#### Positive Time Preference and Intergenerational Equity

Zach Freitas-Groff

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## FAST@MPANY

02-16-22

# What is the 'social cost of carbon'?

The Biden administration has been trying to finalize a new 'social cost of carbon.' Two energy experts break down what that means and how that cost can fluctuate.

## POLITICO

#### ENERGY & ENVIRONMENT

## Biden hikes cost of carbon, easing path for new climate rules

The social cost of carbon could have ripple effects throughout industry.

#### WSJ OPINION

#### OPINION | REVIEW & OUTLOOK Biden's Cost-of-Carbon Inflation

A judge calls out a regulatory ruse to gut cost-benefit analysis.

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#### WHY TRUMP'S SOCIAL COST WAS SO MUCH LOWER

The Trump administration's estimate was lower for two reasons: It accounted for climate damage only within U.S. borders; and the administration placed a lower value on future costs by setting a discount rate of 7%, more than double the 3% used by Obama and Biden. Economists use different rates to "discount" future benefits versus the cost we pay today to get there. A high discount rate on climate means we put a lower value on damages that occur in the future.

Unsurprisingly, discount rates are contentious. New York state uses a 2% discount rate to produce its current social cost of carbon of \$125 per ton. Some analysts argue for a 0% discount rate because anything higher places a lower value on costs borne by future generations.



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  - Optimal tax on gas: 10 cents or \$3?



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  - Relatedly, unclear how those who are patient would deal with the above puzzles.
  - Expanding on recent experimental economics techniques can help address this gap (Andreoni and Sprenger 2012, Augenblick et al. 2015, Exley and Kessler 2018).

Research Question: Are subjects' intergenerational tradeoffs consistent with the conventional welfarist treatment of intertemporal choice?

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- Revealed Time Preference: Compare respondents' intergenerational and self-regarding time preference using non-tradable goods.

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- Broad or Narrow Equity: Observe whether respondents allocate one good differently across generations when we vary the interest rate on another good.

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## Presentation Overview



- Revealed Time Preference: Compare respondents' intergenerational and self-regarding time preference using non-tradable goods.
  - Theoretical Framework: What can we learn about time preference from choice data?
  - Experimental Design
  - Analysis and Pilot Results

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• Consumption discount factor.  $D_i = \frac{\frac{\partial W}{\partial c_D}}{\frac{\partial W}{\partial c_i}}$ ;  $c_{it}$  is the *i*th component of consumption.

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#### Revealed Time Preference: Theoretical Setup

- ▶ A Social Planner (SP) has preferences  $W(c_1, c_2)$  over consumption  $c_t \in \mathbb{R}^{n+}$ .
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  - Pure time preference factor.  $\delta$  is a number such that  $W(c_1, c_2) = u(c_1) + \delta u(c_2)$ .

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  - If c is unidimensional and  $u(c) = \frac{c^{1-\eta}}{1-\eta}$ , then  $\log D = \log \delta \eta \log(\frac{c_2}{c_1})$ .

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#### Revealed Time Preference: Approaches to Calibrating Parameters

• Ethics-based approach to time preference: typically, work from from  $\delta \approx 1$ .



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Market-based approach



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  - ▶ If  $c_i$  is not tradable and SP chooses  $c_{i1} + \frac{c_{i2}}{R} = b$ , choice reveals if  $D_i \ge (\le)R$ .

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  - If the goods are tradable, choice bounds the recipient's interest rate.

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  - Theoretical Framework
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  - Analysis and Pilot Results

Redistribution

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Respondents answer questions in which they allocate a good between two time periods.



Introduction 0000 Revealed Time Preference

Redistribution

Broad or Narrow Ed

- Respondents answer questions in which they allocate a good between two time periods.
- Respondents are randomly assigned to one of two pairs of time periods:



Redistribution

Broad or Narrow Eq

- Respondents answer questions in which they allocate a good between two time periods.
- Respondents are randomly assigned to one of two pairs of time periods:
  - (next month, a year from next month)

Redistribution

Broad or Narrow Ec

- Respondents answer questions in which they allocate a good between two time periods.
- Respondents are randomly assigned to one of two pairs of time periods:
  - (next month, a year from next month)
  - (this week, a year from this week)

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- Respondents complete six sets of questions:

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  - ▶ Each of the following settings: {across generations, within generation, within self}

Redistribution

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  - Each of the following settings: {across generations, within generation, within self}
  - Two of the following goods: {money, video task, sound task}

- Respondents answer questions in which they allocate a good between two time periods.
- Respondents are randomly assigned to one of two pairs of time periods:
  - (next month, a year from next month)
  - (this week, a year from this week)
- Respondents complete six sets of questions:
  - Each of the following settings: {across generations, within generation, within self}
  - Two of the following goods: {money, video task, sound task}

Each question set consists of the same question at five interest rates.

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An decision across generations consists of a decision to allocate a good between a college senior this year and a college senior next year.





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An decision across generations consists of a decision to allocate a good between a college senior this year and a college senior next year.



An decision within generation consists of a decision to allocate a good between a college junior this year and that same person next year.



▶ For pleasant work tasks, we invite Citizens (or the SP) to a two-hour work period.

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- ▶ For pleasant work tasks, we invite Citizens (or the SP) to a two-hour work period.
- ► Task I: Videos



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- ▶ For pleasant work tasks, we invite Citizens (or the SP) to a two-hour work period.
- ► Task I: Videos
  - Citizens (or the SP) choose their favorite video category from a list.



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- ▶ For pleasant work tasks, we invite Citizens (or the SP) to a two-hour work period.
- Task I: Videos
  - Citizens (or the SP) choose their favorite video category from a list.
  - Citizens (or the SP) take notes on 100 minutes of videos.

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- ► For pleasant work tasks, we invite Citizens (or the SP) to a two-hour work period.
- Task I: Videos
  - Citizens (or the SP) choose their favorite video category from a list.
  - Citizens (or the SP) take notes on 100 minutes of videos.
  - The SP's choices determine how much total time the Citizens or the SP get to watch their favorite video category; the rest is spent on videos selected for boredom.

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- ▶ For pleasant work tasks, we invite Citizens (or the SP) to a two-hour work period.
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- ▶ For pleasant work tasks, we invite Citizens (or the SP) to a two-hour work period.
- Task I: Videos
  - Citizens (or the SP) choose their favorite video category from a list.
  - Citizens (or the SP) take notes on 100 minutes of videos.
  - The SP's choices determine how much total time the Citizens or the SP get to watch their favorite video category; the rest is spent on videos selected for boredom.
- Task II: Sound
  - Every 25 minutes, Citizens (or the SP) transcribes letters uttered by a machine for five minutes.

Redistribution

- ▶ For pleasant work tasks, we invite Citizens (or the SP) to a two-hour work period.
- Task I: Videos
  - Citizens (or the SP) choose their favorite video category from a list.
  - Citizens (or the SP) take notes on 100 minutes of videos.
  - The SP's choices determine how much total time the Citizens or the SP get to watch their favorite video category; the rest is spent on videos selected for boredom.
- Task II: Sound
  - Every 25 minutes, Citizens (or the SP) transcribes letters uttered by a machine for five minutes.
  - ▶ For some of the time, an alarm clock rings in the background.

- ▶ For pleasant work tasks, we invite Citizens (or the SP) to a two-hour work period.
- Task I: Videos
  - Citizens (or the SP) choose their favorite video category from a list.
  - Citizens (or the SP) take notes on 100 minutes of videos.
  - The SP's choices determine how much total time the Citizens or the SP get to watch their favorite video category; the rest is spent on videos selected for boredom.
- Task II: Sound
  - Every 25 minutes, Citizens (or the SP) transcribes letters uttered by a machine for five minutes.
  - ▶ For some of the time, an alarm clock rings in the background.
  - The SP's choices determine how much total time the Citizens (or the SP) get without the alarm clock.

You can swap 30 seconds of quiet in December 2020 for **30.0 seconds of quiet** in August 2021. (You must complete 3 minutes of letter-writing in each session.)



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#### Revealed Time Preference: Pilot Interface

P is December 2000; (They must complete 3 minutes of Heter-writing in each estation)

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You can swap 30.0 seconds of quiet for T in August 2001 for 30 seconds of quiet P in December 2020. (They must complete 3 minutes of letter-writing in each



Yes can swep 10.6 seconds of quiet for T in August 2001 for 30 seconds of quiet for P is December 2000. (They must complete 3 minutes of letter-writing in each



You can swap 21.5 seconds of quiet for T in August 2001 for 30 seconds of quiet 5 P in December 2020. (They must complete 2 minutes of letter-writing in each



You can swep 20.9 seconds of quiet for T in August 2001 for 30 seconds of quiet for P in December 2020, (They must complete 3 minutes of letter-writing in each



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Revealed Time Preference

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# Presentation Overview



- Revealed Time Preference: Compare respondents' intergenerational and self-regarding time preference using non-tradable goods.
  - Theoretical Framework
  - Experimental Design
  - Analysis and Pilot Results

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Compare across-generation and self-regarding choices:

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Compare across-generation and self-regarding choices:

▶ The share allocated to the early period at each interest rate



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- Compare across-generation and self-regarding choices:
  - ▶ The share allocated to the early period at each interest rate
  - Nonparametric PDF for δ: the share of SPs who switch at each interest rate from more early to more late

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# Revealed Time Preference: Analysis

Compare across-generation and self-regarding choices:

- The share allocated to the early period at each interest rate
- Nonparametric PDF for δ: the share of SPs who switch at each interest rate from more early to more late

Assume isoelastic utility and estimate  $\delta$  using the following equation:

$$\log c_{2i} - \log c_{1i} = \frac{\log R_i}{\eta} + \frac{\delta}{\eta} + \varepsilon_i$$

Compare across-generation and self-regarding choices:

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•  $c_{1i}$  and  $c_{2i}$  are the amount allocated in decision *i*.

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*R<sub>i</sub>* is the interest rate.

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	Parameter Estimates			
		Inter	Intra	Self
	$\eta$	0.639	1.327	0.556
		(0.236)	(0.887)	(0.194)
	$\delta$	1.051	1.275	1.044
A 11		(0.0955)	(0.310)	(0.115)
Audio	β	1.027	0.901	1.001
	,	(0.0649)	(0.101)	(0.0579)
	Subjects	55	55	55
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Parameter Estimates Continued								
		Inter	Intra	Self				
	$\eta$	2.185	0.597	0.472				
		(1.842)	(0.296)	(0.184)				
	δ	0.941	0.984	1.048				
		(0.227)	(0.0943)	(0.108)				
Video	β	1.065	1.018	0.957				
	,	(0.135)	(0.0530)	(0.0591)				
	Subjects	54	54	54				
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		Inter	Intra	Self	
	$\eta$	1.435	0.197	0.221	
		(1.244)	(0.0864)	(0.113)	
	$\delta$	1.370	0.620	0.432	
		(0.585)	(0.123)	(0.168)	
Money	β	0.796	1.223	1.317	
	1-	(0.213)	(0.0989)	(0.174)	
	Subjects	37	37	37	
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## Presentation Overview



- Revealed Time Preference: Compare respondents' intergenerational and self-regarding time preference using non-tradable goods.
- Redistribution: Test consistency of equity preferences by also having respondents distribute transfers across generations within the same time period.
- Broad or Narrow Equity: Observe whether respondents allocate one good differently across generations when we vary the interest rate on another good.

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# Presentation Overview



- Redistribution: Test consistency of equity preferences by also having respondents distribute transfers across generations within the same time period.
  - Theoretical Framework: What do intergenerational and intragenerational choices jointly imply?
  - Experimental Design
  - Analysis and Pilot Results

Redistribution

If, on the margin, SP is more patient across than within generations, she should want to transfer from the old to the young even in the same time time period.



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- If, on the margin, SP is more patient across than within generations, she should want to transfer from the old to the young even in the same time time period.
  - "On the margin" implies time separability and separability across persons.



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- If, on the margin, SP is more patient across than within generations, she should want to transfer from the old to the young even in the same time time period.
  - "On the margin" implies time separability and separability across persons.
- Away from the margin, there are a few ways we can observe such a discrepnacy:

Redistribution

- If, on the margin, SP is more patient across than within generations, she should want to transfer from the old to the young even in the same time time period.
  - "On the margin" implies time separability and separability across persons.
- Away from the margin, there are a few ways we can observe such a discrepnacy:
  - Preferences are not time-separable or not person-separable.

Redistribution

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- Away from the margin, there are a few ways we can observe such a discrepnacy:
  - Preferences are not time-separable or not person-separable.
  - SP ignores credit when allocating across generations.

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  - SP ignores credit when allocating across generations.
  - ▶ SP is (perhaps futilely) paternalistic when allocating across generations.

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  - (Transferring to a future generation serves as a commitment device.)

- If, on the margin, SP is more patient across than within generations, she should want to transfer from the old to the young even in the same time time period.
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  - Preferences are not time-separable or not person-separable.
  - SP ignores credit when allocating across generations.
  - ▶ SP is (perhaps futilely) paternalistic when allocating across generations.
  - (Transferring to a future generation serves as a commitment device.)
- Does SP exhibit a concern for consistency?

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 Let SP have preferences given by W(c(e))

Interest Rate <i>R</i>	Current Junior ( <i>j</i> )	Current Senior ( <i>s</i> )
Year 1		
Year 2		

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- Let SP have preferences given by W(c(e))
  - ▶ *e*=a sequence of transfers.

Interest Rate <i>R</i>	Current Junior ( <i>j</i> )	Current Senior ( <i>s</i> )
Year 1		
Year 2		

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- Let SP have preferences given by W(c(e))
  - ▶ *e*=a sequence of transfers.
  - $e_{gt}$  goes to generation g at time t.

Interest Rate <i>R</i>	Current Junior ( <i>j</i> )	Current Senior ( <i>s</i> )
Year 1		
Year 2		

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Let	SP	have	preferences	given	by
W(a	с(е)	))			

▶ *e*=a sequence of transfers.

•  $e_{gt}$  goes to generation g at time t.

Consider two cases:

Interest Rate <i>R</i>	Current Junior ( <i>j</i> )	Current Senior ( <i>s</i> )
Year 1		
Year 2		

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<ul> <li>Let SP have preferences given by W(c(e))</li> <li>e=a sequence of transfers.</li> </ul>	Interest Rate <i>R</i>	Current Junior ( <i>j</i> )	Current Senior ( <i>s</i> )
<ul> <li><i>e<sub>gt</sub></i> goes to generation <i>g</i> at time <i>t</i>.</li> <li>Consider two cases:</li> <li>time-separable preferences</li> </ul>	Year 1		
	Year 2		

Redistribution

<ul> <li>Let SP have preferences given by W(c(e))</li> <li>e=a sequence of transfers.</li> </ul>	Interest Rate <i>R</i>	Current Junior ( <i>j</i> )	Current Senior ( <i>s</i> )
<ul> <li>e<sub>gt</sub> goes to generation g at time t.</li> <li>Consider two cases:</li> <li>time-separable preferences</li> </ul>	Year 1		
▶ generations can save/borrow at <i>R</i> ′	Year 2		

Redistribution

<ul> <li>Let SP have preferences given by W(c(e))</li> </ul>	Interest	Current	Current
<ul> <li>e=a sequence of transfers.</li> </ul>	Rate <i>R</i>	Junior (j)	Senior (s)
• $e_{gt}$ goes to generation g at time t.			
<ul> <li>Consider two cases:</li> <li>time-separable preferences</li> </ul>	Year 1		
<ul> <li>▶ generations can save/borrow at R'</li> <li>▶ If choices within + across generations differ, then ∂W(c(e)) ≠ ∂W(c(e))/2.</li> </ul>	Year 2		

Redistribution

	Example 1:	I	1
• Let SP have preferences given by $W(c(e))$	Interest	Current	Current
<ul> <li>e=a sequence of transfers.</li> <li>e<sub>st</sub> goes to generation g at time t.</li> </ul>	Rate <i>R</i>	Junior (j)	Senior ( <i>s</i> )
<ul> <li>Consider two cases:</li> <li>time-separable preferences</li> </ul>	Year 1	<i>e<sub>j1</sub></i>	
<ul> <li>▶ generations can save/borrow at R''</li> <li>▶ If choices within + across generations differ, then <math display="block">\frac{\partial W(c(e))}{\partial e_{i1}} \neq \frac{\partial W(c(e))}{\partial e_{s1}}.</math> </li> </ul>	Year 2	e <sub>j2</sub>	

Redistribution

	Example 1:		
<ul> <li>Let SP have preferences given by W(c(e))</li> </ul>	Interest	Current	Current
e=a sequence of transfers.	Rate <i>R</i>	Junior (j)	Senior (s)
• $e_{gt}$ goes to generation g at time t.			
<ul> <li>Consider two cases:</li> <li>time-separable preferences</li> </ul>	Year 1	<i>e<sub>j1</sub></i>	e' <sub>s1</sub>
generations can save/borrow at R'		VI	17
▶ If choices within + across generations differ, then $\frac{\partial W(c(e))}{\partial e_{i1}} \neq \frac{\partial W(c(e))}{\partial e_{s1}}$ .	Year 2	e <sub>j2</sub> e' <sub>j2</sub>	

Redistribution

	Example 1:	I	
• Let SP have preferences given by $W(c(e))$	Interest	Current	Current
<ul> <li>e=a sequence of transfers.</li> <li>e<sub>rt</sub> goes to generation g at time t.</li> </ul>	Rate <i>R</i>	Junior (j)	Senior ( <i>s</i> )
<ul> <li>Consider two cases:</li> <li>time-separable preferences</li> </ul>	Year 1	<i>e</i> <sup><i>''</i></sup> <sub><i>j</i>1</sub>	$e''_{s1}$ $e'_{s1}$
<ul> <li>▶ generations can save/borrow at R'</li> <li>▶ If choices within + across generations differ, then <sup>∂W(c(e))</sup>/<sub>∂e<sub>i1</sub></sub> ≠ <sup>∂W(c(e))</sup>/<sub>∂e<sub>s1</sub></sub>.</li> </ul>	Year 2	$e_{j2}$ $e'_{j2}$	1/

Redistribution

	Example 1:	1	1
<ul> <li>Let SP have preferences given by W(c(e))</li> </ul>	Interest	Current	Current
<ul> <li>e=a sequence of transfers.</li> </ul>	Rate <i>R</i>	Junior (j)	Senior ( <i>s</i> )
• $e_{gt}$ goes to generation g at time t.			
<ul> <li>Consider two cases:</li> <li>time-separable preferences</li> </ul>	Year 1	$e_{j1}'' \geq e_{j1}$	$e_{s1}''$ $e_{s1}''$
• generations can save/borrow at $R'$		VI	1/
▶ If choices within + across generations differ, then $\frac{\partial W(c(e))}{\partial e_{i1}} \neq \frac{\partial W(c(e))}{\partial e_{s1}}$ .	Year 2	e <sub>j2</sub> e' <sub>j2</sub>	

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	Example 2:		
<ul> <li>Let SP have preferences given by W(c(e))</li> <li>e=a sequence of transfers.</li> <li>e= goes to generation g at time t</li> </ul>	Interest Rate <i>R</i>	Current Junior ( <i>j</i> )	Current Senior ( <i>s</i> )
<ul> <li>Consider two cases:</li> <li>time-separable preferences</li> </ul>	Year 1		e <sub>s1</sub>
<ul> <li>▶ generations can save/borrow at R'</li> <li>▶ If choices within + across generations differ, then <sup>∂W(c(e))</sup>/<sub>∂e<sub>i1</sub></sub> ≠ <sup>∂W(c(e))</sup>/<sub>∂e<sub>s1</sub></sub>.</li> </ul>	Year 2	e <sub>j2</sub>	

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	Example 2:		
<ul> <li>Let SP have preferences given by W(c(e))</li> </ul>	Interest	Current	Current
e=a sequence of transfers.	Rate <i>R</i>	Junior (j)	Senior (s)
e <sub>gt</sub> goes to generation g at time t.			
		$e_{j1}'$	$e_{s1}'$
Consider two cases:	Year 1	$\sim$	$e_{s1}$
time-separable preferences			
▶ generations can save/borrow at R'			$\frac{\text{price}(e'_{j1})}{\frac{1}{2}}$
	Year 2	e <sub>i2</sub>	price( $e_{s1}$ )
If choices within + across generations differ, then $\frac{\partial W(c(e))}{\partial e_{i1}} \not\equiv \frac{\partial W(c(e))}{\partial e_{s1}}$ .		5	$\frac{R'}{R}$

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	Example 2:		
<ul> <li>Let SP have preferences given by W(c(e))</li> </ul>	Interest	Current	Current
<ul> <li>e=a sequence of transfers.</li> </ul>	Rate <i>R</i>	Junior (j)	Senior ( <i>s</i> )
e <sub>gt</sub> goes to generation g at time t.			
		$e_{j1}'=rac{e_{j2}}{R'}$	$e_{s1}'=e_{s1}$
Consider two cases:	Year 1		$e_{s1}$
time-separable preferences			
generations can save/borrow at R'			$\frac{\text{price}(e'_{j1})}{\text{price}(e'_{j1})}$
	Year 2	e <sub>j2</sub>	 
If choices within + across generations $\frac{\partial W(c(e))}{\partial W(c(e))}$		-	<u>R'</u>
differ, then $\frac{\partial P(e(o))}{\partial e_{i1}} \not\equiv \frac{\partial P(e(o))}{\partial e_{s1}}$ .			R

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	Example 2:		
<ul> <li>Let SP have preferences given by W(c(e))</li> </ul>	Interest	Current	Current
e=a sequence of transfers.	Rate <i>R</i>	Junior (j)	Senior ( <i>s</i> )
e <sub>gt</sub> goes to generation g at time t.			. ,
-		$e_{j1}'=rac{e_{j2}}{R'}$	$e_{s1}^\prime=e_{s1}$
Consider two cases:	Year 1		$e_{s1}$
time-separable preferences			
generations can save/borrow at R'			$\frac{\text{price}(e'_{j1})}{(d_{j1})}$
	Voor 2	eia	price $(e'_{s1})$
► If choices within + across generations	redr 2	-52	R'
differ, then $\frac{\partial \mathcal{W}(c(e))}{\partial e_{i1}} \neq \frac{\partial \mathcal{W}(c(e))}{\partial e_{s1}}$ .			$\frac{R}{R}$

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# Presentation Overview



- Redistribution: Test consistency of equity preferences by also having respondents distribute transfers across generations within the same time period.
  - Theoretical Framework
  - Experimental Design
  - Analysis and Pilot Results

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 $\blacktriangleright$  Randomly select an interest rate from R and assign respondents to two groups.



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- $\blacktriangleright$  Randomly select an interest rate from R and assign respondents to two groups.
- Respondents learn they will make a sequence of choices:

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 $\blacktriangleright$  Randomly select an interest rate from R and assign respondents to two groups.

Respondents learn they will make a sequence of choices:

Group I

▶ I.i: Divide *w* between a college junior and a senior in the early period.



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▶ Randomly select an interest rate from *R* and assign respondents to two groups.

Respondents learn they will make a sequence of choices:

Group I

- ▶ I.i: Divide *w* between a college junior and a senior in the early period.
- ▶ I.ii: Same decision as I.i, but now there will be a chance to modify it in I.iii.

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▶ Randomly select an interest rate from *R* and assign respondents to two groups.

Respondents learn they will make a sequence of choices:

Group I

- ▶ I.i: Divide *w* between a college junior and a senior in the early period.
- ▶ I.ii: Same decision as I.i, but now there will be a chance to modify it in I.iii.
- ▶ I.iii: Choose how much of junior's transfer to save at rate *R*.

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#### Group II

II.i: Make the allocation across generations at R again, but now there will be a chance to modify it in II.ii.



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#### Group II

- II.i: Make the allocation across generations at R again, but now there will be a chance to modify it in II.ii.
- ▶ II.ii: Choose how much of the junior's transfer to 'borrow' at rate *R*.



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#### Group II

- II.i: Make the allocation across generations at R again, but now there will be a chance to modify it in II.ii.
- ▶ II.ii: Choose how much of the junior's transfer to 'borrow' at rate *R*.
- ▶ II.iii: Choose whether to reallocate total resources between the junior and senior.

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#### Group II

- II.i: Make the allocation across generations at R again, but now there will be a chance to modify it in II.ii.
- ▶ II.ii: Choose how much of the junior's transfer to 'borrow' at rate *R*.
- ▶ II.iii: Choose whether to reallocate total resources between the junior and senior.
- Treatment where I remind respondents about borrowing/saving?

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#### Group II

- II.i: Make the allocation across generations at R again, but now there will be a chance to modify it in II.ii.
- ▶ II.ii: Choose how much of the junior's transfer to 'borrow' at rate *R*.
- ▶ II.iii: Choose whether to reallocate total resources between the junior and senior.
- Treatment where I remind respondents about borrowing/saving?
- Treatment to test whether bystander recipients affect decisions across generations?

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# Presentation Overview



- Redistribution: Test consistency of equity preferences by also having respondents distribute transfers across generations within the same time period.
  - Theoretical Framework
  - Experimental Design
  - Analysis and Pilot Results

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#### Group II

Li tells us whether the our earlier prediction holds.

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Comparing I.ii to I.i and II.i to the allocation across generations tests time-separability + credit considerations.

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Comparing I.iii to II.ii and intragenerational choice tests recipient-separability.

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Any reallocation in decision II.iii tells us preferences are inconsistent across frames.

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- In the 2020 pilot, respondents allocated a good across and within generations simultaneously.
  - Choose  $e_{a1}$ ,  $e_{a2}$ ,  $e_{b1}$ , and  $e_{c2}$  subject to  $e_{a1} + e_{b1} + \frac{e_{a2} + e_{c2}}{R} \leq w$ .
- The estimated  $\delta$  for money was 0.789 (0.067), about halfway in between the within- and across-generation values. main results
- Suggests that respondents compromise between competing goals.

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# Presentation Overview



- Revealed Time Preference: Compare respondents' intergenerational and self-regarding time preference using non-tradable goods.
- Redistribution: Test consistency of equity preferences by also having respondents distribute transfers across generations within the same time period.
- Broad or Narrow Equity: Observe whether respondents allocate one good differently across generations when we vary the interest rate on another good.

Revealed Time Preference

Redistribution

Broad or Narrow Equity

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- Broad or Narrow Equity: Observe whether respondents allocate one good differently across generations when we vary the interest rate on another good.
  - Theoretical Framework: With a conventional social welfare function, how does the interest rate on one good affect decisions about another good?
  - Experimental Design and Analysis

Redistribution

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With a standard ("holistic") social welfare function, different goods' consumption discount factors are equal at the optimum when goods' value is normalized.



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Redistribution

Broad or Narrow Equity

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  - ▶ When one good's interest rate rises, other goods' allocations should shift earlier.



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Redistribution

Broad or Narrow Equity

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- With a standard ("holistic") social welfare function, different goods' consumption discount factors are equal at the optimum when goods' value is normalized.
  - ▶ When one good's interest rate rises, other goods' allocations should shift earlier.
- Suppose SP allocates two different goods, i and j, between an earlier person and a later generation at interest rates R<sub>i</sub>, R<sub>j</sub>.

▶ If equity concerns are holistic, i.e. 
$$\frac{\partial W(c)}{\partial c_{i1}\partial c_{i1}} < 0$$
, then at the optimum,  $\frac{\partial e_{j2}}{\partial R_i} < 0$ .

Redistribution

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  - For example,  $W(c) = W(U_1(c_1), U_2(c_2))$  where  $U_g$  is generation g's welfare.

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- This does not hold if SPs narrowly frame social welfare, evaluating allocations of different goods separately.

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  - For example,  $W(c) = W(U_1(c_1), U_2(c_2))$  where  $U_g$  is generation g's welfare.
- This does not hold if SPs narrowly frame social welfare, evaluating allocations of different goods separately.
  - For example, consider  $W(c) = c_{i1} + \delta_i c_{i2} + c_{j1} + \delta_j c_{j2}$ .



- Broad or Narrow Equity: Observe whether respondents allocate one good differently across generations when we vary the interest rate on another good.
  - Theoretical Framework
  - Experimental Design and Analysis

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Redistribution

Broad or Narrow Equity  $0 \bullet 0$ 

Vary the interest rates for both goods across SPs.

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- ► Vary the interest rates for both goods across SPs.
- For half of SPs, inform them that each senior can exchange one category of pleasant work for the other at some price.

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- ► Vary the interest rates for both goods across SPs.
- For half of SPs, inform them that each senior can exchange one category of pleasant work for the other at some price.
  - ▶ Test whether social welfare is narrowly framed even when the goods are tradable.

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- ► Vary the interest rates for both goods across SPs.
- For half of SPs, inform them that each senior can exchange one category of pleasant work for the other at some price.
  - ▶ Test whether social welfare is narrowly framed even when the goods are tradable.
- After the main decision, the other SPs allocate a convex budget between the two goods for each generation to allow us to estimate a price.

#### Arbitrage Across Goods and Time: Main Interface com pilot results

#### Choosing Both Sound and Video

Now, you choose what happens to both H and O now and

If we carry out this question, we will invite *H* to complete a survey now and *O* to complete a survey in August 2021. Both will need to complete the full video task and the full sound task.

You decide how they spend their time for each task. Answer the question (move the sliders) to move on.

You can make these swaps:

- Swap 30 seconds of quiet for H now for 30.00 more seconds for O in August 2021.
- Swap 5 minutes of a bloopers video H now for 5:00 more for O in August 2021.

(They must complete 3 minutes of letter-writing and 30 of video notetaking in each session.)



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Revealed Time Preference

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Broad or Narrow Equity ○○●

#### COMING SOON!

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Broad or Narrow Equity



# Thank you!

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#### Pilot Work Task Screenshots

1. Please watch 12 minutes 37 seconds of the video below. In the text box below the video, please note the following for the first 12 minutes 37 seconds of the video:

- Anytime the speaker says the word "asset" or "liability", write down one of the next few words, not counting "a", "an", "and", "but", "or", or "the".
- We will count your answer as correct if the word you choose is one of the next ten words (not counting the excluded ones).

For example, your notes for the first minute might look like (this is not real):
accrual
assets
later
asemester
a

Now, please watch the video and take notes in the text box below:



2. Please watch 17 minutes 23 seconds of the video below. In the text box below the video, please note the following for the first 17 minutes 23 seconds of the video:

- A one- to five-word description of what happens in each clip. That is, each time there is a new fail, write a very brief description.
- We will count the description as correct if it is loosely accurate and describes each clip.

For example, your notes for the first minute might look like (this is not real): fails gets wet eats molify bread has accident

You can write your notes in the same style as those from the previous question.



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- Boring video example: https://youtu.be/OgsjScCr9eU
- Letters: https://youtu.be/bFnctiHGK-s
- Letters with alarm clock: https://youtu.be/2RjwbgX67pl

#### Revealed Time Preference: Pilot Results



#### Revealed Time Preference: Pilot Results



#### Figure 1: Corner Solutions



Mean Share Allocated Later									
		Inter		Intra		Self			
Item		6 mos.	1 yr.	6 mos.	1 yr.	6 mos.	1 yr.		
Audio	Mean	0.56 (0.02)	0.54 (0.03)	0.54 (0.03)	0.55 (0.03)	0.54 (0.04)	0.53 (0.03)		
Video	Mean	0.50 (0.02)	0.50 (0.02)	0.53 (0.03)	0.52 (0.03)	0.52 (0.04)	0.54 (0.04)		
Money	Mean	0.51 (0.03)	0.54 (0.03)	0.41 (0.06)	0.37 (0.06)	0.29 (0.06)	0.29 (0.06)		

#### Revealed Time Preference: Pilot Results



#### Redistribution Within and Across Time: Pilot Results



#### Redistribution Within and Across Time: Pilot Results



#### Redistribution Within and Across Time: Pilot Results


























# Arbitrage Across Goods and Time: Main Interface



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Appendix Figure 3: Response of Later Video Allocations to Later Audio Allocation, Low Price



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Appendix Figure 4: Response of Later Video Allocations to Later Audio Allocation, High Price



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Appendix Figure 5: Relative Allocation to Earlier Junior by Interest Rate



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