Econ 219B
Psychology and Economics: Applications
(Lecture 6)

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Outline

Section 1

Reference Dependence: Golf

Pope and Schweitzer (AER 2011)

- Last example applying the effort framework: golf
- To win golf tournament, only thing that matters is total sum of strokes
- Yet, each hole has a "suggested" number of strokes ("par value")
- That works as a reference point
- **Pope and Schweitzer (AER 2011)**

Is Tiger Woods Loss Averse (Pope & Schweitzer, AER, 2011)

Golf

Start at the tee, end by putting on the green

Total # of strokes determines the winner

Par values of 3, 4, or 5

Eagle, birdie, par, bogey, and double bogey

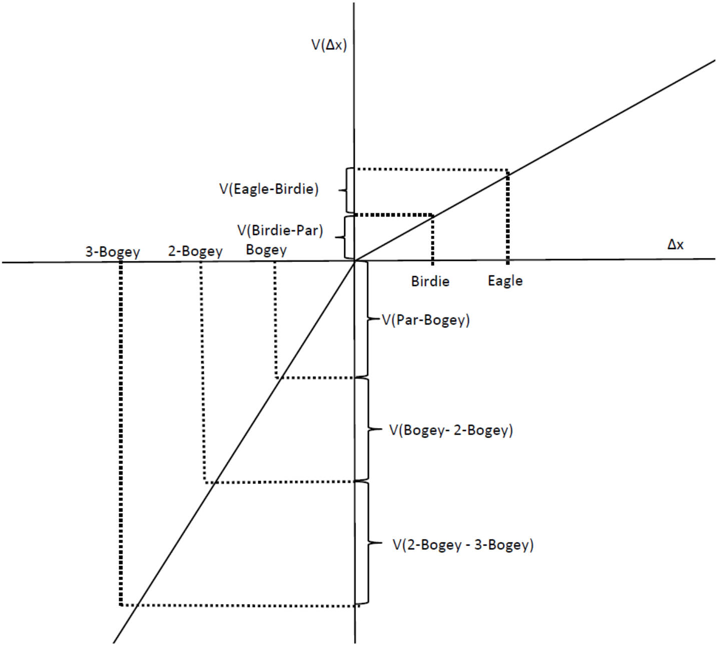
PGA TOUR

40-50 tournaments per/year

~150 golfers per tournament

4 rounds of 18 holes

~$5M total purse – very convex

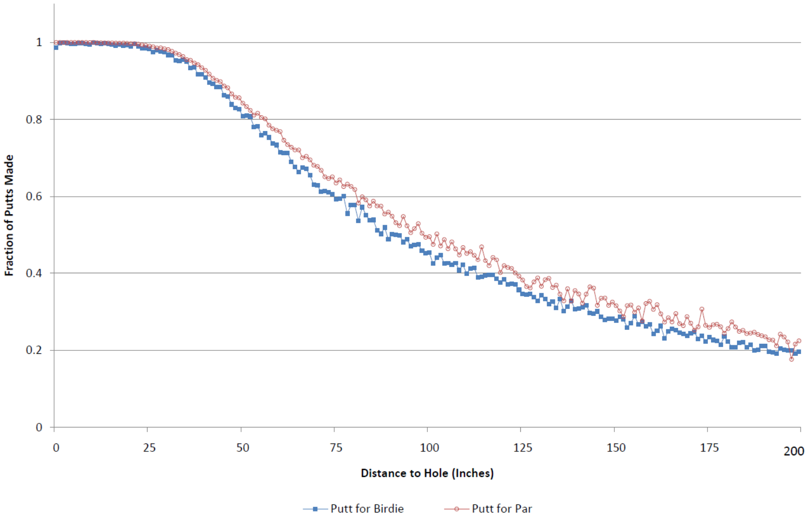


V(Δx)
Δx
V(Eagle-Birdie)
V(Birdie-Par)
3-Bogey
2-Bogey
Bogey
Birdie
Eagle
V(Par-Bogey)
V(Bogey- 2-Bogey)
V(2-Bogey - 3-Bogey)

Data

- PGA Tour ShotLinks data from 2004 to 2009
- 239 Tournaments, 421 golfers (with more than 1,000 putts each), ~2.5 million putts
- X, y, and z coordinates for every ball placement within a centimeter on the green
- Focus on putts attempted for eagle, birdie, par, bogey, or double bogey

"A 10-footer for par feels more important than one for birdie. The reality is, that's ridiculous. I can't explain it in any way other than that it's subconscious. And pars are O.K. – Bogeys aren't." **- Paul Goydos**


Fraction of Putts Made
1
0.8
0.6
0.4
0.2
0
0
25
50
75
100
125
150
175
200
Distance to Hole (Inches)
Putt for Birdie
Putt for Par

	Dependent Variable Equals 1 if Putt was Made Logit Estimation	
	(1)	(2)
Putt for Birdie or Eagle	-.020**	
	(.001)	
Putt for Eagle		-.024**
		(.002)
Putt for Birdie		**-.019****
		(.001)
Putt for Bogey		.009**
		(.001)
Putt for Double Bogey		-.006**
		(.002)
Putt Distance: 7th-Order Polynomial	X	X
Psuedo R-Squared	0.550	0.550
Observations	2,525,161	2,525,161

Section 2

Reference Dependence: Job Search

DellaVigna, Lindner, Reizer, Schmieder (QJE 2017)

- Job Search in Hungary
- Example where identification is not from comparing gains from losses
- Identification comes from
  - how much at a loss relative to reference point
  - reference point adapts over time
  - aim to identify reference point adaptation

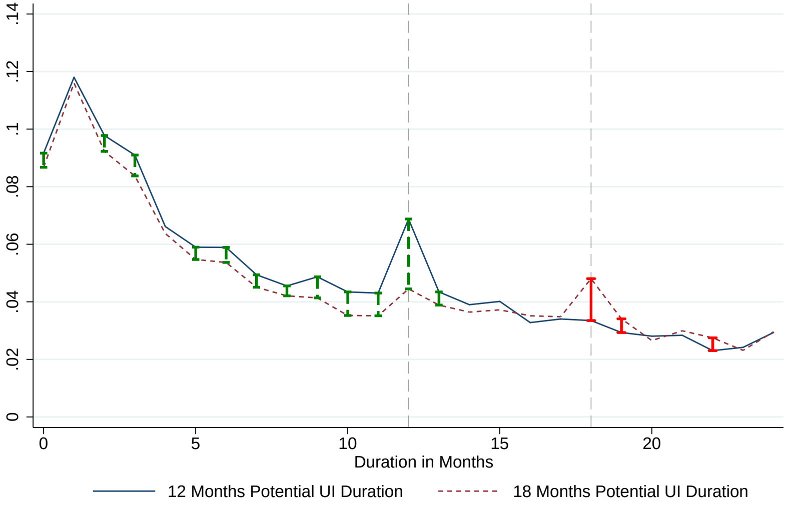
Introduction

- Large literature on understanding path of hazard rate from unemployment with different models.
- **Typical finding**: There is a **spike** in the hazard rate at the **exhaustion point** of unemployment benefits.

⇒ Such a spike is **not easily explained** in the standard (McCall / Mortensen) model of job search.

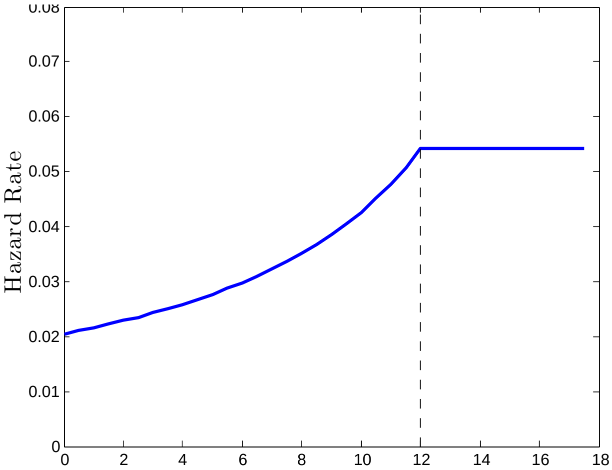
⇒ To explain this path, one needs unobserved heterogeneity of a special kind, and/or storeable offers

Germany - Spike in Exit Hazard



Source: Schmieder, von Wachter, Bender (2012)

Simulation of Standard model



Predicted path of the hazard rate for a standard model with expiration of benefit at period 25

Model - Set-up

- We integrate **reference dependence** into standard McCall / Mortensen **discrete time** model of job search
- Job Search:
    - Search intensity comes at per-period **cost** of $c(s_t)$, which is **increasing** and **convex**
    - With probability s_t, a job is found with salary w
    - Once an individual finds a job the job is kept forever
- Optimal consumption-savings choice
    - Individuals choose optimal consumption c_t (hand-to-mouth $c_t = y_t$ as special case)
- Individuals are **forward looking** and have rational expectations

Utility Function

- Utility function $v(c)$
- **Flow utility** $u_t(c_t|r_t)$ depends on **reference point** r_t:

$$u_t(c_t|r_t) = \begin{cases} v(c_t) + \eta(v(c_t) - v(r_t)) & \text{if} \quad c_t \geq r_t \\ v(c_t) + \eta\lambda(v(c_t) - v(r_t)) & \text{if} \quad c_t < r_t \end{cases}$$

  - η is weight on **gain-loss utility**
  - λ indicates **loss aversion**
  - Standard model is **nested** for $\eta = 0$
- Builds on Kahneman and Tversky (1979) and Kőszegi and Rabin (2006)
  - Note: No probability weighting or diminishing sensitivity

Reference Point

- Unlike in Kőszegi and Rabin (2006), but like in Bowman, Minehart, and Rabin (1999), **reference point is backward-looking**
- The reference point in period t is the **average income** earned over the N periods **preceding period** t and **the period t income:**

$$r_t = \frac{1}{N+1} \sum_{k=t-N}^{t} y_k$$

Key Equations

- An **unemployed** worker's value function is

$$V_t^U(A_t) = \max_{s_t \in [0,1]; A_{t+1}} u\left(c_t | r_t\right) - c\left(s_t\right) + \delta\left[s_t V_{t+1}^E(A_{t+1}) + (1 - s_t)\, V_{t+1}^U(A_{t+1})\right]$$

- Value function when **employed**:

$$V_{t+1}^E(A_{t+1}) = \max_{c_{t+1}} u\left(c_{t+1} | r_{t+1}\right) + \delta V_{t+2}^E(A_{t+2}).$$

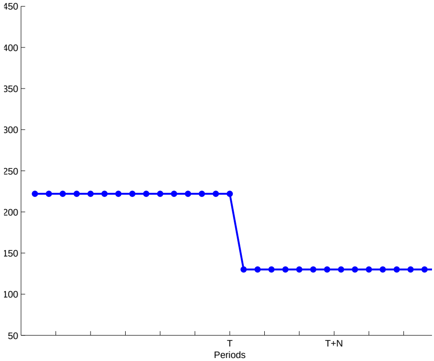
- Solution for **optimal search**:

$$c'\left(s_t^*\right) = \delta\left[V_{t+1}^E\left(A_{t+1}\right) - V_{t+1}^U\left(A_{t+1}\right)\right]$$

- Solve for s_t^* and c_t^* using backward induction

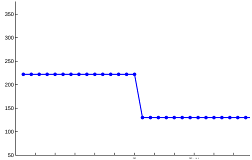
How does the model work?

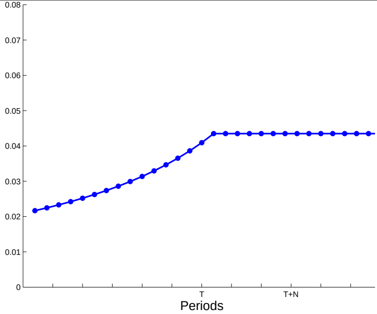
- Consider a **step-wise** benefit schedule



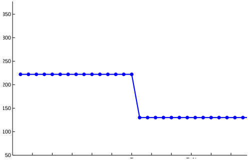
- What are the **predictions** of the **standard** vs. **reference-depedent** model **without heterogeneity**?

Example: Hazards under Two Models

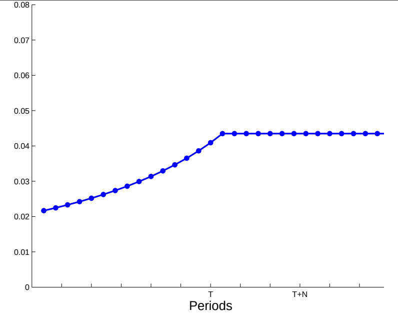


Hazard Rate, Standard Model	Hazard Rate, Ref.-Dep. Model
	

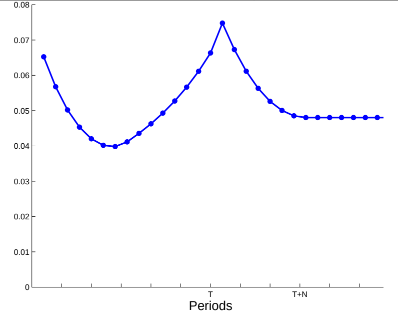
Example: Hazards under Two Models



Hazard Rate, Standard Model

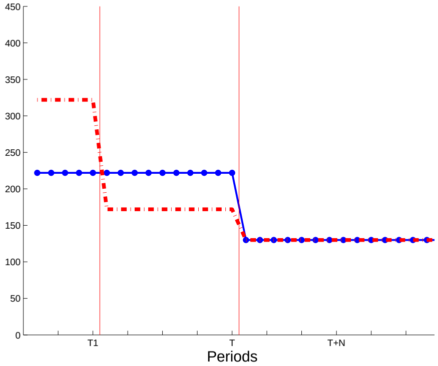


Hazard Rate, Ref.-Dep. Model



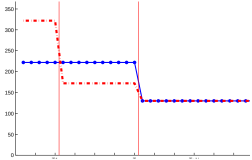
Example: Hazards under Two Models

- Consider the introduction of an additional step-down after T_1 periods, such that total benefits paid until T are identical:

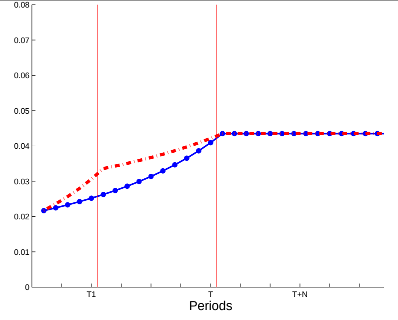


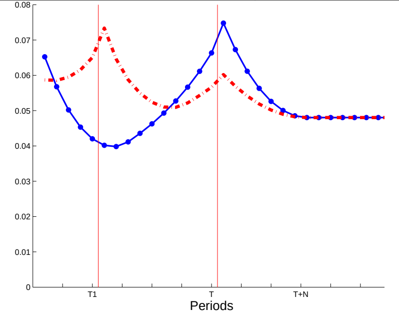
- What are the predictions of the standard vs. ref.-dep. model?

Example: Hazards under Two Models

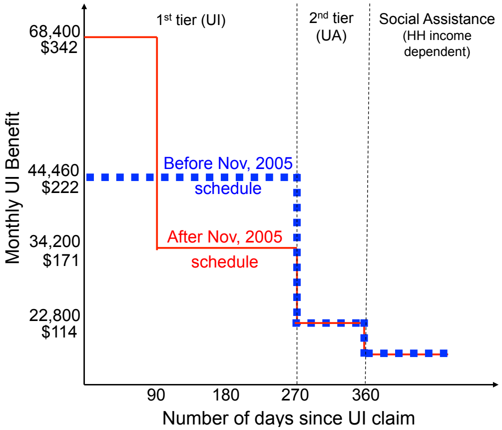


Hazard Rate, Standard Model	Hazard Rate, Ref.-Dep. Model





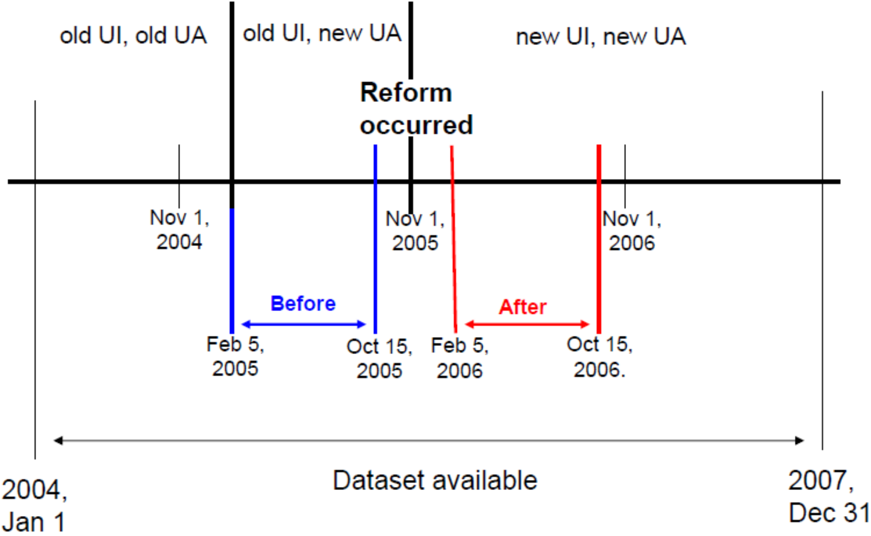
Benefit schedule before and after the reform



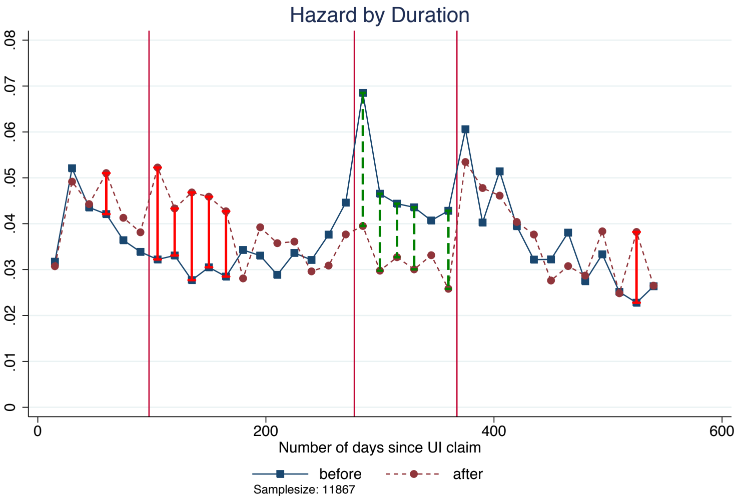
Note: Eligible for 270 days in the first tier, base salary is higher than 114,000HUF ($570), younger than 50.

→ Benefit-Schedule Macro Context Institutional Context

Define before and after

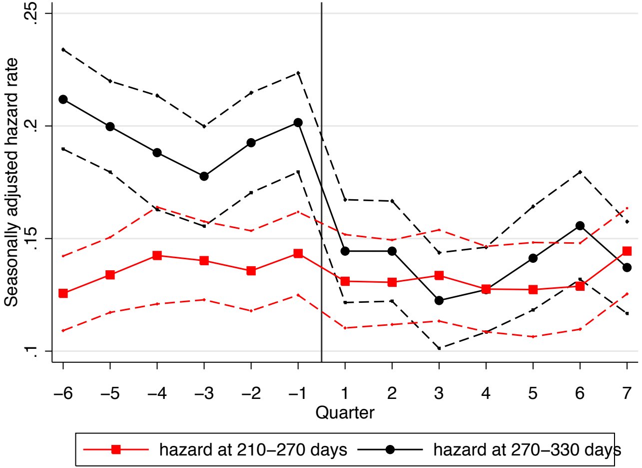


Hazard rates before and after



Survival Rate | Reemployment Wages

Interrupted Time Series Analysis



Before Placebo Test | After Placebo Test

Structural Estimation

- We estimate model using **minimum distance** estimator:

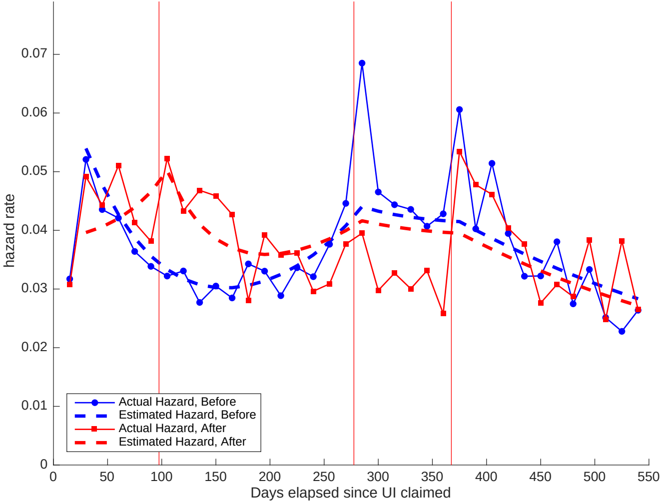
$$\min_{\xi} \left(m\left(\xi\right) - \hat{m}\right)' W \left(m\left(\xi\right) - \hat{m}\right)$$

- $\hat{m}$ - Empirical Moments (without controls)
  - 35 15-day pre-reform hazard rates
  - 35 15-day pre-reform hazard rates
- W is the inverse of diagonal of variance-covariance matrix
- Further assumptions about utility maximization:
  - Log utility: $v(c) = log(c)$
  - Assets $A_0 = 0$, Borrowing limit $L = 0$, Interest rate $R = 1$
  - Cost of effort $c(s) = k_j \frac{s^{1+\gamma}}{1+\gamma}$

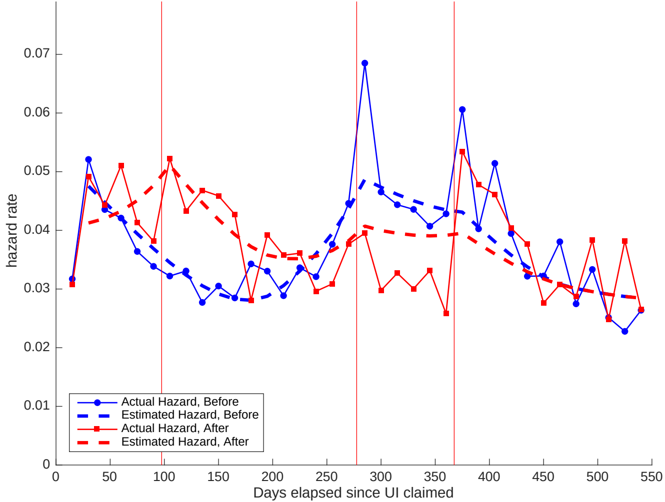
Estimation Method

- Parameters ξ to estimate:
  - λ loss component in utility function
  - N speed of adjustment of reference point
  - 15-day discount factor δ (fixed at $\delta = 0.995$ for hand-to-mouth case)
  - Cost of effort curvature γ
  - Unobserved Heterogeneity: k_h, k_m and k_l cost types, and their proportions (only one type for ref. dep. model)
- Fixed parameters:
  - Gain-loss utility weight $\eta = 0$ (standard model), $\eta = 1$ (ref.-dep. model) Link
  - Reemployment wage fixed at the empirical median Link
- Start with hand-to-mouth estimates ($c_t = y_t$)

Standard Model, 3 types (Hand-to-Mouth)



Ref.-Dep. Model, 1 types (Hand-to-Mouth)



Incorporating Consumption-Savings

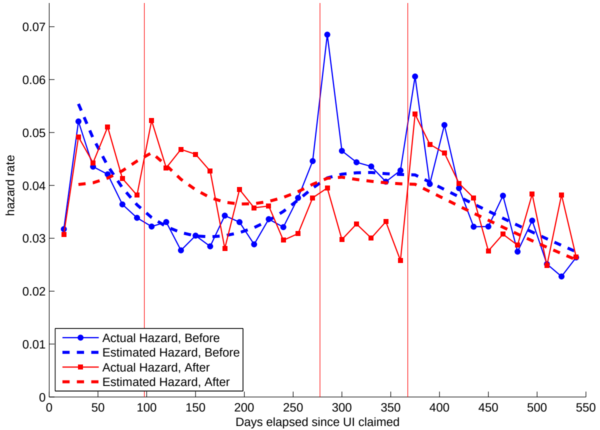
Previous results have key weakness

- Reference-dependent workers are aware of painful loss utility at benefit decrease
- Should save in anticipation
- Ruled out by hand-to-mouth assumption

Introduce optimal consumption:

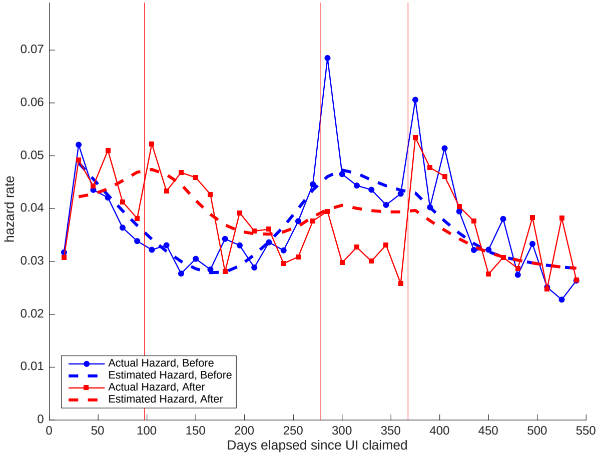
- In each period t individuals choose search effort s_t^* and consumption c_t^*
- Estimate also degree of patience δ and β, δ

Standard model (Optimal Consumption)



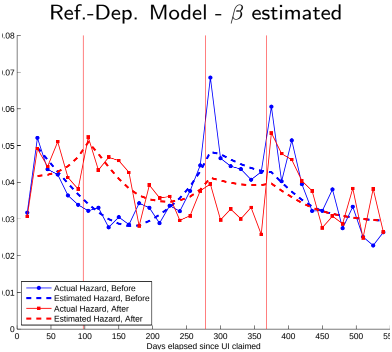
- Standard model with 3 cost types and estimated δ performs no better than with hand-to-mouth assumption

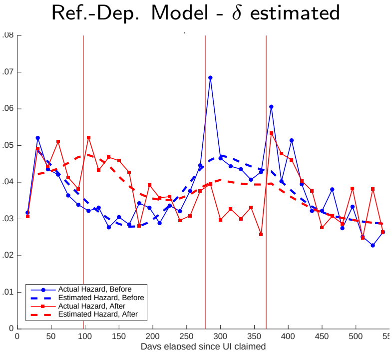
Ref.-Dep. model (Optimal Consumption)



- Reference-dependent model with estimated δ performs well
- BUT: estimated $\delta = .9$ (bi-weekly) – not realistic

Ref.-Dep. model - Discount Factor Estimated





- The reference-dependent model with β, δ performs about equally well - Laibson (1997), O'Donoghue and Rabin (1999), Paserman (2008), Cockx, Ghirelli and van der Linden (2014)
- Estimated $\hat{\beta} = 0.58$ with $\delta = .995$, reasonable
- Noticed: maintained naiveté

Benchmark Estimates (Optimal Consumption)

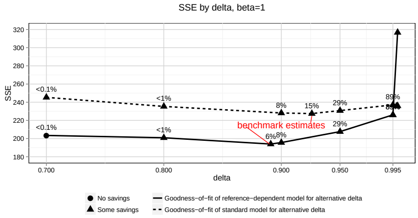
Structural estimation of Standard and Ref.-Dep. models - Optimal Consumption

	(1)	(2)	(3)	(4)
	Standard	RefD.	Standard	RefD.
Discounting:	Delta	Delta	Beta	Beta
Parameters of Utility function				
Utility function $\nu(.)$	log(b)	log(b)	log(b)	log(b)
Loss aversion λ		4.92		4.69
		(0.58)		(0.62)
Gain utility η		1		1
Adjustment speed of reference		184		167.5
point N in days		(11)		(11.2)
δ	0.93	0.89	0.995	0.995
	(0.01)	(0.02)		
	1	1	0.92	0.58
β			(0.01)	(0.19)
Parameters of Search Cost Function				
Elasticity of search cost γ	0.4	0.81	0.07	0.4
	(0.04)	(0.16)	(0.01)	(0.2)
Model Fit				
Goodness of fit	227.5	194.0	229.0	183.5
Number of cost-types	3	1	3	1

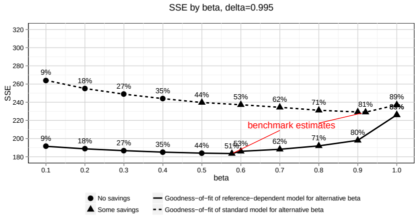
Goodness of fit by Impatience

- Extra dividend of optimal consumption: Estimate patience
  - Unemployed workers estimated to be very impatient
  - Impatience too high in δ model, but realistic with β, δ model
    $\Rightarrow$ Evidence supporting present-bias

Ref.Dep. Model - SSE by (by-weekly)δ



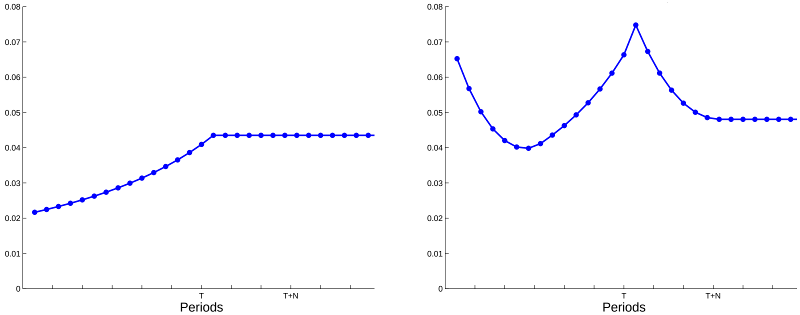
Ref.-Dep. Model - SSE by β



Ongoing Work: Survey

- Key prediction of different models on **search effort**

Search Effort, Standard model Search Effort, Reference Dependence



$\Rightarrow$ Ideally we would have individual level **panel data** on search effort

Ongoing Work: Survey

- Build on Krueger and Mueller (2011, 2014):
  - Large **web based survey** among UI recipients in NJ
  - 5% participation rate
  - No benefit expiration in their sample

Source: Authors' calculations based on the survey data and on administrative data from LWD.

Ongoing Work: Survey

- Conduct SMS-based survey in 2017 in Germany with IAB
- Twice-a-week 'How many hours did you spend on search effort yesterday?'
  - Follow around 10,000 UI recipients over 4 months.
  - Use discontinuity in benefit duration (6/8/10 months) to get control group
  - Examine in particular search effort around benefit expiration
- Advantages of SMS messages:
  - Very easy to reply / low cost to respondent.
  - A lot of control, easy to send reminders etc.

Section 3

Reference Dependence: Full Prospect Theory

Introduction

- Two key features of evidence so far
  1. **Focus not on Risk**
     - Much of the laboratory evidence on prospect theory is on risk taking
     - Field evidence considered so far (mostly) does not directly involve risk
     - House Sale, Merger Offer, Effort
     - Now evidence explicitly on settings with risk: insurance and financial choices
  2. **Focus on Loss Aversion exclusively**
     - Now examine settings where probability weighting plays role
     - Diminishing sensitivity also in finance

Section 4

Reference Dependence: Insurance

Introduction

- **Sydnor (AEJ Applied, 2010)** on deductible choice in the life insurance industry
- Menu Choice as identification strategy as in Del
- laVigna and Malmendier (2006)
- Slides courtesy of Justin Sydnor

Dataset

- 50,000 Homeowners-Insurance Policies
  - 12% were new customers
- Single western state
- One recent year (post 2000)
- Observe
  - Policy characteristics including deductible
    - 1000, 500, 250, 100
  - Full available deductible-premium menu
  - Claims filed and payouts by company

Features of Contracts

- Standard homeowners-insurance policies (no renters, condominiums)
- Contracts differ only by deductible
- Deductible is *per claim*
- No experience rating
  - Though underwriting practices not clear
- Sold through agents
  - Paid commission
  - No “default” deductible
- Regulated state

Summary Statistics

Variable	Full Sample	Chosen Deductible 1000	500	250	100
Insured home value	206,917	266,461	205,026	180,895	164,485
	(91,178)	(127,773)	(81,834)	(65,089)	(53,808)
Number of years insured by the company	8.4	5.1	5.8	13.5	12.8
	(7.1)	(5.6)	(5.2)	(7.0)	(6.7)
Average age of H.H. members	53.7	50.1	50.5	59.8	66.6
	(15.8)	(14.5)	(14.9)	(15.9)	(15.5)
Number of paid claims in sample year (claim rate)	0.042	0.025	0.043	0.049	0.047
	(0.22)	(0.17)	(0.22)	(0.23)	(0.21)
Yearly premium paid	719.80	798.60	715.60	687.19	709.78
	(312.76)	(405.78)	(300.39)	(267.82)	(269.34)
N	49,992	8,525	23,782	17,536	149
Percent of sample	100%	17.05%	47.57%	35.08%	0.30%

* Means with standard errors in parentheses.

Deductible Pricing

- X_i = matrix of policy characteristics
- $f(X_i)$ = "base premium"
  - Approx. linear in home value
- Premium for deductible D
  - $P_i^D = \delta_D f(X_i)$
- Premium differences
  - $\Delta P_i = \Delta\delta f(X_i)$
- $\Rightarrow$Premium differences depend on base premiums (insured home value).

Premium-Deductible Menu

Available Deductible	Full Sample
1000	$615.82 (292.59)
500	+99.91 (45.82)
250	+86.59 (39.71)
100	+133.22 (61.09)

* Means with standard deviations in parentheses

Risk Neutral Claim Rates?

100/500 = 20%

87/250 = 35%

133/150 = 89%

Potential Savings with 1000 Ded

Claim rate?

Value of lower deductible?

Additional premium?

Potential savings?

Chosen Deductible	Number of claims per policy	Increase in out-of-pocket payments *per claim* with a \$1000 deductible	Increase in out-of-pocket payments *per policy* with a \$1000 deductible	Reduction in yearly premium per policy with \$1000 deductible	Savings per policy with \$1000 deductible
\$500	0.043	469.86	19.93	99.85	79.93
N=23,782 (47.6%)	(.0014)	(2.91)	(0.67)	(0.26)	(0.71)
\$250	0.049	651.61	31.98	158.93	126.95
N=17,536 (35.1%)	(.0018)	(6.59)	(1.20)	(0.45)	(1.28)

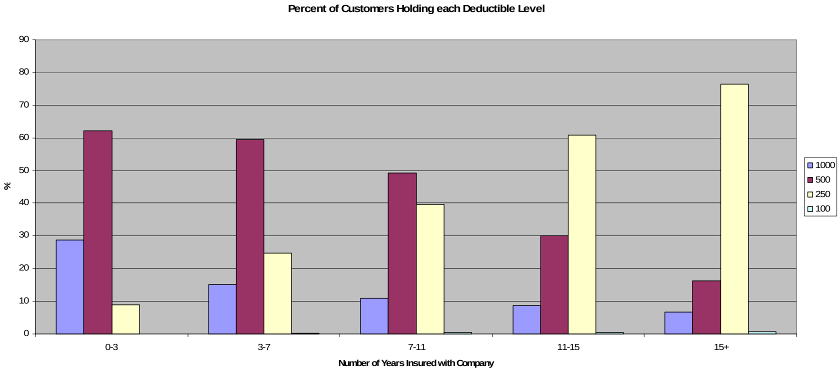
Average forgone expected savings for all low-deductible customers: \$99.88

* Means with standard errors in parentheses

Back of the Envelope

- BOE 1: Buy house at 30, retire at 65, 3% interest rate ⇒ \$6,300 expected
  - With 5% Poisson claim rate, only 0.06% chance of losing money
- BOE 2: (Very partial equilibrium) 80% of 60 million homeowners could expect to save \$100 a year with “high” deductibles ⇒ \$4.8 billion per year

Consumer Inertia?



Look Only at New Customers

Chosen Deductible	Number of claims per policy	Increase in out-of-pocket payments *per claim* with a $1000 deductible	Increase in out-of-pocket payments *per policy* with a $1000 deductible	Reduction in yearly premium per policy with $1000 deductible	Savings per policy with $1000 deductible
$500	0.037	475.05	17.16	94.53	77.37
N = 3,424 (54.6%)	(.0035)	(7.96)	(1.66)	(0.55)	(1.74)
$250	0.057	641.20	35.68	154.90	119.21
N = 367 (5.9%)	(.0127)	(43.78)	(8.05)	(2.73)	(8.43)

Average forgone expected savings for all low-deductible customers: $81.42

Bounding Risk Aversion

Assume CRRA form for u:

$$u(x) = \frac{x^{(1-\rho)}}{(1-\rho)} \quad \textit{for } \rho \neq 1, \quad \textit{and} \quad u(x) = \ln(x) \ \textit{for } \rho = 1$$

Indifferent between contracts iff:

$$\pi \frac{(w - P_L - D_L)^{(1-\rho)}}{(1-\rho)} + (1-\pi)\frac{(w - P_L)^{(1-\rho)}}{(1-\rho)} = \pi \frac{(w - P_H - D_H)^{(1-\rho)}}{(1-\rho)} + (1-\pi)\frac{(w - P_H)^{(1-\rho)}}{(1-\rho)}$$

Getting the bounds

- Search algorithm at individual level
  - New customers
- Claim rates: Poisson regressions
  - Cap at 5 possible claims for the year
- Lifetime wealth:
  - Conservative: $1 million (40 years at $25k)
  - More conservative: Insured Home Value

CRRA Bounds

Chosen Deductible	Measure of Lifetime Wealth (W): (Insured Home Value)		
	W	min ρ	max ρ
\$1,000	256,900	- infinity	794
N = 2,474 (39.5%)	{113,565}		(9.242)
\$500	190,317	397	1,055
N = 3,424 (54.6%)	{64,634}	(3.679)	(8.794)
\$250	166,007	780	2,467
N = 367 (5.9%)	{57,613}	(20.380)	(59.130)

Interpreting Magnitude

- 50-50 gamble:
  Lose $1,000/ Gain $10 million
  - 99.8% of low-ded customers would reject
  - Rabin (2000), Rabin & Thaler (2001)
- Labor-supply calibrations, consumption-savings behavior $\Rightarrow \rho < 10$
  - Gourinchas and Parker (2002) -- 0.5 to 1.4
  - Chetty (2005) -- < 2

Prospect Theory

Model of Deductible Choice

- Choice between (P_L, D_L) and (P_H, D_H)
- π = probability of loss
- EU of contract:
  - $U(P,D,\pi) = \pi u(w-P-D) + (1-\pi)u(w-P)$
- PT value:
  - $V(P,D,\pi) = v(-P) + w(\pi)v(-D)$
- Prefer (P_L, D_L) to (P_H, D_H)
  - $v(-P_L) - v(-P_H) < w(\pi)[v(-D_H) - v(-D_L)]$

No loss aversion in buying

- Novemsky and Kahneman (2005) (Also Kahneman, Knetsch & Thaler (1991))
  - Endowment effect experiments
  - Coefficient of loss aversion = 1 for “transaction money”
- Köszegi and Rabin (forthcoming QJE, 2005)
  - Expected payments
- Marginal value of deductible payment > premium payment (2 times)

So we have:

- Prefer (P_L,D_L) to (P_H,D_H):

$$v(-P_L) - v(-P_H) < w(\pi)[v(-D_H) - v(-D_L)]$$

- Which leads to:

$$P_L^\beta - P_H^\beta < w(\pi)\lambda[D_H^\beta - D_L^\beta]$$

- Linear value function:

$$WTP = \Delta P = \boxed{w(\pi)\lambda}\Delta D$$

= 4 to 6 times EV

Parameter values

- Kahneman and Tversky (1992)
  - λ = 2.25
  - β = 0.88
- Weighting function

$$w(\pi) = \frac{\pi^{\gamma}}{(\pi^{\gamma} + (1-\pi)^{\gamma})^{1/\gamma}}$$

  - γ = 0.69

Choices: Observed vs. Model

Chosen Deductible	Predicted Deductible Choice from Prospect Theory NLIB Specification: $\lambda = 2.25$, $\gamma = 0.69$, $\beta = 0.88$				Predicted Deductible Choice from EU(W) CRRA Utility: $\rho = 10$, W = Insured Home Value			
	1000	500	250	100	1000	500	250	100
\$1,000 N = 2,474 (39.5%)	**87.39%**	11.88%	0.73%	0.00%	**100.00%**	0.00%	0.00%	0.00%
\$500 N = 3,424 (54.6%)	18.78%	**59.43%**	21.79%	0.00%	100.00%	**0.00%**	0.00%	0.00%
\$250 N = 367 (5.9%)	3.00%	44.41%	**52.59%**	0.00%	100.00%	0.00%	**0.00%**	0.00%
\$100 N = 3 (0.1%)	33.33%	66.67%	0.00%	**0.00%**	100.00%	0.00%	0.00%	**0.00%**

Alternative Explanations

- Misestimated probabilities
  - ≈ 20% for single-digit CRRA
  - Older (age) new customers just as likely
- Liquidity constraints
- Sales agent effects
  - Hard sell?
  - Not giving menu? ($500?, data patterns)
  - Misleading about claim rates?
- Menu effects

Barseghyan et al. (2013)

Barseghyan, Molinari, O'Donoghue, and Teitelbaum (AER 2013)

- Micro data for same person on 4,170 households for 2005 or 2006 on
  - home insurance
  - auto collision insurance
  - auto comprehensive insurance
- Estimate a model of reference-dependent preferences with Koszegi-Rabin reference points
  - Separate role of loss aversion, curvature of value function, and probability weighting
- Key to identification: variation in probability of claim:
  - home insurance $\rightarrow$ 0.084
  - auto collision insurance $\rightarrow$ 0.069
  - auto comprehensive insurance $\rightarrow$ 0.021

Predicted Claim Probabilities

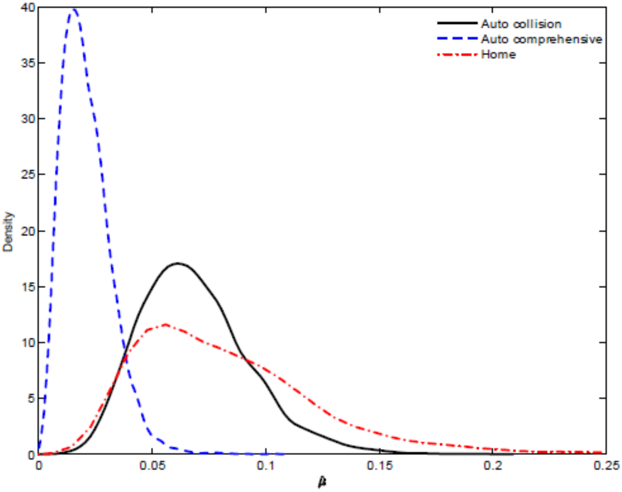


Figure 1: Empirical Density Functions for Predicted Claim Probabilities

Summary

- This allows for better identification of probability weighting function
- Main result: Strong evidence from probability weighting, implausible to obtain with standard risk aversion
- Share of probability weighting function
- With probability weighting, realistic demand for low-deductible insurance
- Follow-up work: distinguish probability weighting from probability distortion

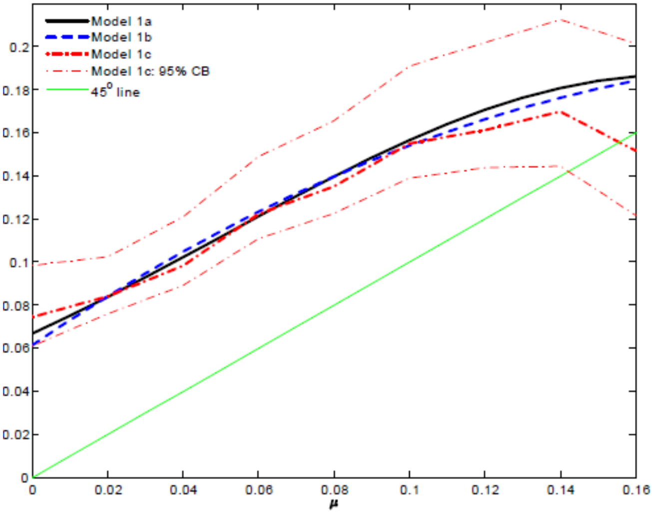


Figure 2: Estimated $\Omega(\mu)$ – Model 1

Table 6: Economic Significance

	(1)	(2)	(3)	(4)	(5)
Standard risk aversion	**r=0**	**r=0.00064**	**r=0**	**r=0.00064**	**r=0.0129**
Probability distortions?	**No**	**No**	**Yes**	**Yes**	**No**
μ	**WTP**	**WTP**	**WTP**	**WTP**	**WTP**
0.020	10.00	14.12	41.73	57.20	33.76
0.050	25.00	34.80	55.60	75.28	75.49
0.075	37.50	51.60	67.30	90.19	104.86
0.100	50.00	68.03	77.95	103.51	130.76
0.125	62.50	84.11	86.41	113.92	154.00

Notes: WTP denotes—for a household with claim rate μ, the utility function in equation (2), and the specified utility parameters—the household's maximum willingness to pay to reduce its deductible from $1000 to $500 when the premium for coverage with a $1000 deductible is $200. Columns (3) and (4) use the probability distortion estimates from Model 1a.

Section 5

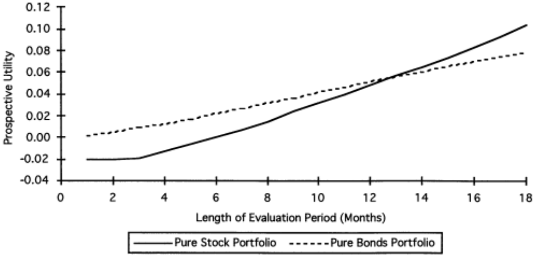
Reference Dependence: Equity Premium

Background

- Equity premium (Mehra and Prescott, 1985)
  - Stocks not so risky
  - Do not covary much with GDP growth
  - BUT equity premium 3.9% over bond returns (US, 1871-1993)
- Need very high risk aversion: $RRA \geq 20$
- **Benartzi and Thaler (QJE 1995)**: Loss aversion + narrow framing solve puzzle
  - Loss aversion from (nominal) losses → Deter from stocks
  - Narrow framing: Evaluate returns from stocks every n months

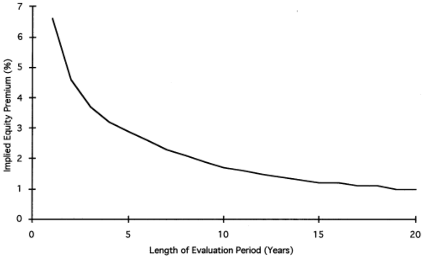
Narrow Framing

- More frequent evaluation $\rightarrow$ Losses more likely $\rightarrow$ Fewer stock holdings
- Calibrate model with λ (loss aversion) 2.25 and full prospect theory specification $\rightarrow$ Horizon n at which investors are indifferent between stocks and bonds



Narrow Framing

- If evaluate every year, indifferent between stocks and bonds
- (Similar results with piecewise linear utility)
- Alternative way to see results: Equity premium implied as function on n



Other Narrow Framing Work

Barberis, Huang, and Santos (QJE 2001)

- Piecewise linear utility, $\lambda = 2.25$
- Narrow framing at aggregate stock level
- Range of implications for asset pricing

Barberis and Huang (2001)

- Narrowly frame at individual stock level (or mutual fund)

Section 6

Reference Points: Forward- vs. Backward-Looking

So Far: Backward-Looking Reference Point

Most papers so far assume assume a backward-looking reference point

- Salient past outcomes
  - Purchase price of home
  - Purchase price of shares
  - Amount withheld in taxes
  - Recent earnings

So Far: Backward-Looking Reference Point

- Status quo
  - Ownership in endowment effect
- Cultural norm
  - 52-week high for mergers
  - Round numbers (as running goals)
  - Number of strokes in a put
- For bunching and shifting test, reference point needs to be
  - Deterministic
  - Clear to the researcher
- For other predictions, such as in job search, exact level less critical

What About Forward-Looking?

- **Koszegi and Rabin** (*QJE* 2006; *AER* 2007): forward-looking reference points
  - Reference point is expectations of future outcomes
  - Reference point is stochastic
  - Solve with Personal Equilibria
- Motivations:
  - Motivation 1: It often makes sense for people to compare outcomes to expectations
  - Motivation 2: Reference point does not need to be assumed
- Evidence so far:
  - Reference point for police arbitration
  - Reference point for watching sports games

Forward-Looking Reference Point

- Drawbacks of forward-looking reference points:
  - Stochastic $\rightarrow$ Lose sharpest tests of reference dependence (bunching and shifting)
  - (Reference point is often taken as expectation, rather than full distribution, to simplify)
  - Often multiplicity of equilibria
- Next, cover papers designed to test reference points as expectations:
  - Endowment effect
  - Effort

Future Research

- Future research: Would be great to see papers with reference point r

$$r = \alpha r_0 + (1 - \alpha) r_f$$

  - r_0 backward-looking / status quo reference point
  - r_f forward-looking reference point
  - What weight on each component?

Section 7

Reference Dependence: Endowment Effect

Plott and Zeiler (AER 2005)

- **Plott and Zeiler (AER 2005)** replicating **Kahneman, Knetsch, and Thaler (JPE 1990)**
  - Half of the subjects are given a mug and asked for WTA
  - Half of the subjects are shown a mug and asked for WTP
  - Finding: $WTA \simeq 2 * WTP$

Table 2: Individual Subject Data and Summary Statistics from KKT Replication

Treatment	Individual Responses (in U.S. dollars)	Mean	Median	Std. Dev.
WTP (n = 29)	0, 0, 0, 0, 0.50, 0.50, 0.50, 0.50, 0.50, 1, 1, 1, 1, 1, 1.50 2, 2, 2, 2, 2, 2.50, 2.50, 2.50, 3, 3, 3.50, 4.50, 5, 5	1.74	1.50	1.46
WTA (n = 29)	0, 1.50, 2, 2, 2.50, 2.50, 3, 3.50, 3.50, 3.50, 3.50, 3.50, 4, 4.50 4.50, 5.50, 5.50, 5.50, 6, 6, 6, 6.50, 7, 7, 7, 7.50, 7.50, 7.50, 8.50	4.72	4.50	2.17

Model

- How do we interpret it? Use reference-dependence in piece-wise linear form
  - Assume only gain-loss utility, and assume piece-wise linear formulation (1)+(3)
  - Two components of utility: utility of owning the object $u(m)$ and (linear) utility of money p
  - Assumption: No loss-aversion over money
  - WTA: Given mug $\rightarrow r = \{mug\}$, so selling mug is a loss
  - WTP: Not given mug $\rightarrow r = \{\varnothing\}$, so getting mug is a gain
  - Assume $u\{\varnothing\} = 0$

This implies:

- WTA: Status-Quo $\sim$ Selling Mug

$$\begin{aligned} u\{mug\} - u\{mug\} &= \lambda\left[u\left\{\varnothing\right\} - u\{mug\}\right] + p_{WTA} \quad \text{or} \\ p_{WTA} &= \lambda u\{mug\} \end{aligned}$$

- WTP: Status-Quo $\sim$ Buying Mug

$$\begin{aligned} u\left\{\varnothing\right\} - u\left\{\varnothing\right\} &= u\{mug\} - u\left\{\varnothing\right\} - p_{WTP} \quad \text{or} \\ p_{WTP} &= u\{mug\} \end{aligned}$$

- It follows that

$$p_{WTA} = \lambda u\{mug\} = \lambda p_{WTP}$$

- If loss-aversion over money,

$$p_{WTA} = \lambda^2 p_{WTP}$$

Results

- Result $WTA \simeq 2 * WTP$ is consistent with loss-aversion $\lambda \simeq 2$
- Plott and Zeiler (*AER* 2005): The result disappears with
  - appropriate training
  - practice rounds
  - incentive-compatible procedure
  - anonymity

Pooled Data	WTP (n = 36)		6.62	6.00	4.20
	WTA (n = 38)		5.56	5.00	3.58

Interpretation 1

- Endowment effect and loss-aversion interpretation are wrong
    - Subjects feel bad selling a 'gift'
    - Not enough training

Interpretation 2

- In Plott-Zeiler (2005) experiment, subjects did *not* perceive the reference point to be the endowment
- Koszegi-Rabin: *Assume* reference point $(.5, \{mug\}; .5, \{\varnothing\})$ in both cases
  - WTA:

$$\left[\begin{array}{c} .5*[u\{mug\}-u\{mug\}] \\ +.5*[u\{mug\}-u\{\varnothing\}] \end{array}\right] = \left[\begin{array}{c} .5*\lambda[u\{\varnothing\}-u\{mug\}] \\ +.5*[u\{\varnothing\}-u\{\varnothing\}] \end{array}\right] + p_{WTA}$$

  - WTP:

$$\left[\begin{array}{c} .5*\lambda[u\{\varnothing\}-u\{mug\}] \\ +.5*[u\{\varnothing\}-u\{\varnothing\}] \end{array}\right] = \left[\begin{array}{c} .5*[u\{mug\}-u\{mug\}] \\ +.5*[u\{mug\}-u\{\varnothing\}] \end{array}\right] - p_{WTP}$$

  - This implies no endowment effect:

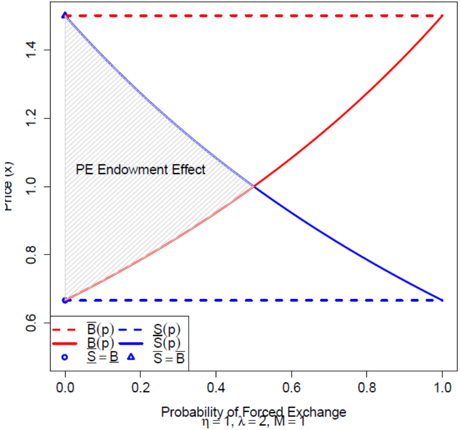
$$p_{WTA} = p_{WTP}$$

Testing Koszegi-Rabin

- Following papers: manipulate probability of exchange to test Koszegi-Rabin
  - **Ericson and Fuster (QJE 2011)**: KR evidence
  - **Heffetz and List (JEEA 2015)**: no KR evidence
- Go over **Goette, Harms, and Sprenger (2016)**
  - Endowment effect in classroom
  - Vary probability p of forced exchange: owner must sell, buyer must buy
  - For probability $p = 0.5$, owner in KR sense is only owner with prob. 0.5, and buyer is owner with $p = 0.5 \rightarrow$ Should be no endowment effect

Prediction

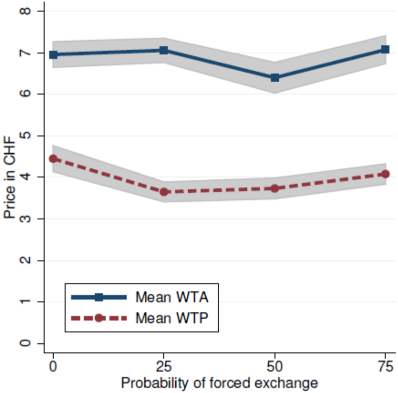
- For $p > 0.5 \rightarrow$ Reverse endowment effect



Results

- What do they find? Mostly, full endowment effect, no KR

Figure 3: Mean Valuations with Forced Exchange



Section 8

Reference Dependence-KR: Effort

Abeler, Falk, Goette, Huffman (AER 2011)

- Return to our earlier real-effort set up
- Individuals put in effort e, with cost $c(e)$
- Value of effort $v(e|r)$ affected by a reference point
- Assume now that the reference point r is a la Koszegi-Rabin
- $\rightarrow$ Evidence that subjects shift effort and bunch at this reference point?
- Design to disentangle forward- versus backward-looking reference points

Design

- Individuals put real effort
  - First training: for 4 minutes count as many zeros in tables as can
  - Then, real task:
    - Decide how long to work, for up to 60 minutes (smart design choice, as higher elasticity of effort than tasks to do in fixed amount of time)
    - With probability 1/2, paid piece rate time effort, $p * e$, $p = .2$
    - With probability 1/2, paid T euros
    - Vary whether $T_{Low} = 3$ or $T_{Hi} = 7$

Standard Model

$$\max_e \frac{T + pe}{2} - c(e)$$
$$-- \quad > \quad e^* = c'^{-1}(p/2)$$

- Solution does not depend on target T

Reference-Dependent Model

Reference-dependent model, with gain-loss utility: Assume reference point is pe with prob. $1/2$, T with prob. $1/2$

- If $pe < T$, utility $v(e|r)$ is (with prob. $1/2$ paid pe, with prob. $1/2$ paid T):

$$
\begin{aligned}
& \frac{T+pe}{2}+\frac{1}{2}\eta\left[\frac{1}{2}(pe-pe)+\frac{1}{2}\lambda(pe-T)\right]+ \\
& +\frac{1}{2}\eta\left[\frac{1}{2}(T-T)+\frac{1}{2}(T-pe)\right] \\
= \; & \frac{T+pe}{2}+\frac{1}{4}\eta(\lambda-1)(pe-T)
\end{aligned}
$$

Reference-Dependent Model

- If $pe > T$, utility is

$$
\begin{aligned}
& \frac{T+pe}{2}+\frac{1}{2}\eta\left[\frac{1}{2}(pe-pe)+\frac{1}{2}(pe-T)\right] \\
& +\frac{1}{2}\eta\left[\frac{1}{2}(T-T)+\frac{1}{2}\lambda(T-pe)\right] \\
= \quad & \frac{T+pe}{2}-\frac{1}{4}\eta(\lambda-1)(pe-T)
\end{aligned}
$$

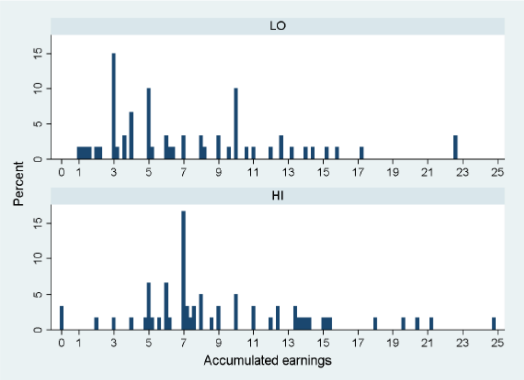
F.O.C. for Effort

- The f.o.c. for effort are

$$\begin{aligned}\frac{p}{2}+\frac{p}{4}\eta(\lambda-1)-c'(e^*) &= 0 \text{ if } pe<T \\ \frac{p}{2}-\frac{p}{4}\eta(\lambda-1)-c'(e^*) &= 0 \text{ if } pe>T\end{aligned}$$

- Thus, should see
  - bunching at T
  - Higher effort for higher T

Results



- KR effect on effort, though smaller than one would expect
- Anchoring can be confound

Gneezy, Goette, Sprenger, Zimmermann (JEEA 2017)

- Focus on possible confound in design of Abeler et al. paper
  - Subject are paid a piece rate with $p = 0.5$ and with $p = 0.5$ are paid T
  - Reference point T is also salient choice
- Remove with alternative design:
  - Subjects are paid \$0 with prob. p
  - Subjects are paid \$14 with prob. q
  - Subjects are paid piece rate with prob. $1 - p - q = 0.5$
- This removes salience-based bunching at T since \$0 or \$14 are not salient points

Gneezy et al. (JEEA 2017)

- (a): Like Abeler et al. but also use ref pt $L = 0$, $L = 14$
- (b): Do stochastic design
- Key result: do not replicate Abeler et al. finding

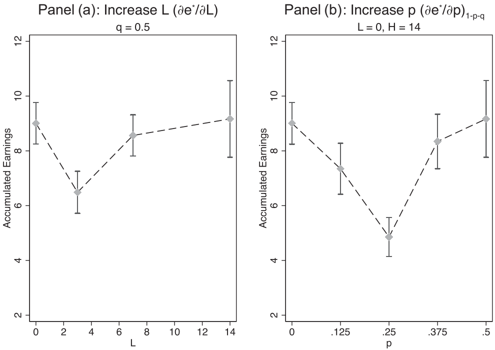


FIGURE 2. Average accumulated earnings across treatments. Standard error bars corresponding to +/− one robust standard error. Panel (a): Average accumulated earnings for each value of L from treatments (0, 0.5, NA, L). Panel (b): Average accumulated earnings for each value of p from treatments (p, q, 14, 0). Observations from subtreatments (0, 0.5, NA, 0) and $(0, 0.5, \text{NA}, 0)_8$ as well

Summary on Reference Points

- Much research remains to be done on reference point determination
  - Not much support for forward-looking reference points
  - Emphasis on backward-looking reference points
  - Can estimate reliable speed of adjustment?
  - Much faster in Thakral and To than in DellaVigna et al.
- Need more designs that ‘reveal’ reference points
  - Use bunching?

Next Lecture

- Social Preferences
  - Wave I: Altruism
  - Wave II: Warm Glow
  - Wave III: Inequity Aversion
  - Wave IV: Social Pressure, Social Signalling, and Social Norms