

Measuring Time Preference and the Elasticity of Intertemporal Substitution with Web Surveys

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Motivation

- Wide range of estimates for these key parameters
- Limitations to existing survey data
- Web surveys enable new formats for intertemporal choice

Behavioral Model of Intertemporal Consumption

$$\Delta \log c = s(r - \rho)$$

- c : consumption,
- r : real interest rate,
- s : elasticity of intertemporal substitution
- ρ : subjective discount rate

Some Previous Estimates

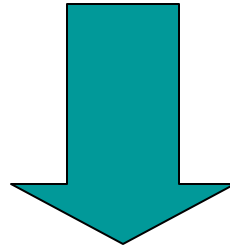
Study	EIS	95% Confidence Interval		Data
	Estimate	Lower	Upper	
Hall (JPE-1988)	-0.40	-0.79	-0.01	1924-40, 1950-83 NIPA
Mulligan (WP-2002)	1.92	0.51	3.33	1931-1997 NIPA
Dynan (AER-1993)	0.10	-1.57	1.77	1985 CEX
Gruber (WP-2006)	2.03	0.47	3.59	1980-2001 CEX

Challenges with standard data

- exogenous variation in interest rates
- treatment of uncertainty, expectations
- measurement error, time aggregation

Research Design

Vary Treatment : r
Observe Response : c_1, c_2



Estimate Parameters : s, ρ

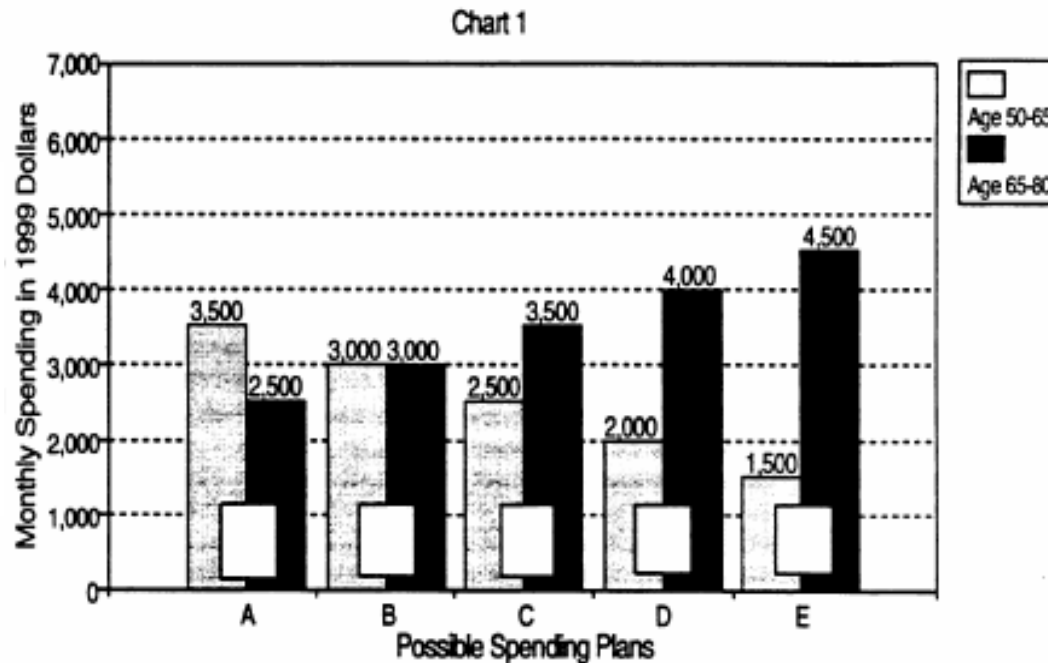
Initial Implementation

Discrete choice: spending before and after retirement in Health and Retirement Study

- 1992 HRS Module
 - Barsky, Kimball, Juster, and Shapiro (QJE 1997)
 - Estimates: $s = 0.18$, $-s \rho = 0.78\%$
- 1999 HRS Mailout
 - Compares to a version in Internet survey
 - Anchoring in discrete choice

Mail Survey

Please put a "1" in the white box of your first choice pattern and a "2" in the white box of your second choice pattern.



- Consumption growth choices: -2.2%, 0%, 2.2%, 4.6%, and 7.3%
- Static format → anchoring, framing effects

Internet Implementation

- Web Graphics to Visualize Intertemporal Trade-offs
- New Continuous Choice and Improved Discrete Choice Versions
- Two Waves of Responses in American Life Panel began in 11/2004 and 8/2006

Outline of Talk

1. Internet Versions
2. Summary Statistics
3. Preference Parameter Estimates
4. Ongoing Analysis

Web Versions

- Discrete Choice
 - Vary Spending Trade-off
- Moveable Bars
 - Vary Spending Trade-off
- Wide Bars
 - Vary Length of Periods

Hypothetical Scenario

Now we have a few questions about your preferences for spending and saving over time. To make the questions comparable for all respondents in the survey, let's suppose that you are now 50 years old, that you will retire when you are 65, and that you will live until you are 80. Further suppose that:

- future health care and nursing home costs are fully covered by insurance,
- there will be no inflation, and
- your income after taxes is guaranteed to be \$3000 each month from age 50 to age 80.

Choose "Next" to continue or "Back" to go back.

Next

Back

Discrete Choice

The next screen shows five possible patterns of monthly spending. In the first situation, increasing spending before retirement by \$100 reduces spending after retirement by \$100. Increasing spending after retirement by \$100 reduces spending before retirement by \$100.

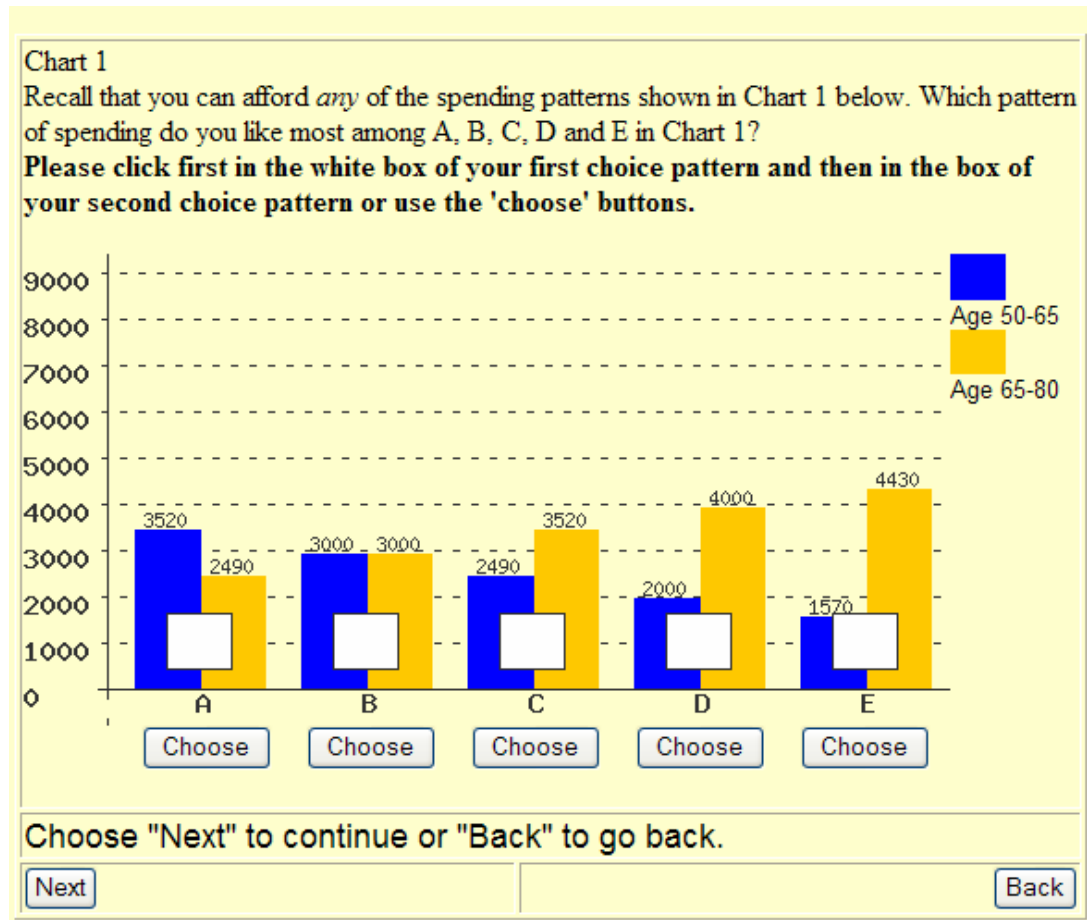
Choose "Next" to continue or "Back" to go back.

Next

Back

- Spending tradeoff implies 0% interest rate
- 4 questions with different interest rates of $r = \{0\%, 4.6\%, 9.2\%, 13.9\%\}$

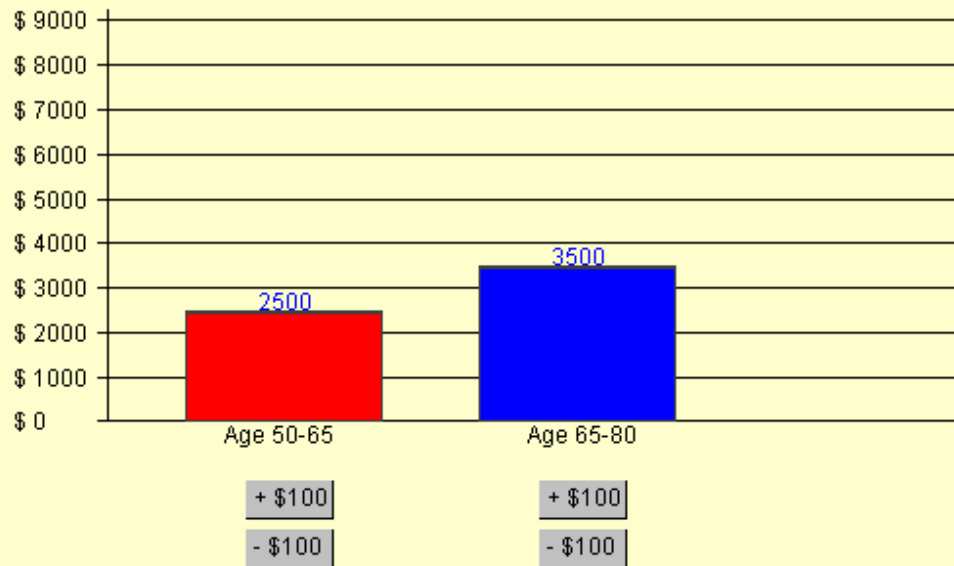
Discrete Choice



- Choose A or E, see 3 more options
- Randomize discrete choice set

Moveable Bars

Please move the bars up and down until you are satisfied with your choice of spending before and after retirement. Then choose 'Next.'



Choose "Next" to continue or "Back" to go back.

Next

Back

- Interactive [graphics](#)
- Click buttons or drag bars

Hypothetical Scenario (Wide Bars)

Now we have a few questions about your preferences for spending and saving over time. To make the questions comparable for all respondents in the survey, let's suppose that you are now 50 years old and that you will live until you are 80. Further suppose that:

- future health care and nursing home costs are fully covered by insurance,
- there will be no inflation, and
- your income after taxes is guaranteed to be 3000 each month from age 50 to age 80.

The 30 years you have left to live are divided into an early period and a later period--which may be of different lengths of time. In each of the following situations, spending \$100 per month more in one period leaves \$100 per month less to spend in the other period.

Choose "Next" to continue or "Back" to go back.

Next

Back

Wide Bars

In the first situation shown on the next screen, the early period is 5 years long, from age 50 to age 55. The later period is 25 years long, from age 55 to age 80.

Increasing spending from age 50 to 55 by \$100 reduces spending from age 55 to 80 by \$100. Increasing spending from age 55 to 80 by \$100 reduces spending from age 50 to 55 by \$100.

Choose "Next" to continue or "Back" to go back.

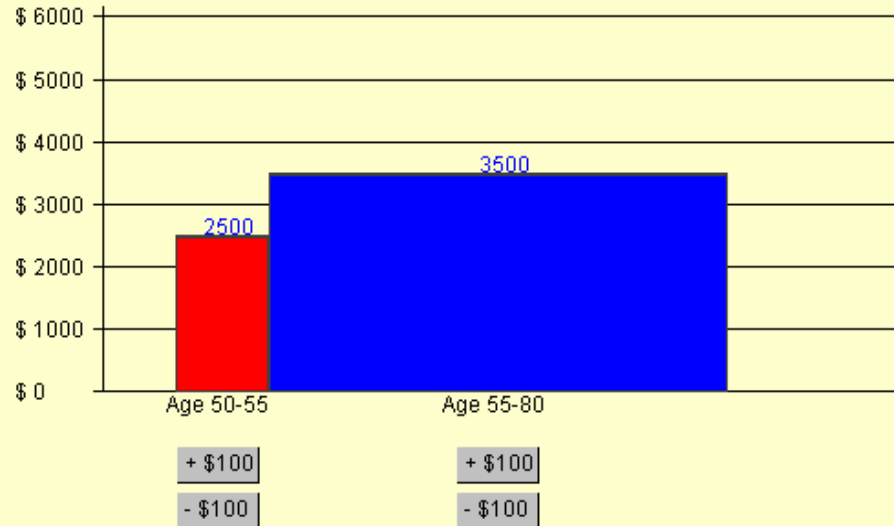
Next

Back

- Use length of periods to vary interest rate
- 5 questions with different interest rates of
 $r = \{-13.5\%, -4.8\%, 0\%, 4.8\%, 13.5\%\}$

Wide Bars

You can move the amounts of your monthly spending in the early period and the later period up and down with your mouse.



Choose "Next" to continue or "Back" to go back.

Next

Back

- \$500 less for 5 years, \$500 more for 25 years

Respondent Characteristics

	Internet Survey	Mail Survey	
		All	Use Web
Mean Age	52.9	56.0	55.2
(Std. Dev.)	(11.1)	(5.4)	(5.5)
College Degree	51%	29%	45%
Male	46%	39%	37%
Median Income	\$70,000	\$55,800	\$72,604
Respondents	842	386	203

NOTE: Tabulations include individuals with at least one active response to a valid survey instrument.

- Large differences in education and income by Internet use

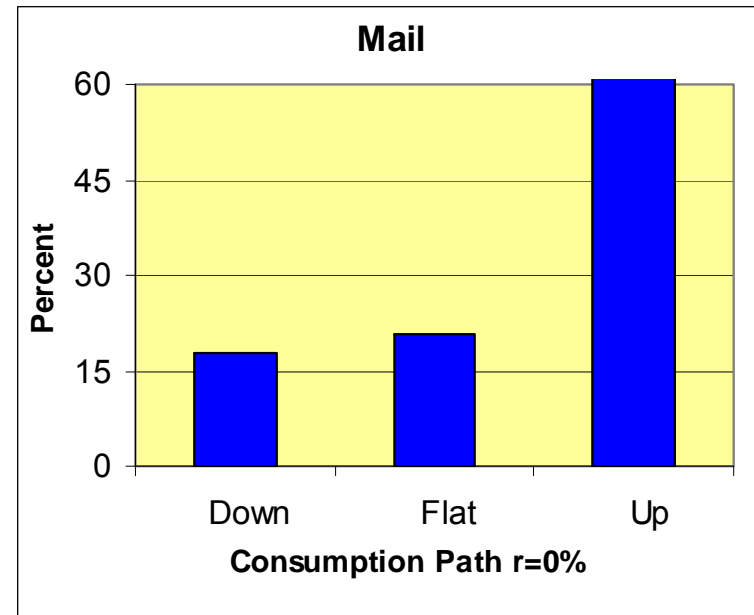
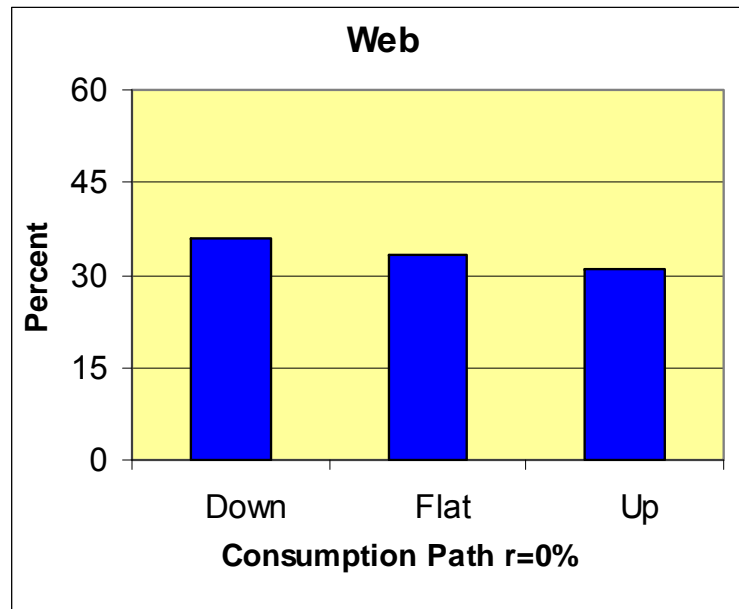
Technical Issues with Web

	Moveable Bars	Wide Bars	Discrete Choice
Respondents Assigned	431	397	928
% Technical Difficulties	49%	54%	6%

NOTE: Tabulations of moveable bars pool ALP waves 2 and 6.

- Moveable and wide bars need Java
- Rounding and other coding issues
- Additional data on response process

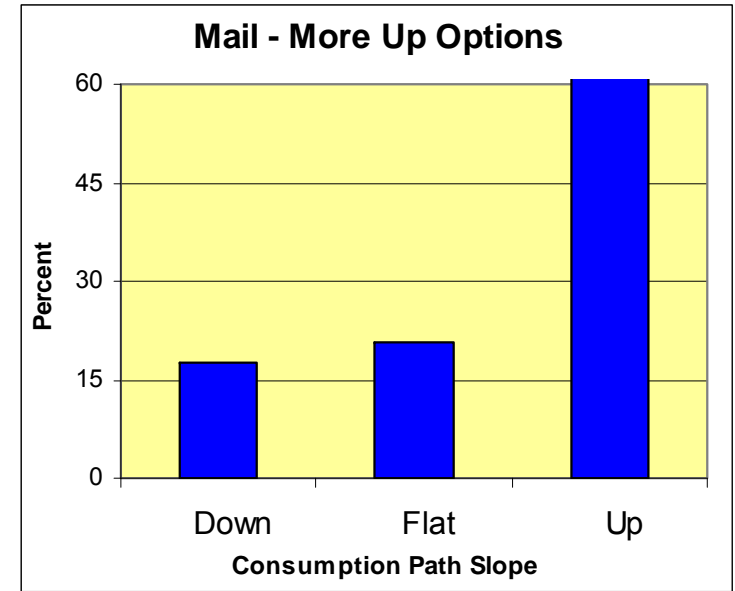
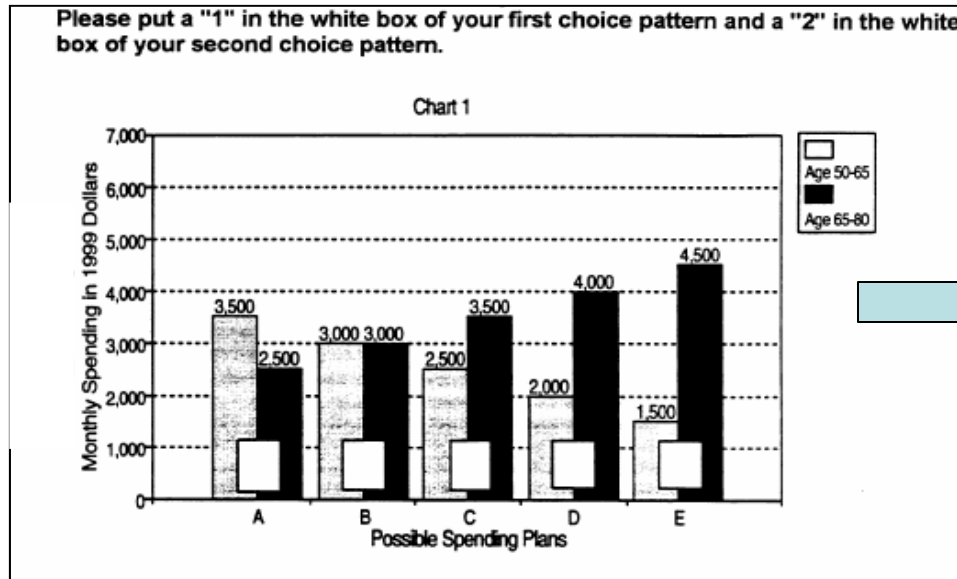
Slope of Desired Consumption Path at 0% Interest Rate



- Mail respondents strongly favor upward slope
- Web respondents slightly favor downward slope

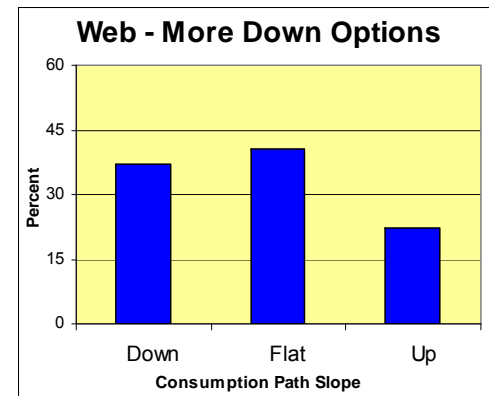
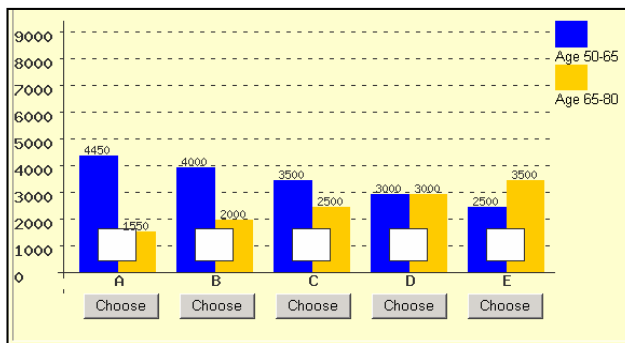
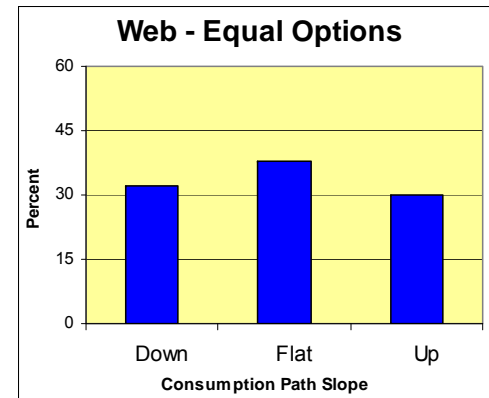
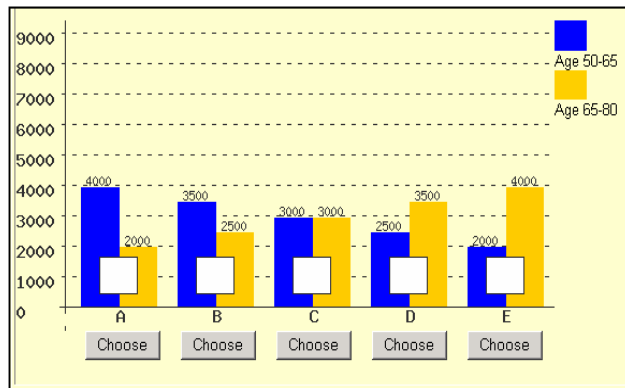
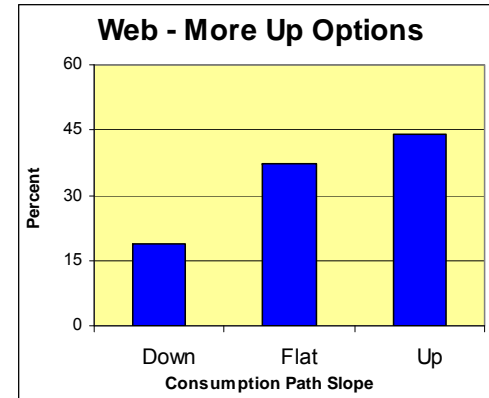
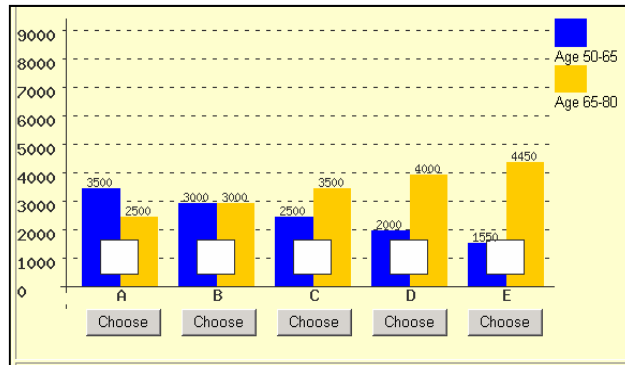
Why Is Mail Survey So Different?

Priming Effects

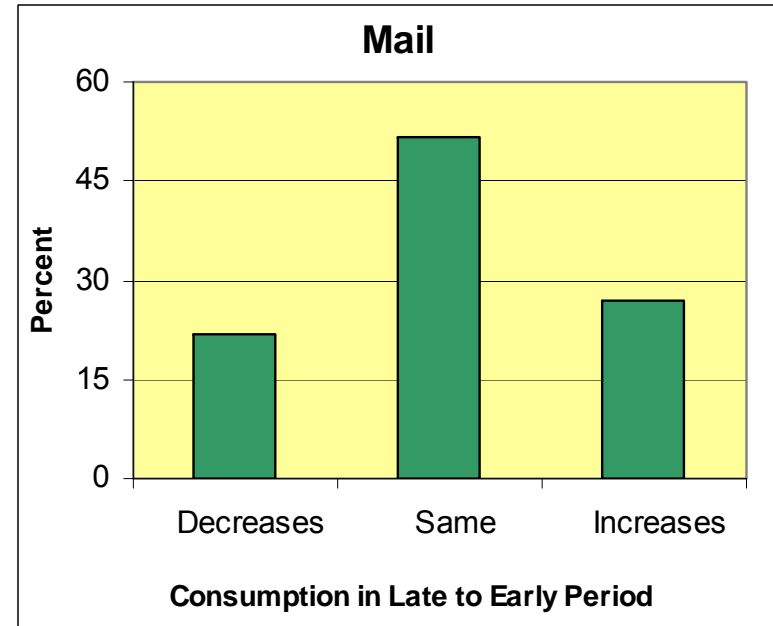
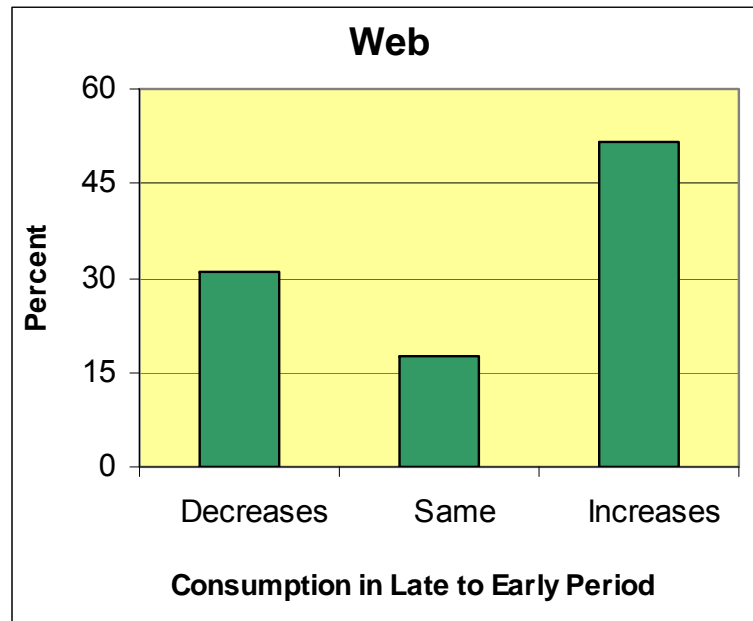


- Compare discrete choice
- Mail survey 3 of 5 “Up” options

Web Randomizes Discrete Choice



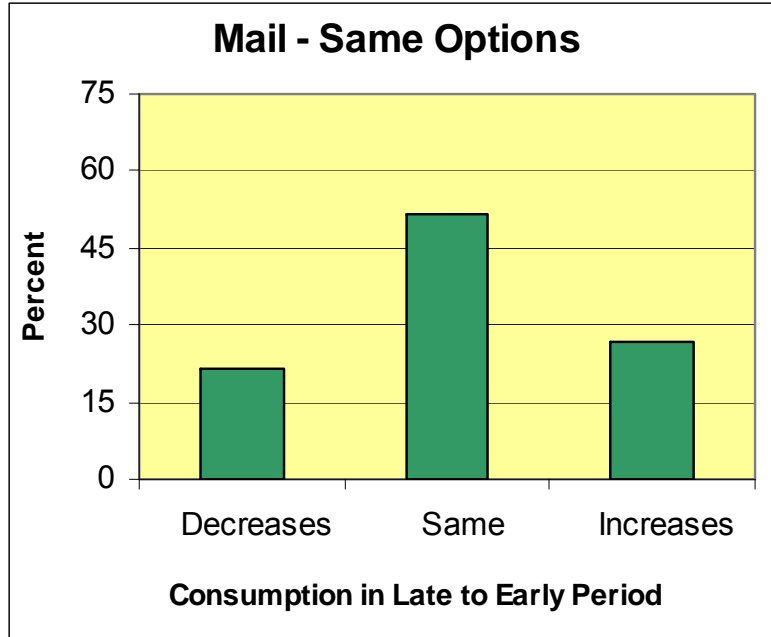
Change in Consumption Ratio as Interest Rate to 14% from 0%



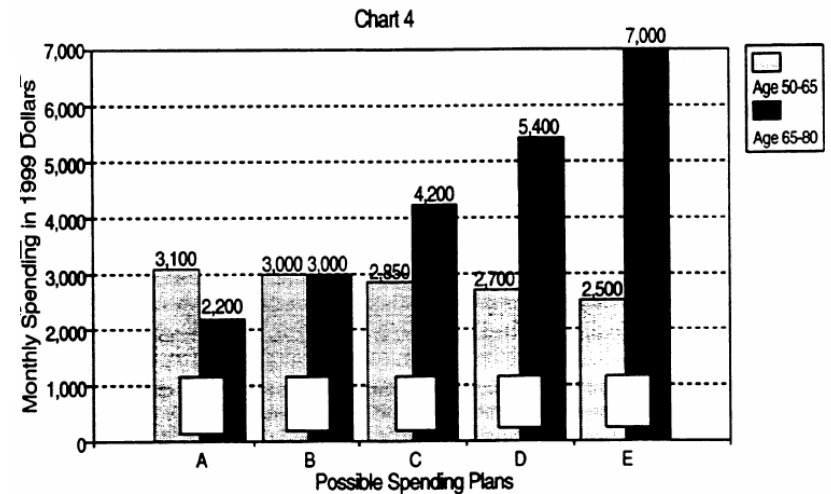
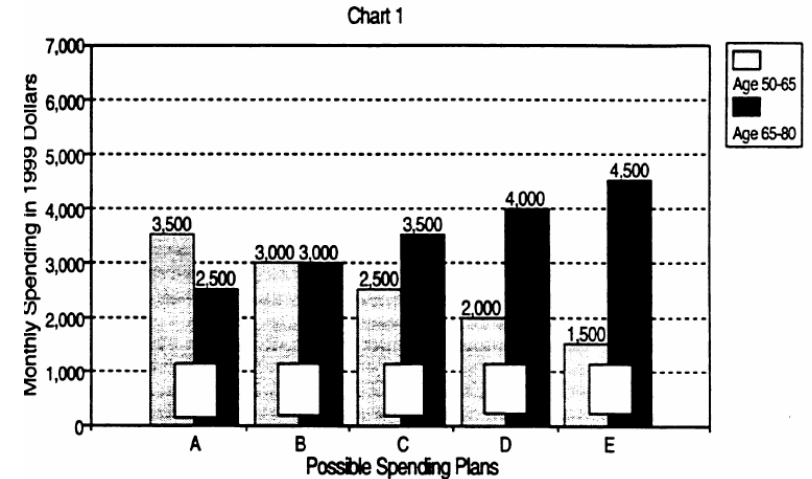
- Internet react more to interest rate change
- But more also move in the “wrong” direction

Again, Why Is Mail So Different?

Anchoring Effects

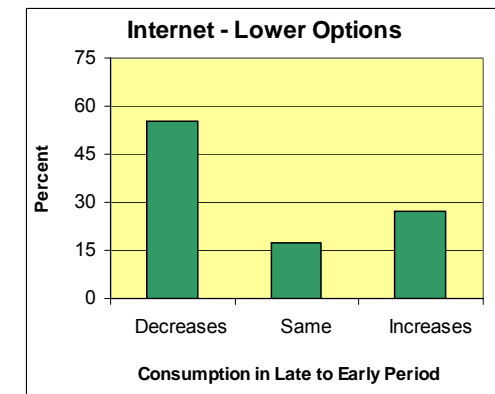
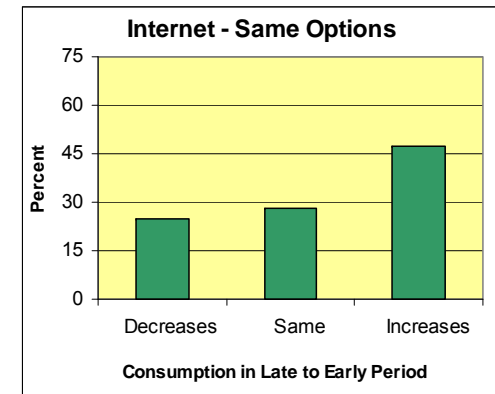
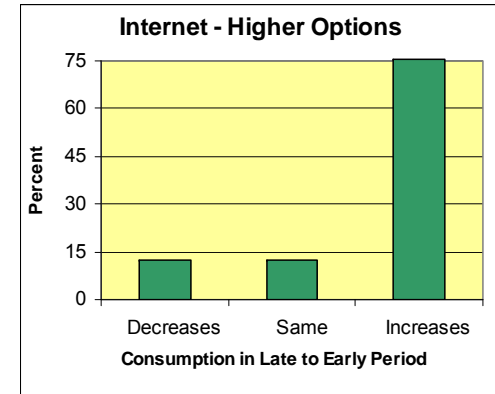
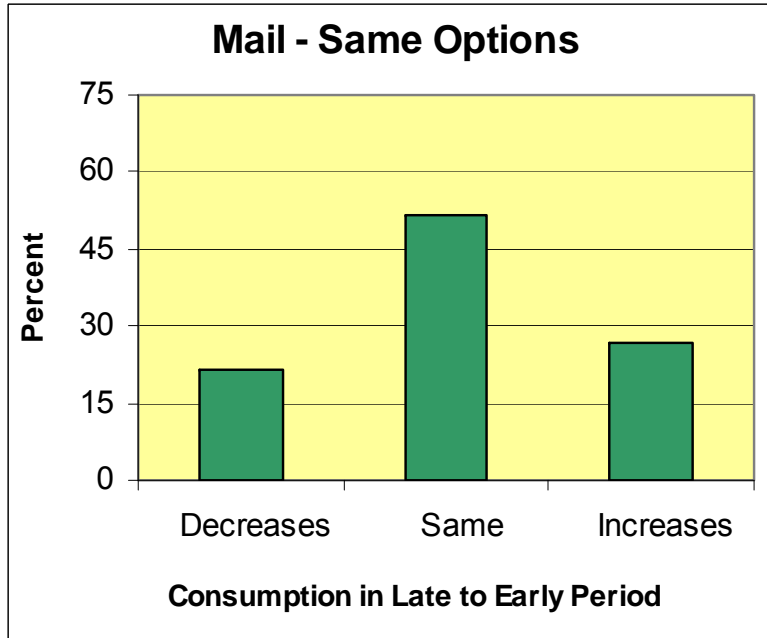


- Compare discrete choice
- Mail same choice set
- Web varies choice set



Again, Why Is Mail So Different?

Anchoring Effects



- Compare discrete choice
- Mail same choice set
- Web varies choice set

Individual Parameter Estimates

- An individual answers 4 or 5 spending scenarios with different interest rates
- Use response at 0% interest rate to estimate the desired spending path $-s\rho$:

$$g_{i,r=0} = \log(C_{i,65-80} / C_{i,50-65}) / 15$$

- Use pairs of responses to estimate elasticity s :

$$s_{i,jk} = (g_{i,k} - g_{i,j}) / (r_k - r_j)$$

- Pool the 3 or 4 elasticities across individuals

Estimates: Consumption Growth at Zero Interest Rate

Consumption Growth at $r = 0\%$: $-s\rho$	Web Survey	Mail Survey
Mean (Std. Error)	-0.10 (0.11)	1.90 (0.15)
Observations	1137	355
Respondents	845	355

NOTE: Estimates in percent per year. Average parameter value from regression of individuals' parameters on a constant. ALP waves are pooled. Standard errors are clustered.

- Web: flat path
- Mailout: upward slope

Estimates: Average Elasticity of Intertemporal Substitution

Elasticity of Intertemporal Substitution: s	Web Survey	Mail Survey
Mean (Std. Error)	0.09 (0.01)	0.01 (0.01)
Standard Deviation		
Overall	0.76	0.41
Between	0.34	0.19
Within	0.70	0.36
Observations	3587	1065
Respondents	844	355

NOTE: Regression pools the elasticity estimates across respondents, waves, and versions. Standard errors are clustered.

- Internet: higher elasticities, well below log utility

Upper Bound on Elasticity?

Web Survey	Estimate	% of Sample
Average EIS (Std. Error)		
Positive EIS	0.57 (0.02)	49%
Non-Negative EIS	0.40 (0.01)	70%
All EIS	0.09 (0.01)	100%

- Average of positive elasticities well below 1.0

Heterogeneity: Consumption Growth at Zero Interest Rate

Consumption Growth at $r = 0\%$: $-sp$	Web Survey
Age 50-64	0.03 (0.24)
Age 65-79	0.22 (0.45)
Ages 80+	0.79 (0.59)
Male	-0.15 (0.23)
College Degree	0.06 (0.24)
Log Income	-0.05 (0.17)

Note: Regression controls for version and wave. Standard errors clustered.

- Consumption path steeper for older respondents
- No effect statistically different from zero

Heterogeneity: Elasticity of Intertemporal Substitution

Elasticity of Intertemporal Substitution: s	Web Survey
Age 50-64	-0.01 (0.02)
Age 65-79	-0.07 (0.03)
Ages 80+	-0.11 (0.09)
Male	-0.003 (0.02)
College Degree	0.01 (0.02)
Log Income	-0.03 (0.01)

Note: Regression controls for version and wave. Standard errors clustered.

- Older respondents, less elastic
- Higher income, less elastic

Ongoing Work

- Improve the Moveable Bar Version
 - In 2008 Cognition Survey
- Estimate Statistical Model
 - Repeat observations address response errors
- External Check on Responses
 - “Reverse” question: vary spending growth and elicit desired interest rate