central bankers?
- For each FOMC member j, we calculate a subjective learning-from-experience forecast $\pi^e_{j,t+1|t}$ as in MN (2016) based on
  - FOMC members' age at time of decision
  - Inflation data since birth (weighted)
  - Gain parameter $\theta = 3.044$ (point estimate in MN 2016 from household survey data)

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  - Inflation data since birth (weighted)
  - Gain parameter $\theta = 3.044$ (point estimate in MN 2016 from household survey data)
- One improvement over MN (2016): **Seasonal** AR(1) as perceived law of motion

$$\pi_{t+1} = \alpha + \phi_1 \pi_t + \phi_4 \pi_{t-3} + \phi_5 \pi_{t-4} + \eta_{t+1},$$

Inflation experiences and FOMC voting behavior: Baseline estimates

	Ordered Probit (i)	Ordered Probit de-"chaired" (ii)	Ordered Probit (iii)	Ordered Probit de-"chaired" (iv)
Experienced-based forecast	216.7	97.4	214.6	98.7
	(66.2)	(39.6)	(67.9)	(39.1)
Wallich Dummy	1.43	1.05	1.39	1.05
	(0.36)	(0.17)	(0.36)	(0.17)
Meeting FE	Yes	No	Yes	No
Thresholds	Role $\times$ $I_{>93}$	Role $\times$ $I_{>93}$	All	All
#Obs.	6707	6707	6707	6707
Pseudo R^2	0.390	0.097	0.391	0.100

Note: De-chaired = excl. meeting FE to check for incidental parameter issues; calculate thresholds relative to chair.

Economic Magnitudes

Average partial effect (APE):

- Increase of 0.1% in experience-based forecast ($\approx$ a typical SD of FOMC members' experience-based inflation forecasts in an FOMC meeting) $\longrightarrow$ about one third increase in probability of hawkish dissent (relative to unconditional mean of 4.0%)
- Increase of 0.1% in experience-based forecast $\longrightarrow$ about one third decrease in probability of dovish dissent (relative to unconditional mean of 2.4%)

Wallich effect

- "Hyperinflation treatment" $\longrightarrow$ large reduction in probability of dovish dissent, 5 pp, and large increase in probability of hawkish dissent, 8 pp.
- In other words: Hyperinflation "treatment" $\approx$ 1.0 pp increase in experience-based inflation forecast

FOMC Members' Inflation Forecasts and Experience-based Forecast

Dependent variable: Difference between

- FOMC member's inflation projection from the Semiannual Monetary Policy Report (MPR) to the Congress
- Fed Staff's inflation forecast from Green Book available prior to each FOMC meeting.

	All FOMC Members		Regional Fed President	
	(i)	(ii)	(iii)	(iv)
Exp.-based Fcst. - Staff Fcst.	0.549	0.506	0.591	1.070
	(0.207)	(0.308)	(0.217)	(0.505)
Meeting FE	No	Yes	No	Yes
Observations	256	256	127	127
Adjusted R^2	0.395	0.847	0.410	0.854

Next Steps: Alternative outcome variables

- Votes / forecasts most directly linked monetary policy.
- **Language**: Can we detect the hawkish or dovish nature of FOMC members in their speeches or articles about them? Does experienced inflation affect the semantics of FOMC Members?
- Cf. "communication via speeches" among FOMC members and reluctance to dissent (among some)

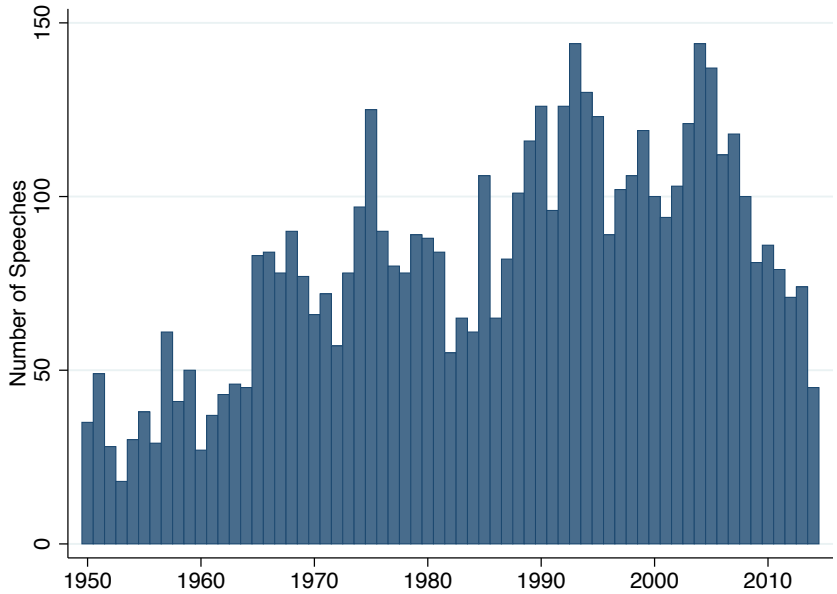
Example

"Disruptive inflation has plagued our economy for something like 12 years. During that period its virulence has varied, as high as 12.0 per cent in the fourth quarter of 1974 and as low as 1.5 per cent in the second quarter of 1967. But the experience has made clear that we are not "learning to live" with inflation. Increasingly inflation is seen for what it is – a serious addiction that gradually undermines the vitality and even viability of the addict."

(Henry Wallich, "Using the tax system to restrain inflation" (1978, statement before the Joint Economic Committee))

Data Speeches

- 6000+ speeches & statements by FOMC members digitally available.
- At least 1 speech for 104 out 144 FOMC members since 1951.
- Mean 140 speeches (median 101) per FOMC member.



Identifying hawkish/dovish language

- **Idea** (Apel and Grimaldi, 2012)
  - Examine adjective-noun combinations.
  - Select nouns representing the goals of the central bank, adjectives reflect the sentiment of the FOMC member towards that goal.
  - Nouns: inflation, cyclical position, growth, price, wages, oil price, development
  - Hawkish adjectives: increase, fast, strong, high
  - Dovish adjectives: decrease, slow, weak, low
- **Measure**:

$$Net\ Index = \frac{Hawkish}{Hawkish + Dovish} - \frac{Dovish}{Hawkish + Dovish}$$

Does Inflation Experience explains Hawkish/Dovish Language?

	Net Index
Experienced-based forecast	22.71**
	(11.41)
Wallich Dummy	0.18**
	(0.07)
Macro Condition Controls	yes
Member Controls	yes
Year-Quarter Fixed Effects	yes
Observations	3092
R	0.117

Results large in magnitude: one SD increase in exp-based forec. (0.017) leads to an increase of 0.7 SD of net index (0.562).

Other applications

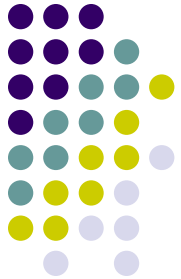
- **Consumption decisions**
  - Experience = unemployment rates over lifetime so far
  - Outcome = detailed consumption data, incl. use of coupons, brand versus store brand
  - Finding: having lived through recession periods (high unemployment) leads to a significantly sharper reaction in consumption choice

- **Institutional memory** (with C. Bouwman)
  - Is banks' risk taking affected by their "history," i.e., the environments the institutions and their CEOs have faced in the past?
  - Cf. debate about equity ratios and bank capitalization.
  - Experience: founding year, "life-time bank so far", age CEO, experience CEO, in terms of banking crises, distance to default
  - Preliminary discussion (using only data post 1980 in AER P&P 2015); well-identified results using a century of data hopefully soon.

Other applications: Managerial Decisions

- Do managers' "personal histories" explain managerial decisions in the core areas, such as mergers, investment, capital structure?
- Mounting evidence, e.g., Malmendier, Tate, and Yan (*Journal of Finance* 2011):
  1. Experience of economic crisis (Great Depression) predicts aversion to external financing (including investment-cash flow sensitivity).
  2. Experience of military service predicts aggressive financing, including high leverage.

Theoretical Underpinning



- Why? Search for a new expectations framework in macro-finance.
- Experience effects combines “recency effects” (as also overinference models, natural expectations) and cross-sectional heterogeneity
- Generate predictions on longterm effects that
  - Vary by age group
  - Vary by population structure (e.g.US millennials starting to outnumber baby boomers [post-world war experience]; aging versus young countries)

Personal Experience and Financial Markets

Theoretical Underpinning

- CARA-Normal framework.
- Portfolio Decisions: agents can invest in a risky and a risk-free asset.
- **Two key ingredients**:
  - Overlapping Generations (OLG).
  - Experience-Based Learning (EBL).

The Model: Financial Markets

- Agents can invest in two assets:
  - A single risky asset (a "Lucas Tree") that pays random iid dividends:

$$d_t \sim N\left(\theta, \sigma^2\right)$$

  - A riskless asset that pays $r > 1$ and is in infinitely elastic supply.
- **Uncertainty about fundamentals:** Agents do not know the true mean of dividends θ and use past observations to learn it.
  - To keep the model tractable, we assume that σ^2 is known at all times.

Agent's Problem

The optimization problem of an alive n-generation at time t is given by

$$\max_{x_t^n} E_t^n[-\exp(-\gamma x_t^n s_{t+1})]$$

subject to:

$$s_{t+1} = p_{t+1} + d_{t+1} - p_t r$$

- $E_t^n[\cdot]$: expectation computed with beliefs of generation n at time t.
- CARA utility (no wealth effects).
- We assume WLOG that agents are born with no wealth $W_n^n = 0$.

Learning Process: EBL

How do agents learn the mean of dividends: θ?

- The belief about θ of an alive n-generation at time t is

$$\theta_t^n = \sum_{k=0}^{t-n} d_{t-k} w(k, \lambda, t-n)$$

$$w(k, \lambda, t-n) = \frac{(t-n+1-k)^\lambda}{\sum_{k'=0}^{t-n}(t-n+1-k')^\lambda}.$$

- Taken from Malmendier-Nagel (2011): λ parametrizes the relative weight given to most recent observations (Availability Bias):
  1. $\lambda > 0$, more recent observations receive relative more weight.
  2. $\lambda = 0$ equal weight.
  3. For US data: $\approx 1 - 3$.

Learning Process: EBL

How do agents learn the mean of dividends: θ?

- The belief about θ of an alive n-generation at time t is

$$\theta_t^n = \sum_{k=0}^{t-n} d_{t-k} w(k, \lambda, t-n)$$

$$w(k, \lambda, t-n) = \frac{(t-n+1-k)^\lambda}{\sum_{k'=0}^{t-n}(t-n+1-k')^\lambda}.$$

- Taken from Malmendier-Nagel (2011): λ parametrizes the relative weight given to most recent observations (Availability Bias):
  1. $\lambda > 0$, more recent observations receive relative more weight.
  2. $\lambda = 0$ equal weight.
  3. For US data: $\approx 1 - 3$.

Some observations: Comparison to Bayesian Updating

- We compare EBL with learning from data observed during one's life but using Bayes rule with prior $N(m, \tau^2)$.
- The belief of a "Bayesian" generation t at time $t + age$ is:

$$\beta^t_{t+age} = \frac{\tau^{-2}}{\tau^{-2} + \sigma^{-2}(age+1)} m + \frac{(age+1)\sigma^{-2}}{\tau^{-2} + \sigma^{-2}(age+1)} \theta^t_{t+age}$$

  with θ^t_{t+age} computed with $\lambda = 0$.
- For diffuse priors ($\tau \to \infty$), $\beta^t_{t+age} \to \theta^t_{t+age}$ computed with $\lambda = 0$.
- As $age \to \infty$, $\beta^t_{t+age} - \theta^t_{t+age} \to 0$ (and both converge to the truth).

Some observations: Convergence in general?

- By construction, the beliefs of generation-n experience-based learners' at time $n + age$ are

$$\theta^n_{n+age} \sim N(\theta, \sigma^2 \sum_{k=0}^{age} (w(k, \lambda, age))^2).$$

- Whether θ^n_{n+age} converges to the truth as $age \to \infty$ will depend on whether $\sum_{k=0}^{age} (w(k, \lambda, age))^2 \to 0$.
- This in turn depends how fast the weights for "old" observations decay to zero.

Equilibrium

Definition

An equilibrium is a demand profile for the risky asset $\{x_t^n\}_{n\geq 0, t\geq 0}$, a demand profile for the riskless asset $\{a_t^n\}_{n\geq 0, t\geq 0}$ and a price schedule $\{p_t\}_{t\geq 0}$ such that

1. given the price schedule, $\{(a_t^n, x_t^n) : t \in \{n, ..., n+2\}\}$ solves the maximization problem of generation n, and
2. markets clear at all periods, i.e.,

$$1 = \frac{1}{q} \sum_{n=t-q}^{t} x_t^n, \ \forall t. \tag{1}$$

- A *linear equilibrium* is one with p_t affine in $d_t, ..., d_{t-K}$ for some K.

Benchmark Case: Full Information: θ is known

Equivalent to a benchmark with no disagreements and no learning (static beliefs.)

- Unique equilibrium
  - $p_t = c \in \mathbb{R}$; i.e., p_t is constant. No price dynamics.
  - $x_t^n = 1$ for all $t \in [n, ..., n+q-1]$ and zero otherwise. No demand dynamics.
- Trade levels and portfolio allocations are independent of θ.

Characterization of Prices and Demands

1. *Prices are more responsive to more recent dividend realizations.*

   Proposition. For $\lambda > 0$, $0 < \beta_{q-1} < .... < \beta_1 < \beta_0 \leq \frac{1}{r-1}$.

2. *Recency bias increases the dependence of prices on recent dividends.*

   Lemma. β_0 is increasing in λ and $\lim_{\lambda \to \infty} \beta_k = 0$ for $k > 0$.

3. *Younger generations react more strongly to more recent shocks.*

   Proposition. For any two n- and $(n+1)$-generations alive at time $t > q$, there exists a $j_0 \in \{0, ..., t\}$, such that:

$$\frac{\partial x_t^n}{\partial d_{t-j}} \geq \frac{\partial x_t^{n+1}}{\partial d_{t-j}} \qquad \text{for any } j \in \{0, ..., j_0\}$$

$$\frac{\partial x_t^n}{\partial d_{t-j}} \leq \frac{\partial x_t^{n+1}}{\partial d_{t-j}} \qquad \text{for any } j \in \{j_0, ..., t\}$$

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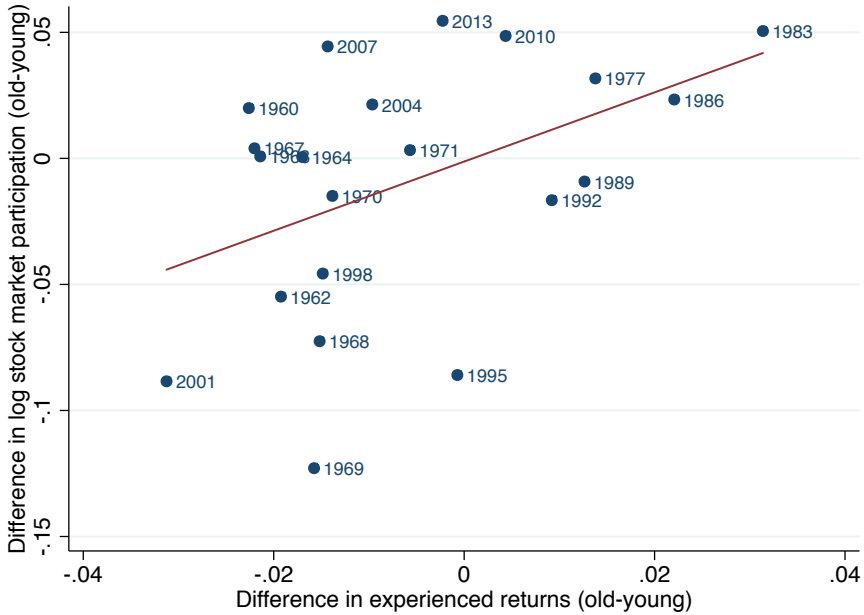
Model Predictions

- Differences in experienced dividends / returns should help predict the cross-section of stock market participation and asset holdings.
- Periods of disagreement should be associated with higher trade volume.
- Return predictability: past dividends should help predict **expected** future returns.
- Economies with more recency bias (e.g. larger fraction of young people in the market), should experience larger price volatility.

Stylized Empirical Facts

Differences in stock return experience & stock-market participation (SCF data)



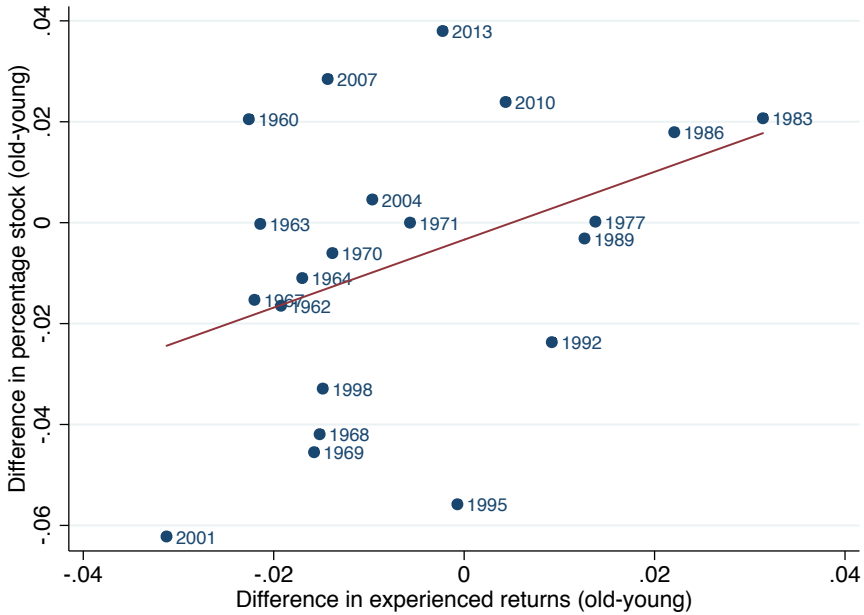
(a) $\lambda = 1$

(b) $\lambda = 3$

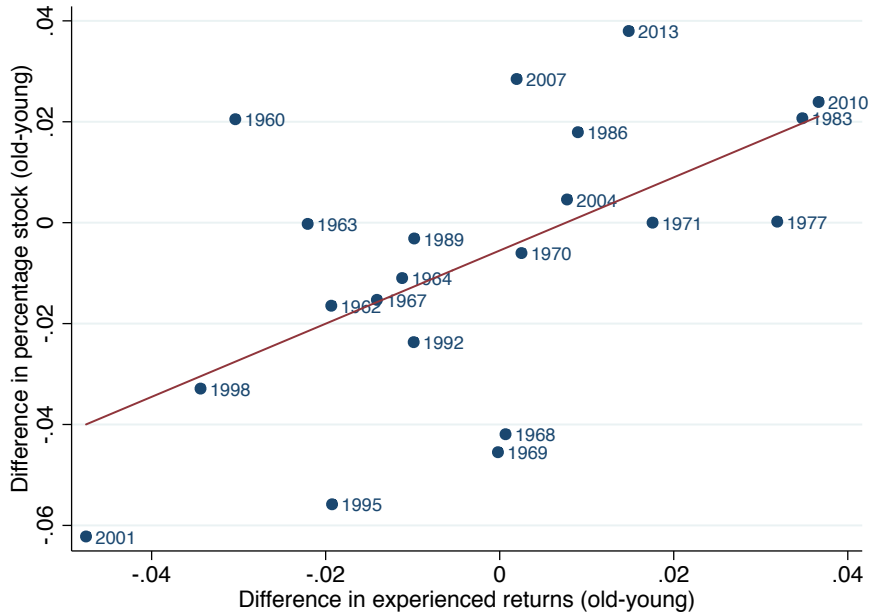
Figure: Experienced Returns and Market Participation

Stylized Empirical Facts

Differences in stock return experience & stock-market exposure (SCF data)



(a) $\lambda = 1$



(b) $\lambda = 3$

Figure: Experienced Returns and Stock Holding

Stylized Empirical Facts

Standard Deviation of Experience and Market Turnover

(a) MA with 1 Lag (b) MA with 3 Lags (c) MA with 5 Lags

Figure: Turnover Ratio and Disagreement in Experienced Returns

Figure: The dashed line depicts the turnover ratio from its trend. The solid line shows the standard deviation of experienced stock returns for a given year. The turnover ratio is smoothed by taking the moving average with 1, 3 and 5 lags.

Implications

- Economists and policy-makers have long wrestled with the **long-lasting effects of financial crises and other macroeconomic shocks**.
  - For Great Depression, Friedman and Schwartz (1963): experience of that time created a "**mood of pessimism that for a long time affected markets**."
  - For recent financial crisis, Blanchard (2009): "**The crisis has left deep scars**, which will affect both supply and demand for many years to come."
- Texbook economics: no help if pre-crises conditions re-established.

Implications

- Existing approaches: crisis-induced reduction in *aggregate investment* and effect on capital formation (including human capital)
  - Secular stagnation (first raised by Hansen (1939) who conjectured a protracted period of low growth following the Great Depression; in current context, e.g., Summers 2014a, 2014b)
  - Hysteresis effects (term first raised in Blanchard and Summers (1986) to characterize the high and rising unemployment in Europe; in current context Delong and Summers (2012))
- Experience effect: **Micro-level source of aggregate fluctuations**

Implications

- Experience effects provide a framework to explain how states of the economy (e.g. booms/recessions/crises) can have long-lasting effects in financial markets by shaping agents' beliefs.

  ➔ Formalization of Friedman and Schwartz's view.

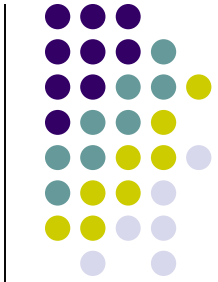
- Link between demographics and portfolio choices; e.g., when do young invest more in risky assets?
- Persistent intergenerational differences: impact on trade volume, price autocorrelation and volatility.
- Link between demand of risky assets (or more broadly, participation on stocks), demographics/life cycle, and state of the economy.

Potential for De-biasing

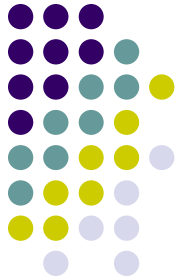
- **For individuals** (revert earlier to investment that truly matches their risk attitudes; realize earlier that they have biased beliefs about the risk and returns) → would also benefit **financial institutions** (profits from investors not withdrawing funds)
- **For managers** (optimizing corporate decisions)
- **For policy makers?** (Avoid over-reaction to recent crisis, avoid under-reaction to past crises)
  - BUT: incentives? (Re-election probabilities correlated with recent economic "luck" and response to recent economic crises.)

Exploring this possibility requires smart lab and field experiments!

The Big Picture



- **Importance of psychological concepts of risk and risk perception**
  - *Here*: Availability
  - Overconfidence, Illusion of control, Familiarity, …
- **Individual-level implications** (investment, mortgage borrowing, corporate decisions)
- **Aggregate implications** (stock market valuation, inflation)



Thank you!