Coherence and Correspondence Decision Criteria

How to Evaluate Processes

16th SAET Conference on Current Trends in Economics
Rio de Janeiro

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Outline

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- How to evaluate decision processes?
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- Method 2: Compare choice EVs
- Conclusions

Why Processes?

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- Source of choice - causal role
- Outcome data may mislead
  - Error
  - Luck
- Pedagogy
  - Teach choice strategies
  - (Kitcher 1992; “naturalistic” norms)

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- Proponents of ecological rationality argue that modeling people “as if” they maximize EU doesn’t help us understand (or evaluate) their choices
- People really use heuristics to choose
- We need to understand why those heuristics work when they work, and when they’ll fail

How to Evaluate Processes?

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- Lottery choices:
  - Objective outcomes and probabilities
  - Straightforward to apply EU axioms
- Test lotteries:
  - Taken from decision science literature
  - 171 unique lotteries
  - 1 to 5 non-negative outcomes
  - Wide range of “types”
  - ~80 randomly-generated

How to evaluate processes: An easy test case

- Processes:
  - Minimax
  - Maximax
  - Hurwicz: alpha as .1, .25, .5, .75, .9
  - Priority Heuristic
- EV maximizing choice for comparison

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    - Compare minima; if difference large enough relative to maximum, take higher minimum.
    - Compare probabilities of minima; if difference exceeds 10%, take lower probability of minimum.
    - Compare maxima; if differ by sufficient proportion, take higher maximum.
    - Take lottery with higher probability of maximum.

How to evaluate processes: First pass

- Lottery choices are preferential choices
- No “right” answer unless there’s dominance
- Hence Expected Utility Theory, which tests for choice coherence

Method 1:
The Axiomatic Test

Axiomatic Test:

- For each process, simulate its choice for every pair of lotteries in the set (29070 choices)
- Find triples of choices that violate transitivity
- Find quadruples that violate independence

Results of Axiomatic Test

Process	# Trans violations	# Ind violations
PH	101253 (~12%)	3
Minimax	0	6*
Maximax	0	0
Hurwicz .1	0	2
Hurwicz .25	0	3
Hurwicz .5	0	3
Hurwicz .75	0	4
Hurwicz .9	0	4

Transitivity and the Priority Heuristic

A	$10.60
B	$11.40 * .97; $1.90 * .03
C	$310 * .15; $230 * .15; $170 * .15; $130 * .15; $0 * .35

Is this adequate?

“If the compelling normative principle is, for example, wealth, then why not simply study the correlates of high-wealth-producing decision procedures and rank those procedures according to the wealth they produce?”

Nathan Berg, *The consistency and ecological rationality approaches to normative bounded rationality*

Method 2: Objective Performance Standards

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- Cycles are costly
- Statistically, a C>A choice is associated with a ~28% drop in choice EV all else equal (significant to .001 level)
- Average % of available EV attained by choice is 64% given violation, 95% with no violation.

This fits … cost may even be understated.

A	$10.60	EV $10.60
B	$11.40 * .97; $1.90 * .03	EV $11.12
C	$310 * .15; $230 * .15; $170 * .15; $130 * .15; $0 * .35	EV $126

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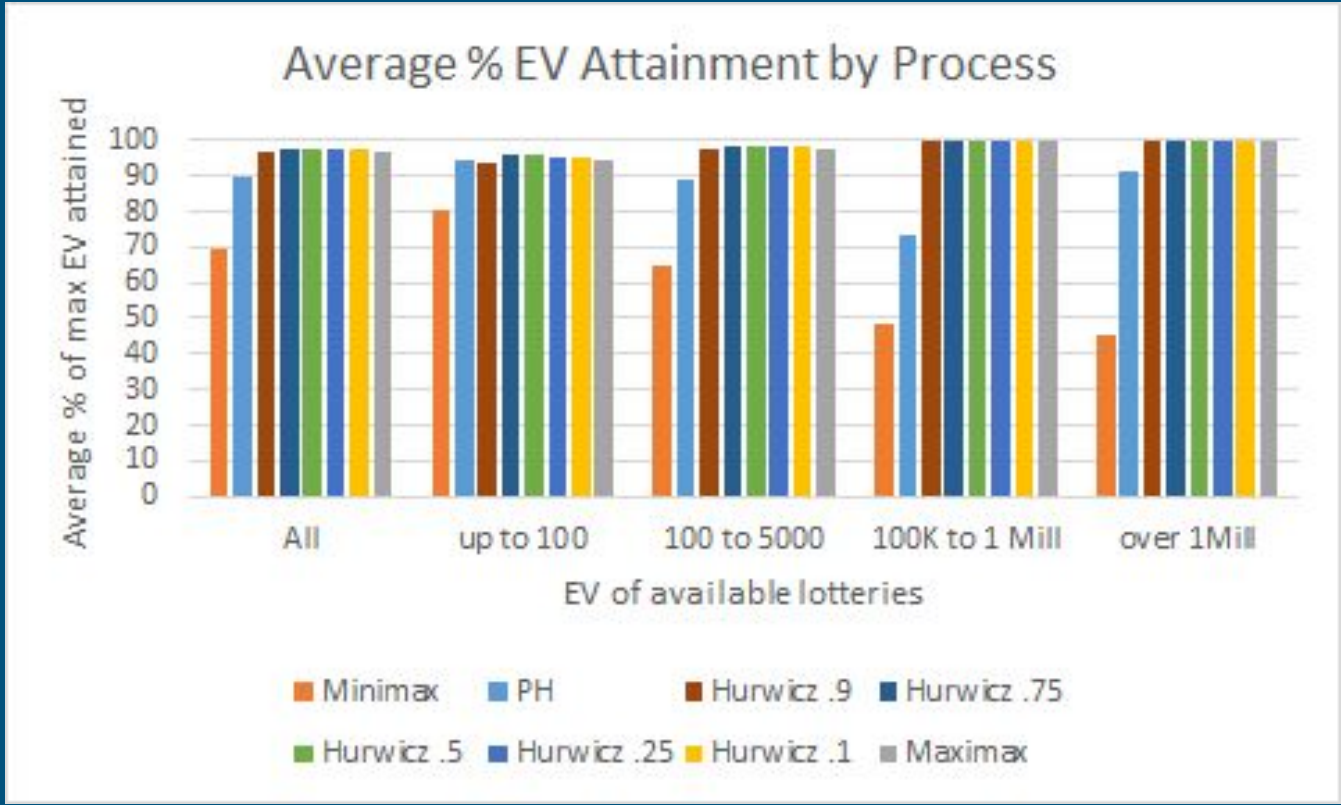
- Again, violation associated with an EV cost of ~ 30% ceteris paribus, significant to .001 level
- Violations yield 66% of available EV on average, compared to 99% for non-violations

How do the processes rank on expected wealth?



Conclusions

Concluding Morals

- The Priority Heuristic is hard to defend from a normative viewpoint
  - … but costs to using inferior processes are likely to be modest
- Method 1 (axiomatic evaluation of processes) is vindicated by Method 2
  - … along with all the theoretical arguments
  - Provides a defensible way to compare processes, quantify their rationality
- Ordinary expected utility evaluation is vindicated
  - Evidence that EU violations are costly
  - Process analysis is more work, less straightforward, and parasitic on choice pattern analysis

Selected References

- Nathan Berg. The consistency and ecological rationality approaches to normative bounded rationality. *Journal of Economic Methodology* 21.4 (2014): 375-395.
- Eduard Brandstätter, Gerd Gigerenzer and Ralph Hertwig. The priority heuristic: Making choices without trade-offs. *Psychological Review* 113.2 (2006): 409-432.
- Philip Kitcher. The naturalists return. *The Philosophical Review* 101.1 (1992): 53-114.

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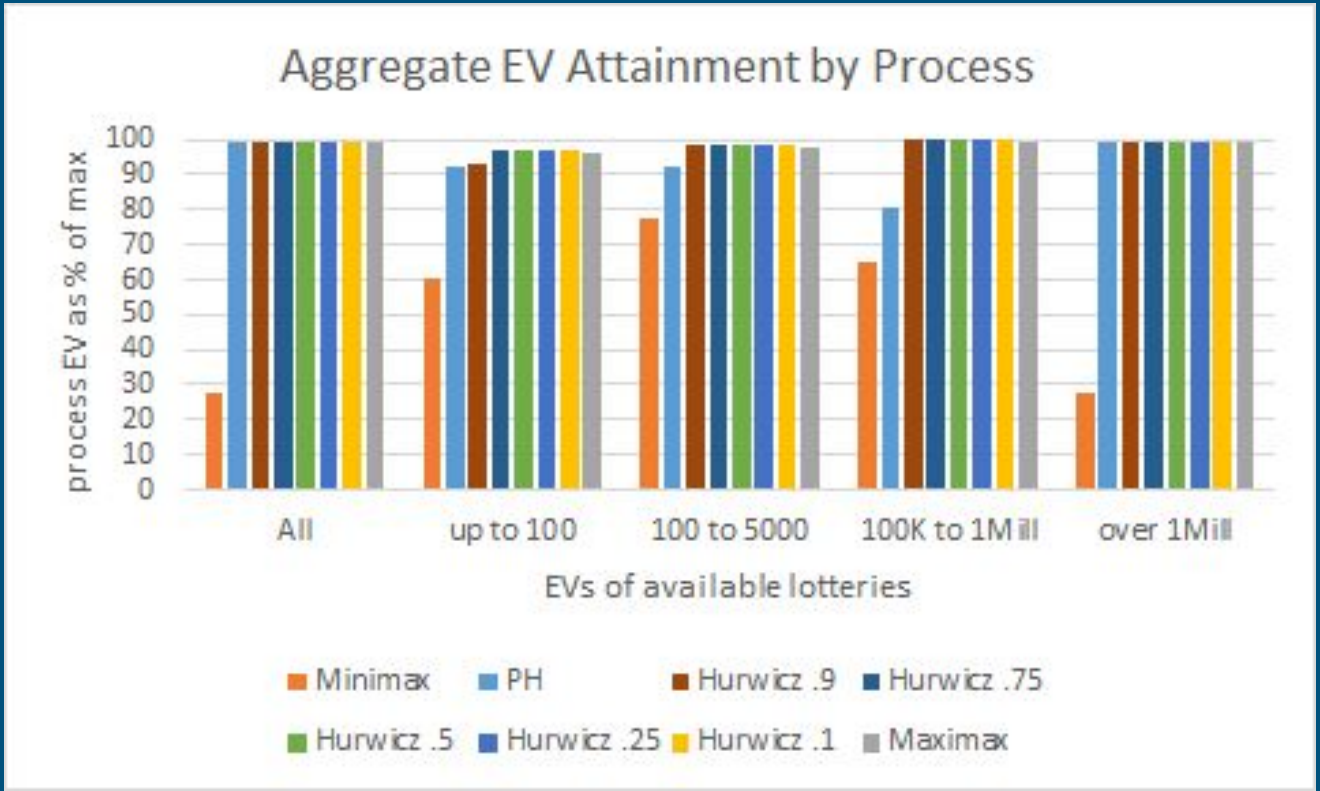

Why Processes? My take.

- The positive reasons for caring about processes are legitimate.
- Process information is often inaccessible. But when we have it, if we can use it, we should.
- For many purposes within economics, studying processes wouldn't be practical or efficient. But for normative purposes, their relevance might outweigh these concerns.

Transitivity and the Priority Heuristic

A	$3000 * .002; 0 * .998
B	$10.6
C	$17.9 * .92; $7.2 * .08

Transitivity and the Priority Heuristic

A	$15.5
B	$18.9 * .9; $6.7 * .1
C	$5M * .1; 0 * .9

Transitivity and the Priority Heuristic

A	$15.5
B	$18.9 * .9; $6.7 * .1
C	$1000 * .5; 0 * .5

Transitivity and the Priority Heuristic

A	$15.5
B	$18.9 * .9; $6.7 * .1
C	$2500 * .33; 0 * .67

Independence and the Priority Heuristic

A	$3 * .5	EV $1.5
B	$1	EV $1
C	$3 * .05	EV $0.15
D	$1 * .1	EV $0.10

Independence and the Priority Heuristic

A	$4000 * .8	EV $3200
B	$3000	EV $3000
C	$4000* .2	EV $800
D	$3000 * .25	EV $750