Windfall Gains and Financial Risk Taking

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Disclaimer

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Question

What is the causal effect of wealth on financial risk taking?
– Briggs, Cesarini, Lindqvist, Östling (2017a,b)

1. What is the effect of a windfall gain on the probability of stock market participation?

2. What is the effect of a windfall gain on the share of risky assets in a household's financial portfolio?

3. What is the effect of a windfall gain on a household's balance sheet?

Why do we care?

- Changes in wealth have been proposed to affect asset prices:
  - Limited stock market participation contributes to high equity premia (e.g. Saito (1995), Basak et al. (1998))
  - Time variation in risk aversion contributes to countercyclicality in risk premia (e.g. Constantinides 1990, Campbell et al. (1999))
- More broadly, precise estimates of the effect of wealth on financial risk taking inform mechanisms behind household financial decisions

Empirical Challenge

1. Wealth shocks are rarely exogenous
2. Wealth is hard to measure accurately

"The ideal experiment would be to exogenously dump a large amount of wealth on a random sample of households and examine the effect ... on their risk-taking behavior"

– Chris Carroll (2002)

Addressing this Challenge

- Sample of Swedish lottery players matched to administrative wealth records
  - $500 million assigned to more than 300,000 individuals, underlying participant pool of $\approx$ 4 million
  - Three distinct lottery subsamples with different selection criteria
  - Institutional features that permit identification of causal effect
  - High quality wealth measures
  - High quality demographic and income measures and no attrition

Empirical Result 1

- What is the causal effect of a wealth shock on the probability of stock market participation?
  - 150K USD causes 12 percentage point **increase** in stock market participation among pre-lottery equity market nonparticipants
  - Even among winners of more than 300K USD, majority pre-lottery equity market nonparticipants do not enter.
- Non-participation of the wealthiest households “is a significant challenge to financial theory” – Campbell (2006)
  - Challenge extends to nonwealthy nonaprticipants as well and is much larger than previously documented

Empirical Result 2

- What is the causal effect of a wealth shock on the share of risky assets in a household's portfolio?
  - 150K USD causes 9 percentage point **decrease** in risky portfolio share among pre-lottery equity market participants
  - Negative effect robust across subpopulations and lotteries
- First paper to find empirical evidence that wealth causes a decrease in risky portfolio share
  - Brunnermeier et al. (2008) wealth causes **no change**
  - Calvet et al. (2009) wealth causes an **increase**
  - Chiappori et al. (2011) wealth causes **no change**
  - Paravisini et al. (2015) wealth causes an **increase**
- However, result is consistent with model featuring non-tradaeble income

Empirical Result 3

- What is the causal effect of a wealth shock on household balance sheets?
  - Windfalls gain cause:
    - Bank accounts to increase initially, but effect diminishes over time
    - No change in real estate holdings
    - Small reductions in outstanding debt
    - Modest increases in equity holdings
    - Large increases in bond holdings

Interpreting Results

- Quantitative lifecycle portfolio choice model comparable to Gomes Michaelides (2005)
- When calibrated to match historical Swedish data, the model
  1. Overpredicts effect of wealth on stock market entry
     - Median entry cost of ≈300K USD needed to match estimated effects
  2. Overpredicts negative effect of wealth on risky portfolio share
     - Non-tradable human capital generates negative effect of wealth on risky portfolio share

Literature

- Non-participation - Mankiw Zeldes (1991), Halliasos Bertaut (1995), Vissing-Jørgensen (2002), Malmendier Nagel (2010), Andersen Nielsen (2011)
- Portfolio share - Brunnermeir Nagel (2008), Calvet Campbell Sodini (2007,2009), Chiappori Paiella (2011), Calvet Sodini (2014)
- Structural portfolio choice models - Samuelson (1969), Merton (1971), Viceira (2001), Gomes Michaelides (2005), Cocco (2005), Cocco Gomes Maenhout (2005), Davis Kubler Willen (2006), Khorunzhina (2013), Fagerang Gottlieb Guiso (2013)
- Behavioral Finance - Guiso Japelli (2002, 2005), Vissing-Jørgensen (2003), Campbell (2006), Calvet Campbell Sodini (2007), Guiso Sapienza Zingales (2008), Grinblatt Keloharju Linnainmaa (2011)

Lottery Data

Kombi

- Subscription lottery run by Swedish Social Democrats
- Selection by political ideology

PLS

- Prize linked savings accounts
- Selection by bank account ownership

TV-Triss

- Scratch-ticket game/TV show
- Selection by lottery ticket purchase

Registry data

- Year-end records of financial variables from 1999-2007
  - $\approx$ 86% of all wealth
  - Stocks
  - Mutual Funds
  - Bonds
  - Bank Accounts
  - Debt
  - Real Assets
- Other demographic covariates, $\mathbf{Z}_{i,-1}$
  - Income
  - Age
  - Gender
  - Education
- All-Year and Post-1999 samples

Sample Description

Table: **Comparing Samples**

	Post-1999		Post-1999 by Lottery		
	Pooled	**Pop**	**PLS**	**Kombi**	**Triss**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Demographic					
Female	.516	.516	.575	.436	.558
Age (years)	56.3	56.3	63.2	62.2	51.9
Household Members (#)	1.97	1.97	1.75	1.81	2.13
Household Income (K USD)	38	37	28	31	43
Married	.519	.525	.518	.483	.543
Retired	.311	.279	.481	.425	.217
Self-Employed	.046	.059	.026	.003	.040
Student	.026	.032	.032	.078	.052
College	.193	.257	.229	.153	.216
Financial					
Net Wealth (K USD)	131	161	220	124	127
Gross Debt (K USD)	54	52	35	37	67
Home Owner	.702	.630	.666	.732	.686
Equity Participant	.591	.558	.682	.625	.560
Risky Share	.536	.586	.525	.549	.573

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Sample Description

Table: **Prize Distribution**

Prize Amount (USD)	**A. All-Year**	**B. Post-1999**
$L_i \leq 1.5K$	293,470	71,211
$1.5K < L_i \leq 15K$	16,020	742
$15K < L_i \leq 75K$	3,348	1,240
$75K < L_i \leq 150K$	232	89
$150K < L_i \leq 300K$	605	298
$300K < L_i$	190	78

Identification

Identification

- Use institutional knowledge of lotteries to construct cells $\mathbf{X}_i$ in which wealth is randomly assigned
- Control for for cell-fixed effects in statistical analyses

Estimating equation

$$Y_{i,s} = L_{i,0} \times \beta_s + \mathbf{Z}_{i,-1} \times \gamma_s + \mathbf{X}_i \times M_s + \eta_{i,s}$$

- $L_{i,0}$: assigned wealth normalized by 1M SEK (150K USD)
- Z_i: controls observed the year before the lottery
- Causal interpretation of β_s: Lottery wealth is randomly assigned conditional on $\mathbf{X}_i$

Identification

Table: Testing for Random Assignment

	All-Year		Post-1999	
	Pooled		Pooled	
	(1)	(2)	(7)	(8)
Fixed Effects	Cells	None	Cells	None
Demographic Controls				
F-stat	.69	11.54	.87	10.01
p	.74	<.001	.56	<.001
Financial Controls				
F-stat	—	—	1.81	12.80
p	—	—	.14	<.001
Demographic+Financial Controls				
F-stat	—	—	1.29	15.20
p	—	—	.22	<.001

Estimating Equation

Identification

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	Pooled		Pooled	
	(1)	(2)	(7)	(8)
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F-stat	—	—	1.81	12.80
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Demographic+Financial Controls				
F-stat	—	—	1.29	15.20
p	—	—	.22	<.001

1 Data and Identification

2 Selected Statistical Analyses

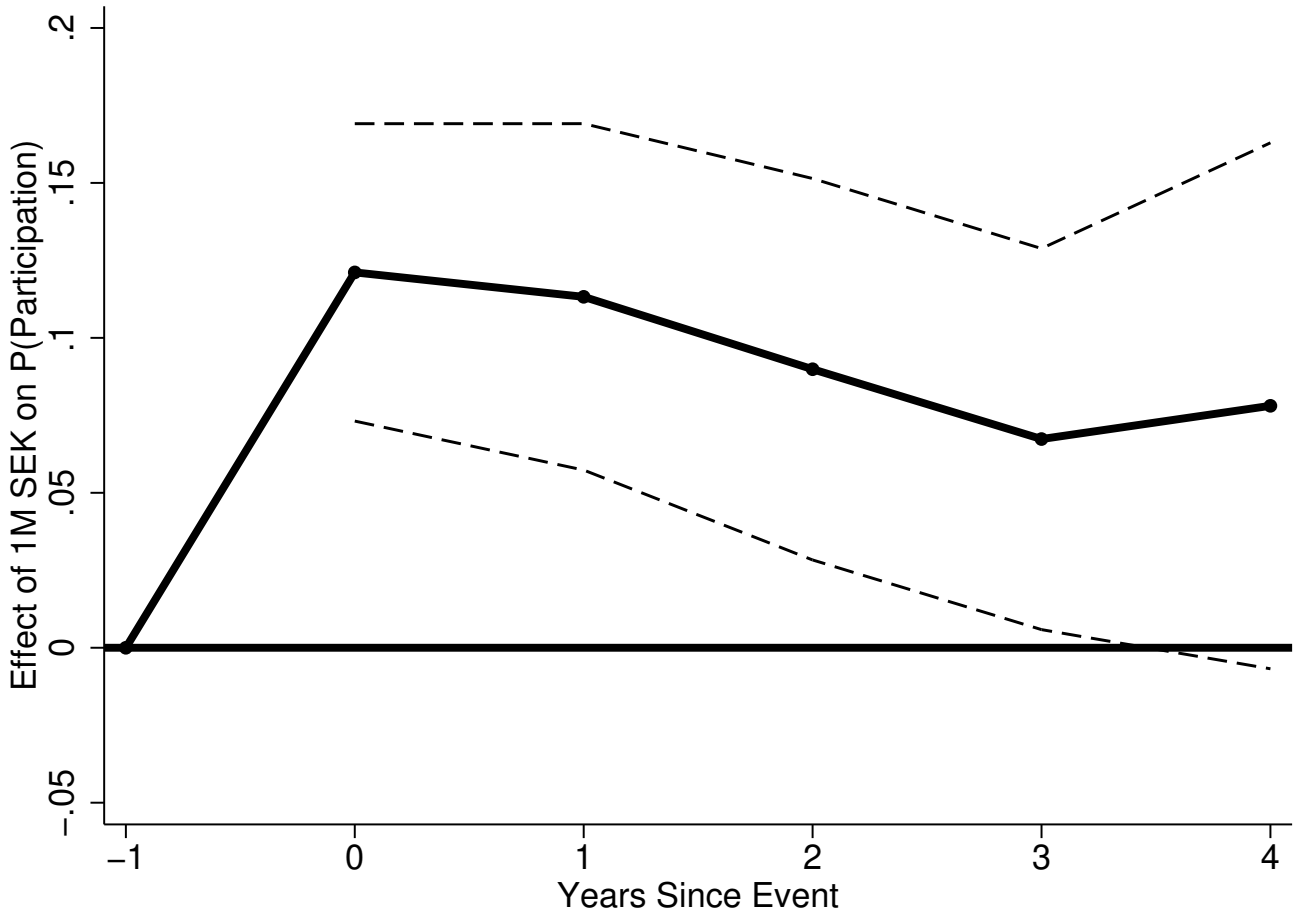
3 Structural Model

Questions

1. Pre-lottery Equity Market Nonparticipants:
   - What is the effect of wealth on participation?
   - Are the effects nonlinear in prize size?
   - How can we interpret these results?
   - Preferences or Beliefs/Information?
2. Pre-lottery Equity Market Participants:
   - What is the effect of wealth on risky portfolio share?
   - Is the effect similar across subamples?
   - How does the effect compare to non-experimental estimates?
   - How can we interpret these results?
3. How are lottery winnings allocated?
   - What do we learn from allocation patterns?

Participation

What is the effect of wealth on equity market participation probability among pre-lottery nonparticipants?



Unconditional

Participation

Are the effects nonlinear in prize size?

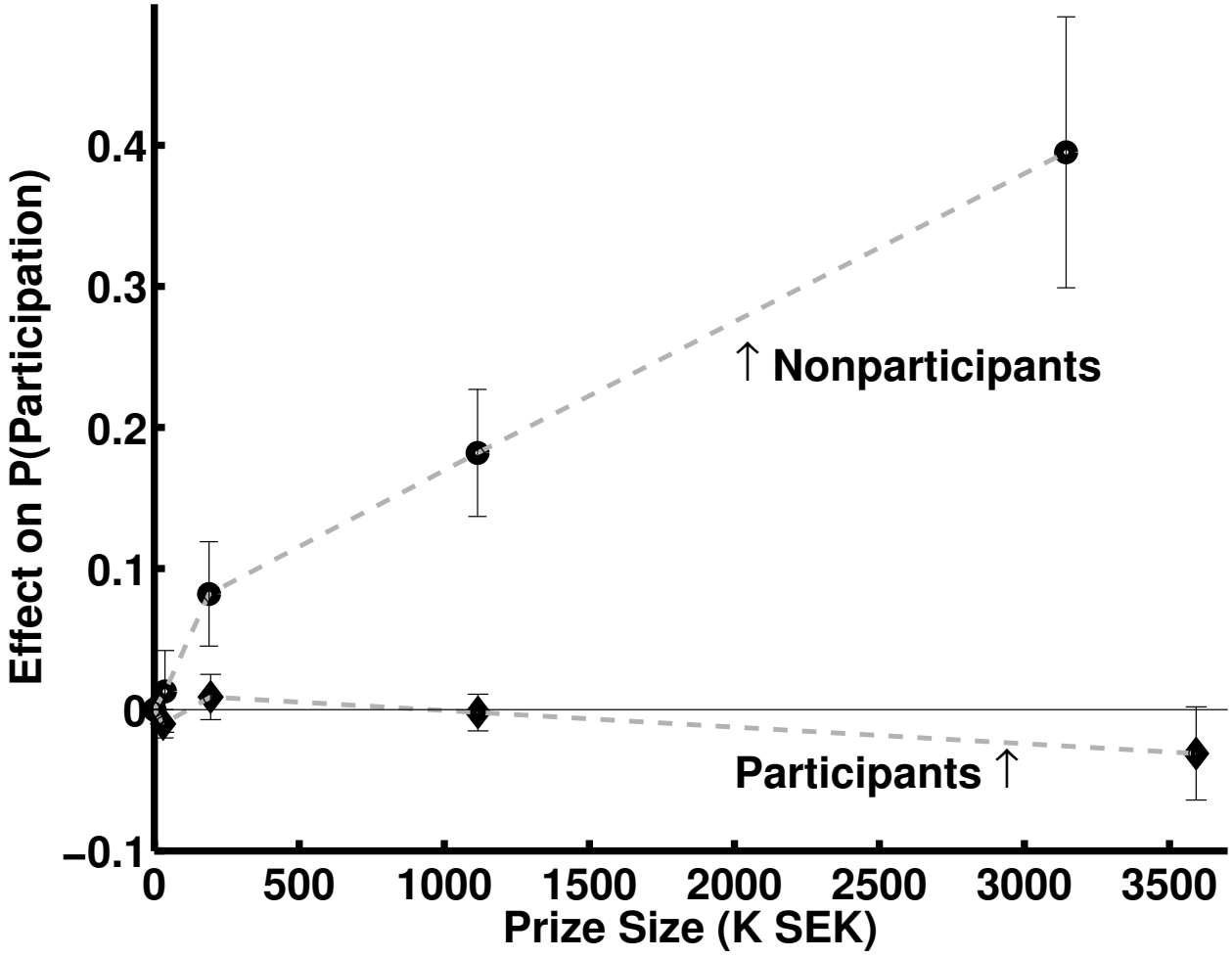


Figure: Categories (in K USD): 0-1.5, 1.5-15, 15-150, 150-300, 300+

Participation

How can we interpret these results?

$$Benefit_{i,t} = W_{i,t} \times RiskyShare_{i,t} \times (r^{ce}_{i,t} - r^{f}_{t})$$

- Calibration (Vissing-Jørgensen (2003))
  - $(r^{ce}_{i,t} - r^{f}_{t}) = .04$
  - $RiskyShare_{i,t} = .59$
- Then $W_{i,t} = 300\text{K USD} \implies Benefit_{i,t} \approx 7,080 \text{ USD}$

Participation

Preferences or Beliefs/Information?

	Gross Debt		Liquidity Share		Net Wealth		Self-Employed		Home Owner	
	=0	>0	Low	High	Low	High	Yes	No	Yes	No
Effect	.212	.094	.116	.134	.137	.066	.133	.035	.105	.144
SE	.036	.026	.033	.042	.029	.034	.026	.025	.027	.051
p	<.001	<.001	.000	.001	<.001	.081	<.001	.348	<.001	.004
N	9763	10150	6838	9147	15113	4780	19237	676	11652	8621
Hetero *p*	.007		.734		.112		.007		.496	

Unshown analyses:

- No effect on structured products rules out loss aversion
- Allocation to asset classes rules out status quo bias

Participation

Preferences or **Beliefs/Information**?

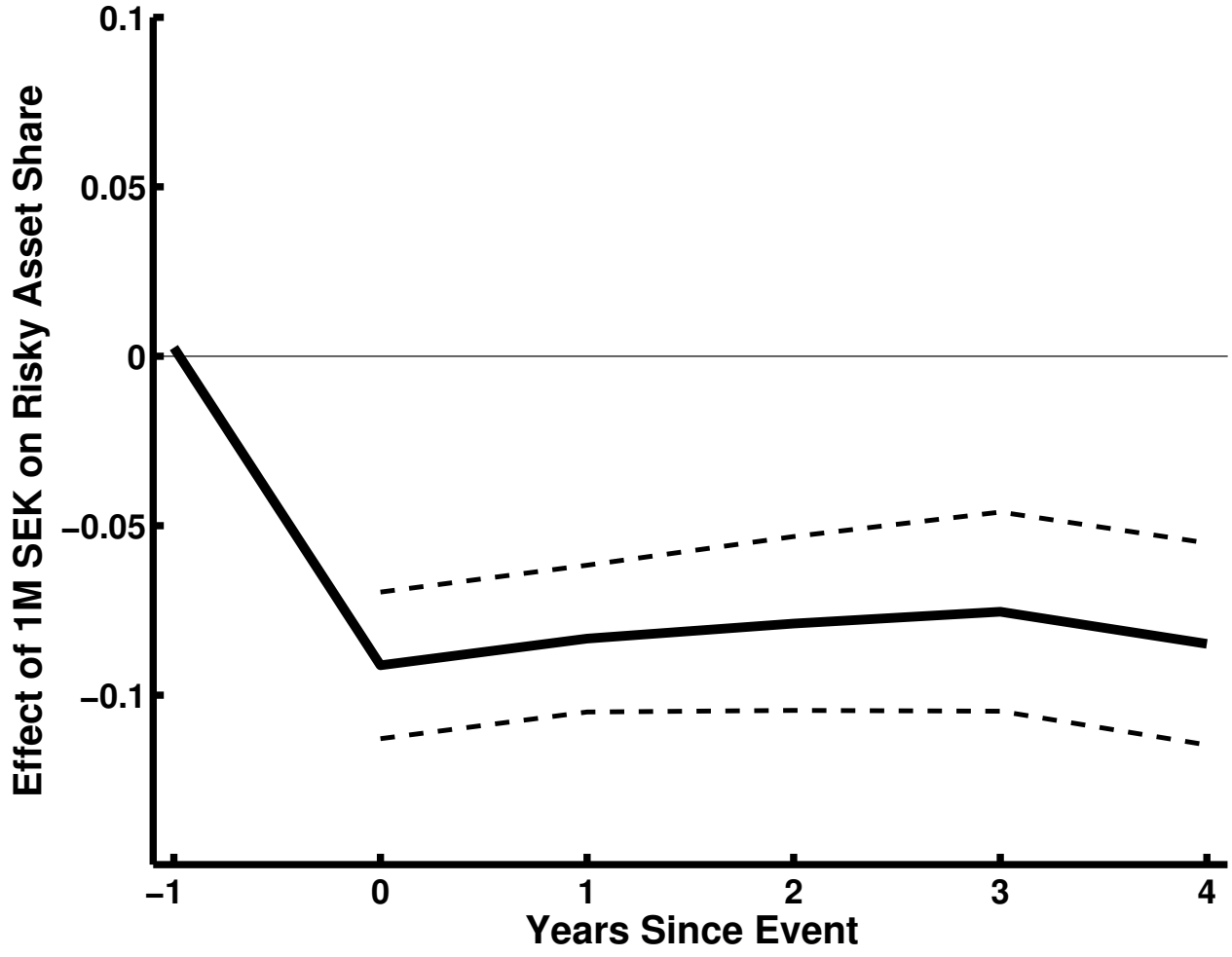
	Equity Returns, Age 18-25		Equity Returns Last Year		Education			Cognitive Skills	
	Low	High	Negative	Positive	Primary	Secondary	Tertiary	Low	High
Effect	.086	.176	.053	.140	.067	.134	.219	.039	.304
SE	.030	.036	.039	.028	.038	.035	.035	.055	.147
p	.004	.000	.167	.000	.077	.000	.001	.476	.038
N	10591	8687	10402	8876	9141	7320	2233	804	957
Hetero *p*	.056		.069			.044/.110		.090	

Unshown analyses:

- Positive effect on subjective equity return beliefs

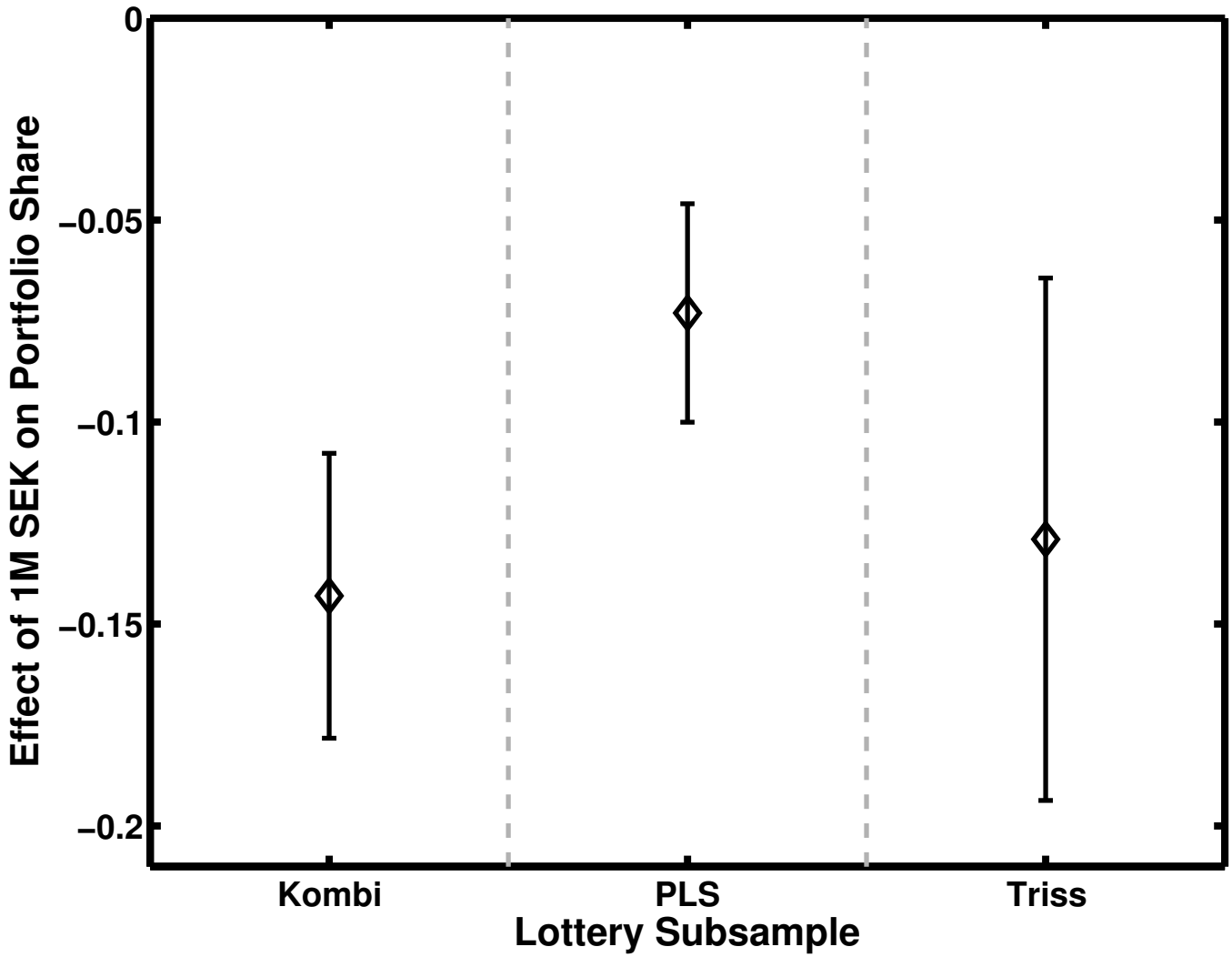
Portfolio Share

What is the effect of wealth on risky portfolio share among pre-lottery equity market participants?



Portfolio Share

Is the effect similar across subamples?



Portfolio Share

How do the estimates compare to non-experimental estimates?

$$\Delta_s \alpha_t = \beta_s \Delta_s w_t + \rho q_{t-s} + \gamma \Delta_s h_t + \epsilon_t$$

	$s = 2$ **Year**		$s = 5$ **Year**	
	OLS	**TSLS**	**OLS**	**TSLS**
	(1)	**(2)**	**(3)**	**(4)**
Full Sample				
Δw_t	-.014	-.025	.003	.045
SE	(.002)	(.069)	(.002)	(.083)
Brunnermeier Nagel (2008)				
Δw_t	.023	-.136	-.013	-.012
SE	(.011)	(.076)	(.009)	(.058)

Portfolio Share

How can we interpret these results?

- Literature:
  - Brunnermeier Nagel (2008) wealth causes no change in portfolio share
  - Calvet et.al. (2009) wealth causes an increase in portfolio share
  - Chiappori Paiella (2011) wealth causes no change in portfolio share
  - Paravisini et.al. (2015) wealth causes an increase in portfolio share
- This study:
  - Change in wealth causes a decrease in portfolio share

Portfolio Share

How can we interpret these results?

$$V(W) = \max_{\alpha} \mathbb{E}\left[U(C)\right]$$
$$s.t. \;\; C = W\left((r - r_f)\alpha + (1 + r_f)\right)$$

If relative risk aversion is constant, then $\alpha^\star = \bar{\alpha}$ independent of wealth.

Portfolio Share

How can we interpret these results?

$$V(W) = \max_{\alpha} \mathbb{E}\left[U(C - X)\right]$$
$$s.t. \;\; C = W\left((r - r_f)\alpha + (1 + r_f)\right)$$

If relative risk aversion is constant, then $\alpha^\star = \bar{\alpha}$ independent of wealth.

Allowing for consumption habit X, the allocation becomes

$$\alpha^\star = \bar{\alpha}\left(1 - \frac{X}{W(1 + r_f)}\right)$$

- Plausible explanation for findings in prior studies.

Portfolio Share

How can we interpret these results?

$$V(W) = \max_{\alpha} \mathbb{E}\left[U(C - X)\right]$$
$$s.t. \;\; C = W\left((r - r_f)\alpha + (1 + r_f)\right) + H$$

If relative risk aversion is constant, then $\alpha^\star = \bar{\alpha}$ independent of wealth.

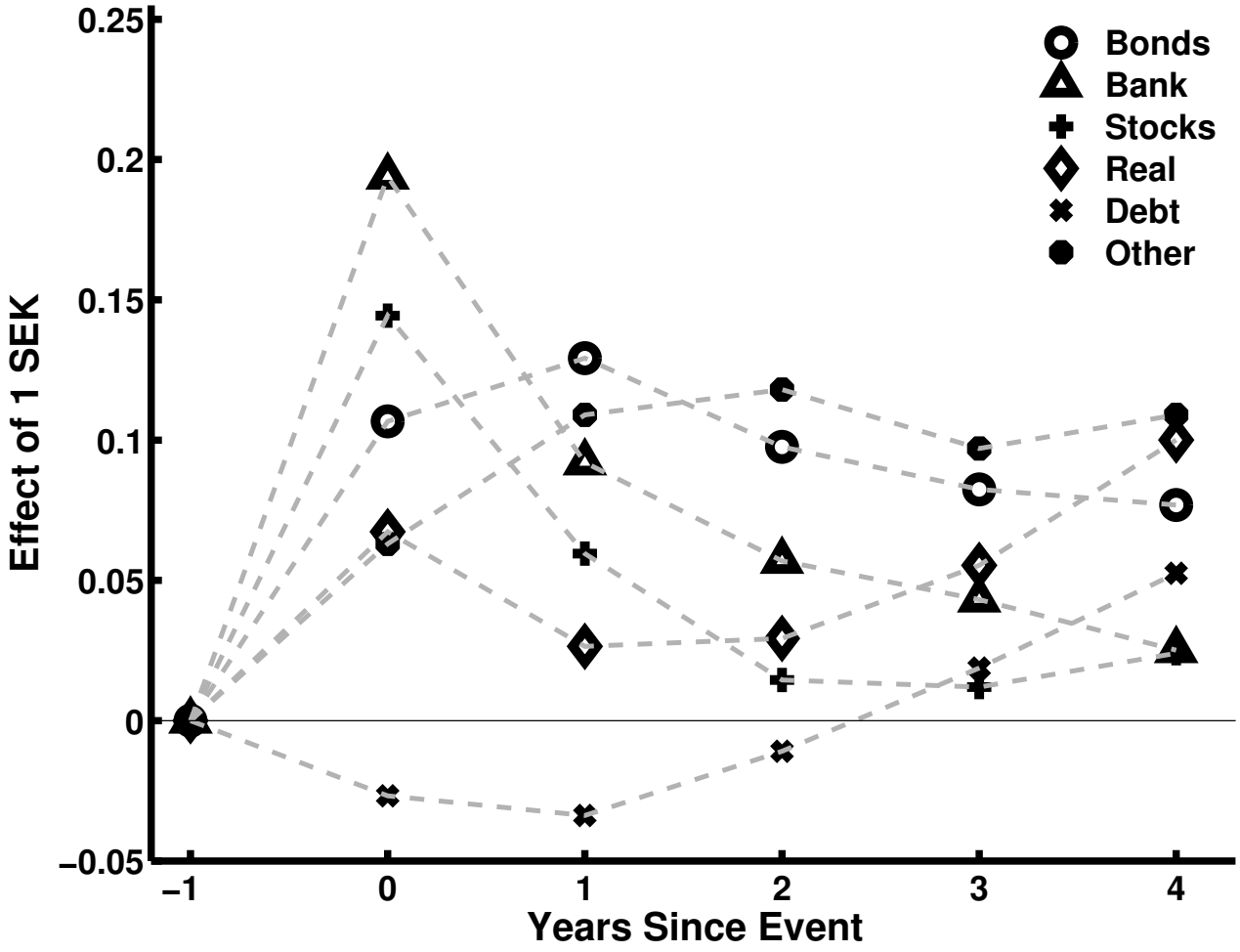
Allowing for habit X and risky labor income H, the allocation becomes

$$\alpha^\star = \left(1 - \frac{X}{W(1 + r_f)} + \frac{H}{W}\right)\left(\bar{\alpha} - \frac{\sigma_{h,r}}{\sigma_r^2}\right) + \frac{\sigma_{h,r}}{\sigma_r^2}\left(1 - \frac{X}{W(1 + r_f)}\right)$$

- Plausible explanation for findings in this study
- Plausible explanation for sensitivity to choice of instrument

Allocation of Windfall Gain

Effect of Wealth on Asset Categories among Pre-lottery Equity Market Nonparticipants



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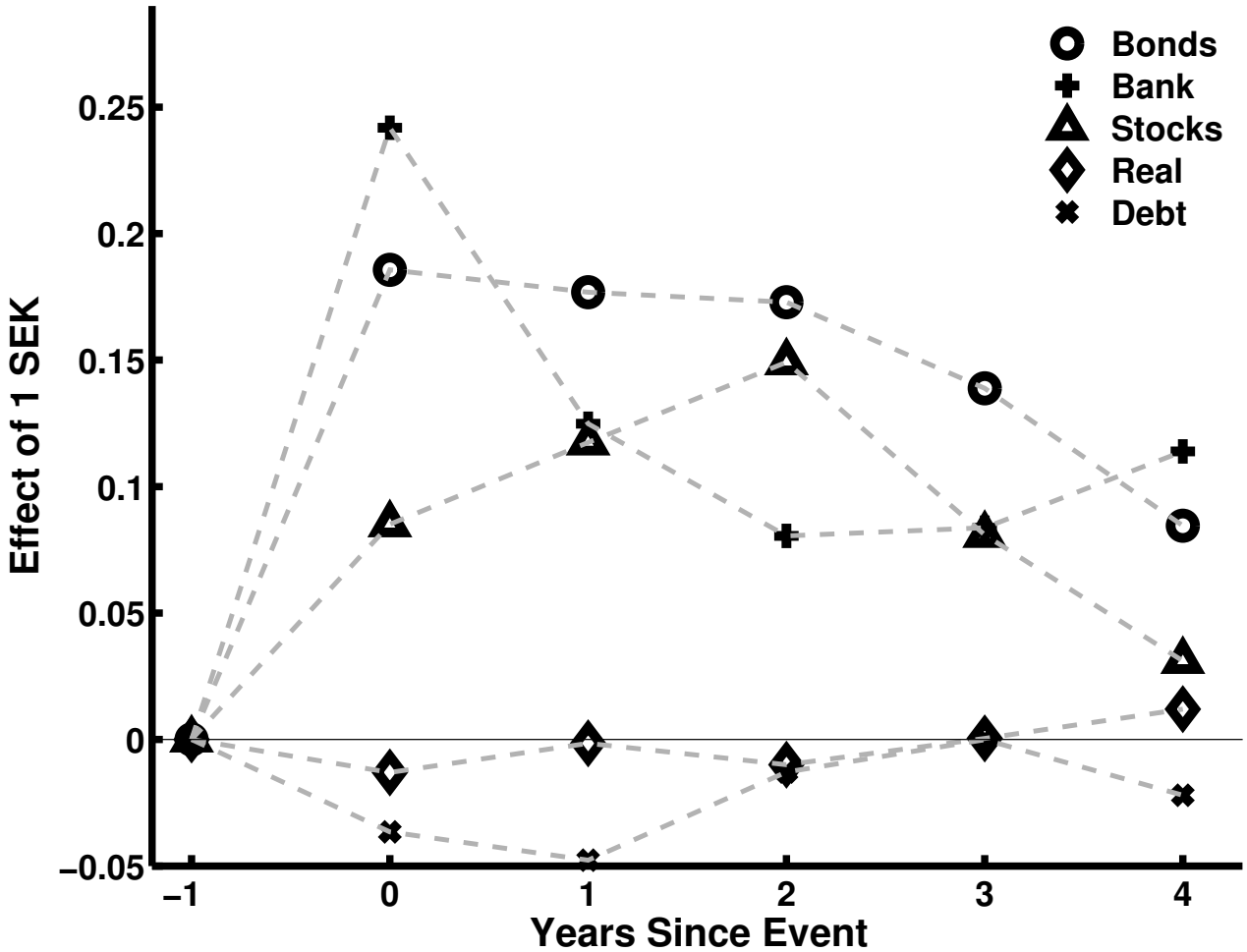

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Structural Model

Can a structural model of lifecycle portfolio choice replicate the effects on stock market participation and portfolio choice?

- Lifecycle portfolio choice model comparable to Gomes Michaelides (2005) (and others)
  - Preferences: Epstein-Zin utility
  - Two assets: risk free and equity
  - Equity returns: lognormal distribution
  - Income: stochastic permanent and transitory component
  - Mortality: age specific survival probability s_t
  - State variables: wealth, permanent income, prior participation
  - Choices: consumption, saving, participation, equity share
  - Costs: one-time entry cost, per-period participation cost

Structural Results

Experiment:

1. Solve model and save policy functions
2. For every member of the lottery data set, simulate windfall gain and subsequent participation and portfolio choices
3. Repeat statistical analysis on simulated data set

Structural Results

Comparison of Model-Predicted Effect of 150K USD to Empirical Estimates.

Effect	Estimate (1)	Baseline (2)	Habit (3)	$\sigma_{n,s} = .15$ (4)	$\rho = 8$ (5)	Lower Eq. Premium (6)
Participation						
Nonparticipants	.121	.253	.231	.209	.223	.178
Portfolio Share						
Participants	-.091	-.123	-.204	-.081	-.143	-.112

Exercise 1

How large would entry costs need to be to match the estimated effect on participation probability?

- Parametrize distribution of equity market entry and participation costs ($\Theta = [\theta_\chi, \theta_\kappa]$)

$$\kappa_i \sim F_{\theta_\kappa}(\kappa)$$
$$\chi_i \sim G_{\theta_\chi}(\chi),$$

- Estimate cost distributions using Method of Indirect Inference

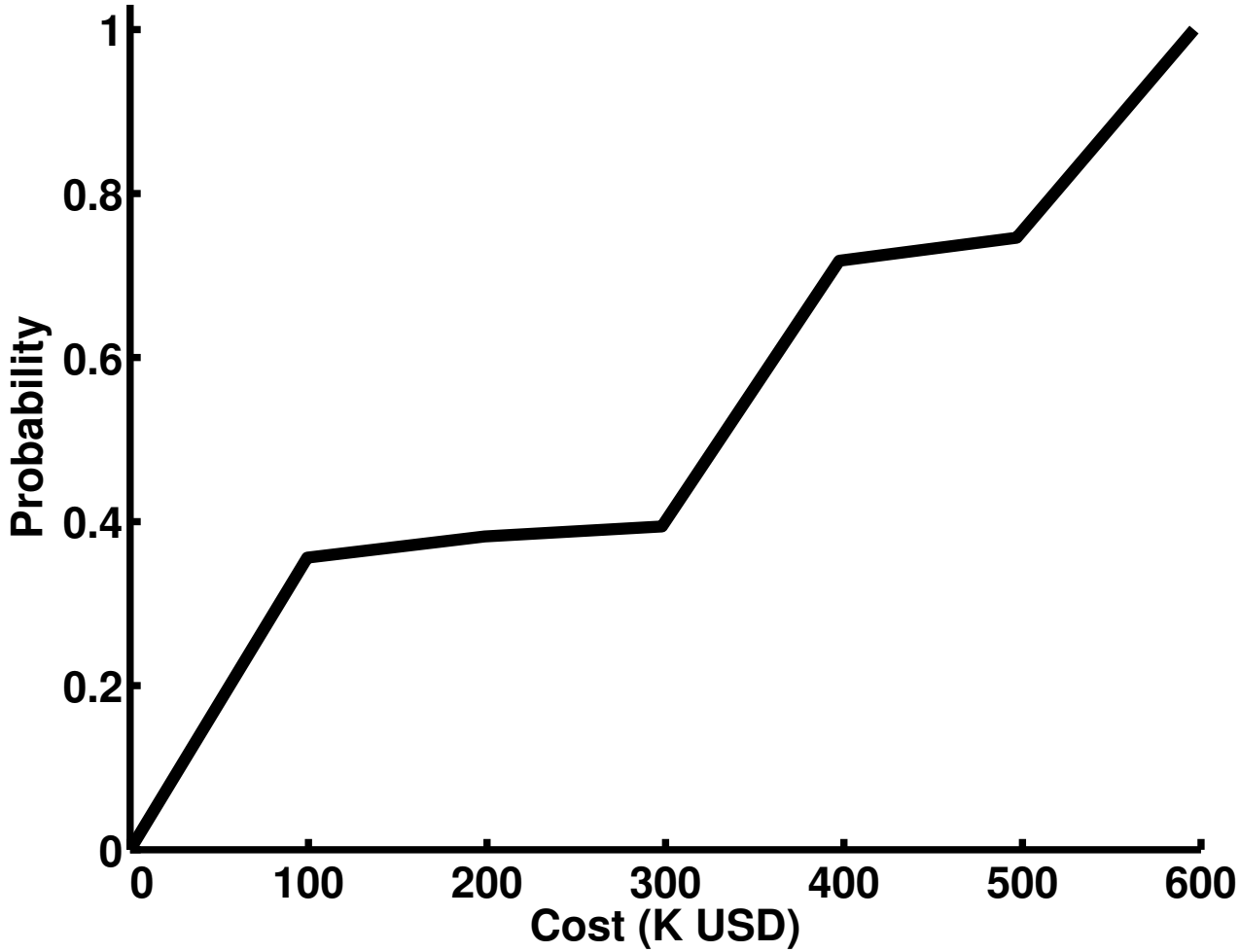
$$\hat{\Theta} = \arg\min_{\Theta}(\hat{\beta} - \tilde{\beta}(\Theta))' W (\hat{\beta} - \tilde{\beta}(\Theta))$$

  - $\hat{\beta}$ - vector of empirical coefficients
  - $\hat{\beta}$ - vector of model implied coefficients

- Additional assumption: $P_t = 1$

Exercise 1

How large would entry costs need to be to match the estimated effect on participation probability?



Exercise 2

What if the windfall gain affects both wealth and income?

- Portfolio share increases in permanent income, decreases in financial wealth
- Experiment: Hold present discounted value of windfall gains constant, but assign half to an increase in P_t
  - Effect on stock market participation: .214
  - Effect on risky asset share: -.017
- More closely replicates findings in other studies.

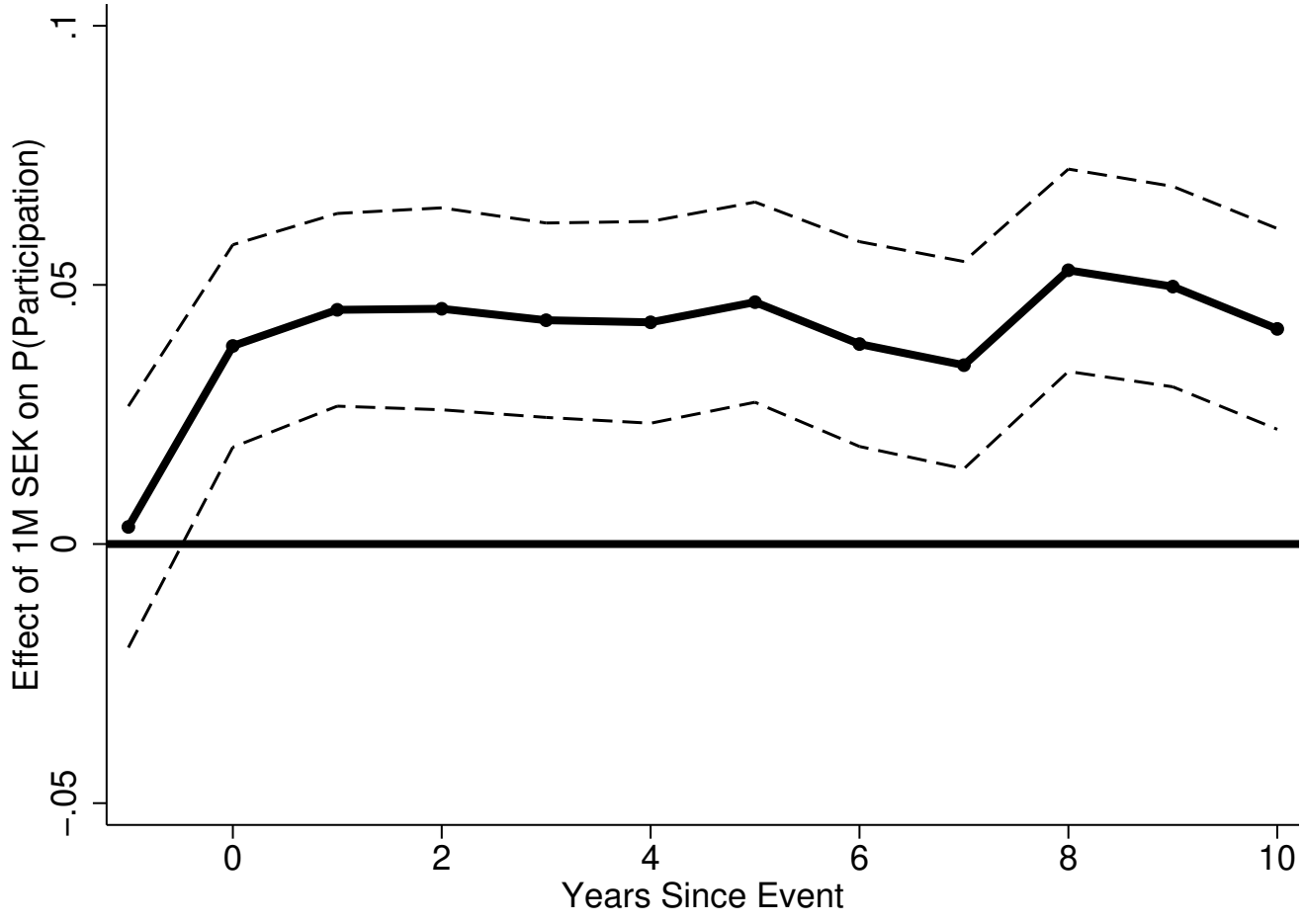
Conclusion

- Exogenous assignment of wealth causes 9 percentage point decrease in risky portfolio share among pre-lottery participants
    - Counterintutitive, but aligns with quantitative predictions of standard model under multiple extensions
- Exogenous assignment of wealth causes 12 percentage point increase in stock market participation probability among pre-lottery nonparticipants
    - Intuitive, but difficult to align with quantitative predictions of standard model, even after introducing multiple extensions
    - Suggestive evidence that education/information/beliefs explain small effects on entry
- Risky asset share can not be interpreted as proxy for risk aversion without carefully controlling for future labor income
- Two types of investors

$$L_{i,0} = X_i \times \Gamma + \mathbf{Z}_{i,-1} \times \rho_{-1} + \epsilon_i$$

Back

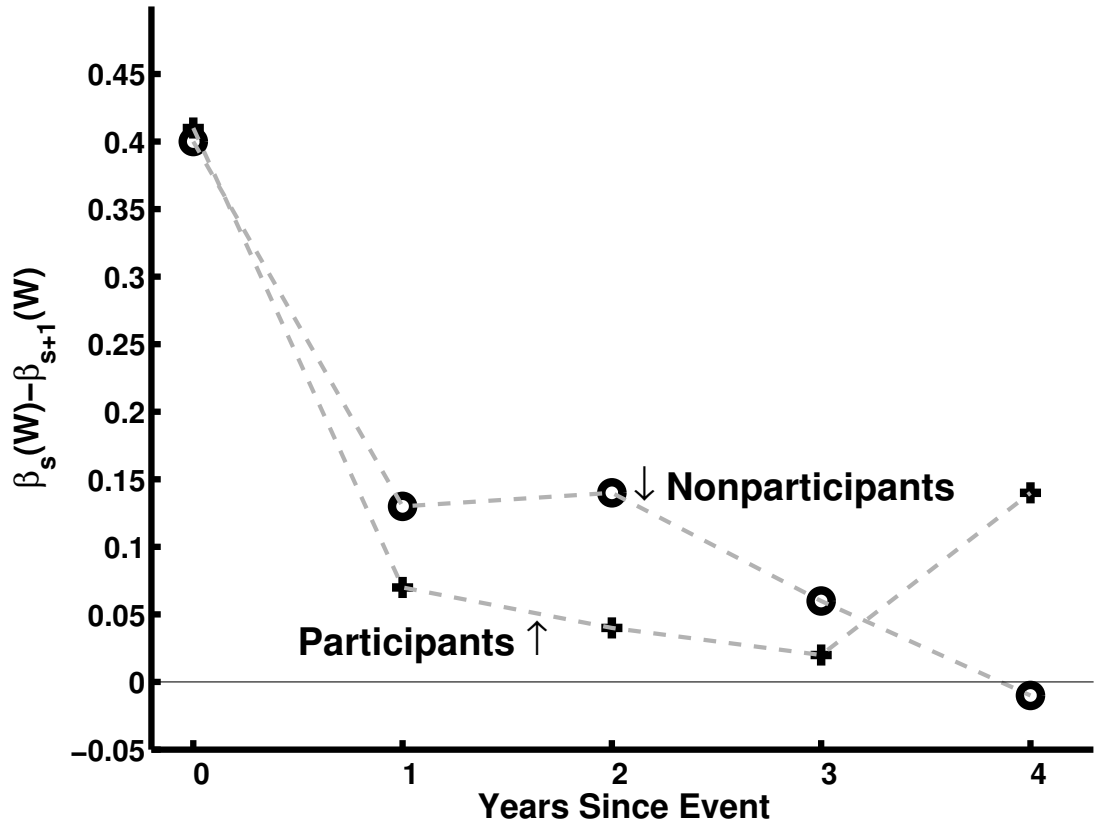
What is the causal effect of wealth on participation probability?



Back

Marginal Propensity to Consume

Upper Bound of MPC from Lottery Wealth**

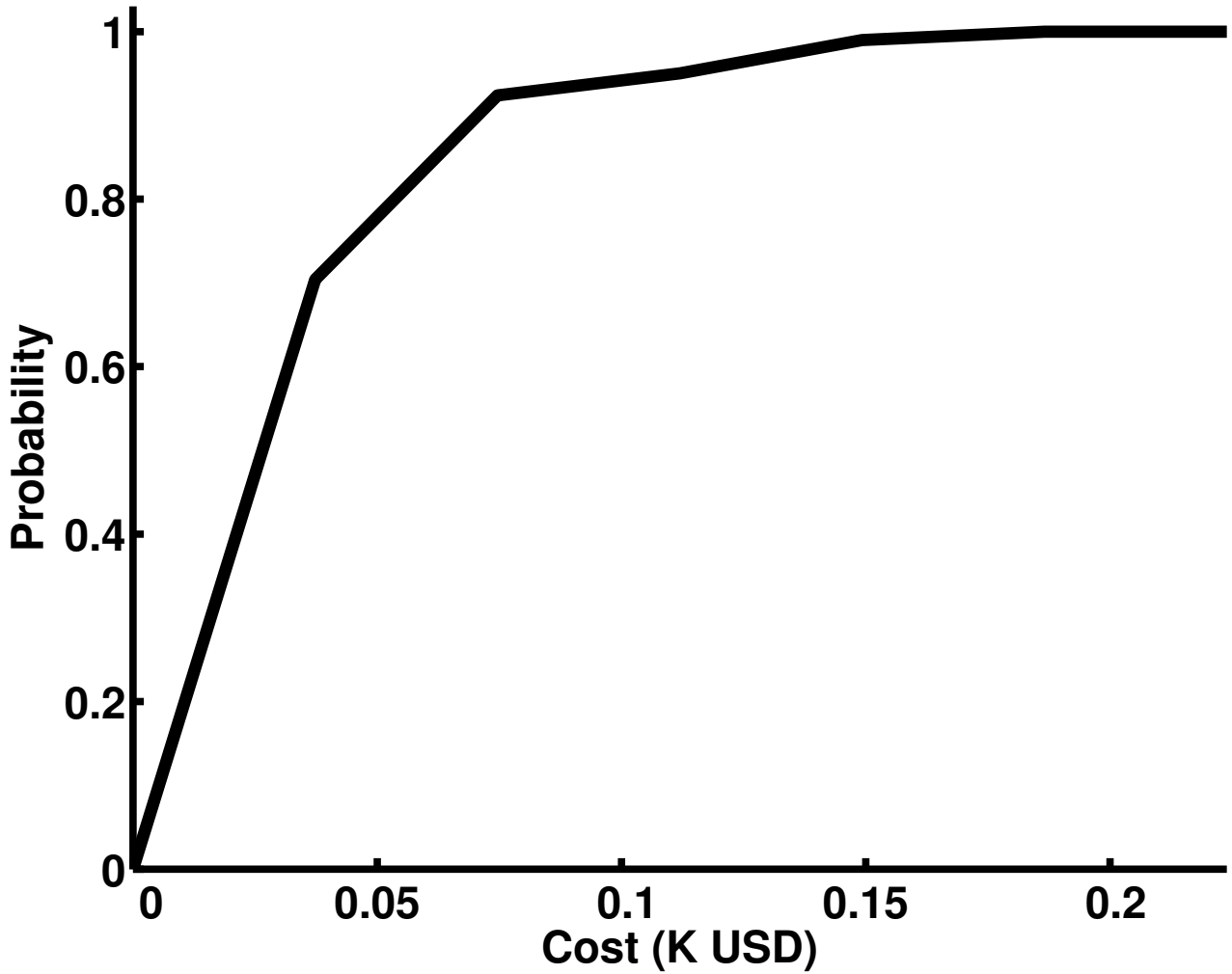


**Important caveat: Wealth measures cover only approximately 86% of total wealth. Furthermore, home improvements, car and other durables, donations, and money transferred to non-spouse family members are not accounted for.

Back

Exercise 1

How large would participation costs need to be to match the estimated effect on participation probability?



Back