Stochastic Dominance and Demand for Surprise

Sev Toussaert

University of Oxford

12 March 2024

Introduction

- New project at the intersection of decision theory and experimental economics.
- Dream: bring decision theory to talk more about the real world. Spoiler alert: it's hard and messy (at least for me!)
- Interest in identifying and measuring the non-material costs/benefits that enter our utility function:
  - Work on self-control costs
  - Today: look at anticipatory utility and the demand for "surprise goods"

Surprise goods

Many examples: surprise movie or dinner experience, surprise gift to a friend, mystery hotels, loot boxes in video games, etc.

I want to understand:

- How much people value "surprise" goods
- The characteristics of those goods that maximize demand

Why interesting? (1)

The market for goods with a surprise/mystery component has expanded e.g., now you can buy a surprise box with pretty much anything in it.

- "Unboxing" video with surprise egg viewed 94 million times

Suggests there is demand BUT those goods are usually a bundle of things:

- personalization (food/clothing boxes)
- delegation of choice (friend)
- price discounts
- novelty (discovering new products)

Very hard to know how much people value the surprise component of these goods. Need experimental variation to isolate that.

Why interesting? (2)

- If people value those goods for the surprise, research could shed new light on the **design of incentives**.
  - Time, risk, social preferences leveraged by behavioral incentive design.
    ⇒ How about information preferences?
  - Surprises have a motivational component e.g., Duolingo mystery cards
  - People may expand more resources for an uncertain reward than a certain reward (Shen et al., 2015)
- Might be particularly motivational for certain populations:
  - Give a surprise toy to kids if they take their vaccine.
  - New research on the use of gamification in mHealth apps.
- Could be very **cost-effective**. In fact, people might be willing to accept worse options overall to get a surprise.

What is inside the box is often worth much less than its price ...

Why interesting? (3)

- The previous discussion suggests that people may accept a worse outcome to preserve the excitement of not knowing what it is.
- Preference for randomization due to anticipatory utility may come with **violations of stochastic dominance**:

$$(p, x; 1-p, y) \succ x \succ y$$

- Very interesting from a theoretical perspective because stochastic dominance is usually taken to be a normative property.
- Theorists will make (sometimes maybe unnatural) assumptions to ensure that FOSD is preserved (e.g., Rank-Dependent EU).
- Taking this normative view appears less justified when anticipatory utility matters.

Why interesting? (4)

If people enjoy surprises, then we might want to account for them in welfare calculations:

The Deadweight Loss of Christmas

By Joel Waldfogel*

When economists comment on holiday gift-giving, it is usually to condone the healthy effect of spending on the macro-economy. However, an important feature of gift-giving is that consumption choices are made by someone other than the final consumer. A potentially important *micro*economic aspect of gift-giving is that gifts may be mismatched with the recipients' preferences. In the standard microeconomic framework of consumer choice, the best a gift-giver can do with, say, $10 is to duplicate the choice that the recipient would have made. While it is possible for a giver to choose a gift which the recipient ultimately values above its price—for example, if the recipient is not perfectly informed—it is more likely that the gift will leave the recipient worse off than if she had made her own consumption choice with an equal amount of cash. In short, gift-giving is a potential source of deadweight loss.

This paper gives estimates of the deadweight loss of holiday gift-giving based on surveys given to Yale undergraduates.[1] I find that holiday gift-giving destroys between 10 percent and a third of the value of gifts. While these recipients may be unrepresentative of the U.S. population, their *gifts* are not necessarily unrepresentative. Holiday expenditures average $40 billion per year, implying that a conservative estimate of the deadweight loss of Christmas[2] is a tenth as large as estimates of the deadweight loss of income taxation. I also explore how deadweight loss and the tendency to give cash gifts vary with the relationship and age difference between giver and recipient. I find that gifts from friends and "significant others" are most efficient, while noncash gifts from members of the extended family are least efficient and destroy a third of their value. I develop a simple expected-utility model to explain the decision to give cash, as opposed to in-kind gifts. The data are consistent with the model: cash gifts are most common from the sorts of givers whose noncash gifts have the lowest expected value to recipients (given their cost) and high variability in recipient valuation.

I. Theory

A. *The Consequences of Gift-Giving*

Students are customarily taught in economics courses that unfettered consumer choice leads the consumer to higher utility than constrained choice. Thus, for example, government grants-in-kind are inefficient, unless the consumer would have chosen to consume at least the amount of the good granted, had the grant been cash.

One can analyze the possible inefficiency

*Department of Economics, Yale University, New Haven, CT 06520. I am grateful to my colleagues at Yale for lunchtime conversation which refined this idea.

[1]Much existing research examines the theoretical

The New York Times

An Economist Goes Christmas Shopping

Share full article | 132

By Josh Barro

Dec. 19, 2014

"The Deadweight Loss of Christmas" is the sort of academic paper that makes ordinary people think economists are kind of crazy.

"I find that holiday gift giving destroys between one-third and one-tenth of the value of gifts," proclaimed Joel Waldfogel, then an economics professor at Yale, in the 1993 paper. He estimated that ill-chosen gifts caused between $4 billion and $13 billion a year in economic waste; for comparison, he cited an estimate that put economic costs of the income tax at $50 billion.

This is the sort of provocation economists love: It rejects a beloved, sentimental tradition and devalues interpersonal interaction, while upholding the virtue of individual choice. After all, why should you shop for me, when I certainly know what I want better than you do? It's no surprise that Mr. Waldfogel's paper, "The Deadweight Loss of Christmas," was published in The American Economic Review, one of the world's top three economics journals.

Why interesting? (5)

What Drives Demand for State-Run Lotteries?
Evidence and Welfare Implications

Benjamin B. Lockwood ⓡ Hunt Allcott ⓡ Dmitry Taubinsky ⓡ Afras Sial*

March 7, 2022

Abstract

We use natural experiments embedded in state-run lotteries and a new nationally representative survey to provide reduced-form and structural estimates of risk preferences and behavioral biases in lottery demand. We find that sales respond more to the expected value of the jackpot than to price, but are unresponsive to variation in the second prize—a pattern that implies probability weighting but is inconsistent with standard parameterizations. In the survey, we find that lottery spending decreases modestly with income and is strongly associated with measures of innumeracy, poor statistical reasoning, and other proxies for behavioral bias. These bias proxies decline with income and statistically account for 43 percent of lottery purchases, suggesting that at least some of lottery demand is due to behavioral bias, not just anticipatory utility or entertainment value. We use these empirical moments to estimate a model of socially optimal lottery design. In the model, current multi-state lottery designs increase welfare but may harm heavy spenders.

Objectives of this research

1. Show that stochastic dominance violations can emerge naturally and frequently when the DM derives anticipatory utility from his choices.

   ⇒ **assess the prevalence of this phenomenon**

2. Demonstrate that those violations are not due to noise; they have a very specific structure.

   ⇒ **characterize the shape of those violations**

3. Understand what people maximize i.e., what dimensions of uncertainty they value.

   ⇒ **derive implications for the modelling of anticipatory utility***

* Not there yet. At all.

Generating anticipatory utility (1)

- What do I mean by anticipatory utility?

  Utility derived ahead of the realization of an event (e.g., prize draw, consumption of a good, enjoyment of an activity) **from simply *thinking* about the outcome.**

  ⇒ anxiety, dread, fantasy, excitement, thrill
  ⇒ belief-dependent utility

- Mostly studied in the lab; often negative consumption events such as receiving electric shocks (Falk and Zimmermann 2017, Engelmann et al. 2022), or getting medical test results (Ganguly and Tasoff 2017)

- Here: (i) field study; (ii) positive consumption event (in normal times): going on a holiday trip

Generating anticipatory utility (2)

I worked with a company that sells **surprise trips**. There are several of them. Got in touch with a start-up based in Singapore called “Anywhr”.

What they (used to) offer:

1. At the time of booking: You give your budget, dates, travel preferences.
2. 3 days after booking: You receive a teaser with the forecast, departure time and airport.
3. One week before going to the airport: You receive a sealed envelope with all the information about your trip.
4. Suggestion: open only at the airport.

Until COVID-19 at least, the market was doing very well, attracting more and more travellers around the world.

NY Times March 9, 2019

The New York Times

TRENDING

Can't Decide Where to Go? Leave it to These 'Surprise Vacation' Planners.

Clues and packing tips abound, but the destination remains a mystery until the last minute.

You might be wondering who are the crazy people who do this ...

Clearly, not everyone would like this; need to understand heterogeneity.

Where did I go?

Well, since it's a talk about surprises and anticipatory utility, you will learn only at the end of the presentation (that was too tempting...).

What are "surprise trips"?

Fun but complex object with many dimensions. Will need to simplify a lot.

First: what's a holiday trip?

- An experiential good, where an experience is defined by a vector of n characteristics.
- A trip is a probability measure over experiences: already random!

Second: what's a "surprise trip"?

- A lottery over holiday trips with:
  1. unknown probability distribution (ambiguity)
  2. unknown support! (unawareness)
  3. late resolution of uncertainty

⇒ Here, focus on **risky lotteries** over fixed set of destinations
⇒ Keep realization date at 7 days before travel (no teaser)

What I will study (1)

How am I going to construct those risky lotteries?

STEP 1: Elicit preferences over a set X of destinations

$\Rightarrow$ ordinal ranking $\succeq$ on X

$\Rightarrow$ cardinal measure of preferences: WTP for each destination

STEP 2: Use the information on $\succeq$ obtained in STEP 1 to construct discrete choice problems of the type:

Choose between:

- Option A: a trip to a known destination
- Option B: a risky lottery over a subset of X

Example: Suppose Paris $\succ$ London. Then offer a choice between:

- Option A: Paris for sure
- Option B: 50/50 chance of Paris and London

What I want to know: How often and when do people take Option B?

What I will study (2)

To understand what makes people violate stochastic dominance, I am going to vary the characteristics of Option A and B.

In particular, the lotteries will differ in:

1. The number of possible trips
2. The trip destinations (how desirable they are according to the DM)
3. The probability measure (objectively given)

If the DM values uncertainty, what does he maximize?

$\Rightarrow$ Classify DMs into types according to the type of violations they exhibit.

Roadmap

1. Theoretical framework
2. Experimental design
3. Some findings ($N = 83$)

Primitive

I consider a weak order $\succeq$ on $\Delta^n(X)$ where:

- $X := \{x_1, x_2, ..., x_n\}$ is a set of n possible destinations
- $\mathbf{p} := (p_1, p_2, ..., p_n) \in \Delta^n(X)$ is a probability measure on X
- $v_k := v(x_k)$ is the valuation of trip x_k
- $\mathbf{v} := (v_1, v_2, ..., v_n)$ is the corresponding vector of valuations

Stochastic dominance

Stochastic dominance property:

$$\mathbf{p} \rhd_{SD} \mathbf{q} \text{ if } \mathbf{p}\{z : z \preceq x\} \leq \mathbf{q}\{z : z \preceq x\} \text{ for all } x \in X$$

The DM satisfies stochastic dominance if

$$\mathbf{p} \rhd_{SD} \mathbf{q} \text{ implies } \mathbf{p} \succ \mathbf{q}$$

Weaker property called "Internality":

$$x \succ y \Rightarrow x \succ px + (1-p)y \succ y \text{ for all } \alpha \in (0,1)$$

Will be interested in violations of the type:

$$px + (1-p)y \succ x \succ y \text{ for some } \alpha \in (0,1)$$

Other type of violation $x \succ y \succ px + (1-p)y$ has been documented (indirectly) by Gneezy, List and Wu (QJE, 2006).

Utility

I am going to study the following maximization problem:

$$\max_{\mathbf{p}\in\Delta^n(X)} U_{\alpha,\Psi}[\mathbf{p}] := \mathbf{p}\cdot\mathbf{v} + \alpha\Psi(\mathbf{p},\mathbf{v})$$

where $\Psi(.) \geq 0$ summarizes uncertainty in $\mathbf{p}$ and α is a taste parameter.

Primarily focus on functions of the form $\Psi(\mathbf{p},\mathbf{v}) = \psi(H(\mathbf{p},\mathbf{v}))$ where

1. $H(\mathbf{p},\mathbf{v})$ is "valid" measure of uncertainty (Frankel & Kamenica, 2019)
   - $H(x_k,\mathbf{v}) = 0$ for all $x_k \in X$
   - H is globally concave in $\mathbf{p}$
2. $\psi(.)$ is a strictly monotone transformation such that $\psi(0) = 0$.

When $\alpha > 0$, this representation generates a preference for randomization violating stochastic dominance. Goal:

- Understand the shape of Ψ
- Evaluate the size of α for each individual

Measures of uncertainty

Today, I will focus on a subset of these measures and their properties:

- Shannon entropy:

$$\Psi(\mathbf{p}, \mathbf{v}) = \psi(-\sum_{i=1}^{n} p_i \ln(p_i))$$

- Residual variance:

$$\Psi(\mathbf{p}, \mathbf{v}) = \psi(\sum_{i=1}^{n} p_i(1 - p_i))$$

- Variance in valuations:

$$\Psi(\mathbf{p}, \mathbf{v}) = \psi(\sum_{i=1}^{n} p_i(v_i - E[v])^2)$$

- Size of the support:

$$\Psi(\mathbf{p}, \mathbf{v}) = \psi(|\mathrm{supp}(\mathbf{p})| - 1)$$

Monotonicity properties (1)

What simpler properties does the DM violate with these different measures? Look at monotonicity in probabilities and monotonicity in prizes:

P-MON: For any $n \geq 2$, $\mathbf{p} \in \Delta^n(X)$, and x_i, x_j, x_k s.t. $x_j \succ x_k$,

$$x_i \succ (\ldots, x_j, p_j; \ldots; x_k, p_k; \ldots) \Rightarrow x_i \succ (\ldots, x_j, p_j - \epsilon; \ldots; x_k, p_k + \epsilon; \ldots)$$

$\forall \epsilon > 0$ s.t. $\mathbf{p}_\epsilon := (\ldots, p_j - \epsilon, \ldots, p_k + \epsilon, \ldots) \in \Delta^n(X)$ and $\text{supp}(\mathbf{p}) = \text{supp}(\mathbf{p}_\epsilon)$.

X-MON: For any $n \geq 2$, $\mathbf{p} \in \Delta^n(X)$, and x_i, x_j, x_k, $\tilde{x}_k$ s.t. $x_k \succ \tilde{x}_k$,

$$x_i \succ (\ldots, x_j, p_j; \ldots; x_k, p_k; \ldots) \Rightarrow x_i \succ (\ldots, x_j, p_j; \ldots; \tilde{x}_k, p_k; \ldots)$$

Monotonicity properties (2)

Can verify that:

- Entropy and residual variance violate P-MON and satisfy X-MON.
- Variance in valuations violates both.
- Support violates neither.

$\Rightarrow$ Use these properties to classify DMs into types.

Implementation

- Conducted a small pilot (about 10 people recruited on Facebook) in December 2019 - led me to simplify a lot.
- Collected data in March 2020 with 83 UK travellers recruited via Facebook + LSE subject pool (NOT the company's customers).
- 1 in 20 respondents could win a free trip to a European destination for 4 days and 3 nights worth £420 (+ travel vouchers/money).
- Survey with 5 sections - one randomly selected to count.

Experimental design in a nutshell

1. Elicitation of preference ordering over 10 destinations.
2. 45 binary choice problems with various lotteries
3. One "design-your-own lottery" task
4. Two valuation tasks: choose your realization date + "wildcard" trip
5. One control task (with money) + information on travellers' preferences

Destinations (1)

Presented with a set of 10 destinations:

Düsseldorf, Gothenburg, Maastricht, Midi-Pyrénées, Porto, Prague, Santiago de Compostela, Sofia, Turku, and Zakopane.

Destinations selected with 4 concerns in mind:

- no two destinations should be in the same country
- should offer a diversity of experiences
- should be easy to travel to and from (+ safe!)
- should all have the same market value

Destinations (2)

Destination: **Turku** (Finland)

Description: Step back through the ages in this medieval town, and explore the maze-like chambers of the impressive Turku Castle. Enjoy nature in national parks, sunbathe on beaches, and explore museums, art galleries, historic sites, restaurants aplenty, and shopping hotspots, all around town.

Accommodation: Arrive at Helsinki airport and take a train to Turku. For the best experience of living local, stay in a cosy Airbnb that you'll have entirely to yourself, located conveniently in the central of town.

Preference elicitation (1)

Elicitation of weak ordering $\succeq$ on X:

1. Rank alternatives in terms of preference
2. Elicit valuation by asking for equivalent amount of money ($\leq$ £500)

Incentive compatible procedure under standard assumptions:

- Valuations elicited through BDM (like second-price auction)
- Higher chance of being offered a higher ranked destination

More tricky here: random mechanism could be manipulated to generate excitement.

- Limited concern even in theory (delay only until the end of the survey)
- Additional checks in place
- If anything, would lead to a downward bias in the estimate of α

Preference elicitation (2)

1. **Sofia**. Your minimum price: £ 400
2. **Düsseldorf**. Your minimum price: £ 320
3. **Maastricht**. Your minimum price: £ 300
4. **Gothenburg**. Your minimum price: £ 280
5. **Prague**. Your minimum price: £ 250
6. **Santiago de Compostela**. Your minimum price: £ 200
7. **Porto**. Your minimum price: £ 180
8. **Turku**. Your minimum price: £ 150
9. **Zakopane**. Your minimum price: £ 120
10. **Midi-Pyrénées**. Your minimum price: £ 110

Binary choice problems (1)

Present 45 binary choice problems (in fixed order because of increasing complexity).

Option A: x_1, x_2, x_3, x_5 or x_{10}

Option B (lottery) varies in:

- Cardinality of the support: 2, 3, 5 or all 10 destinations (+ 6 degenerate choices)
- Rank of destinations
- Probability measure: $(p, 1-p)$ with $p = 0.1$, 0.5 or 0.9; (close to) uniform for $n > 2$

Binary choice problems (2)

Note:

- Choices displayed depend on participant's rank ordering.
- Also offer choices allowing to test for opposite violations of stochastic dominance (preference for certainty).

Design own lottery

Binary choice setup does not tell us about the optimal **p**.

In the next part, I offer people to build their own lottery:

- Pick support of the lottery (degenerate lotteries allowed)
- Pick ticket allocation (100 tickets to play with)

Allows to better understand the objective function of the DM.

Valuation of a “wildcard trip”

Admittedly, the risky lotteries I study are far from what the company sells. What’s the relationship?

Elicit valuation for a “wildcard trip”:

- One additional trip chosen by the company
- Same market value and conditions as the other 10 trips
- Also in Europe (not necessarily a new country)
- Told nothing else

Remark: More extreme uncertainty than what the company sells: participants cannot restrict the set of states of the world in any way.

Preference for delay

- I want to argue that (at least part of) the observed violations are due to anticipatory utility.
- If true, people should prefer to delay the resolution of uncertainty:
  - Elicit **preferred revelation date** and **WTP for delay**
  - Ask participants to give the **main reasons for their choices**

Optimal date

Choice from list of dates:

- *"today, after I completed the survey"*, *"about 48h from now"*, *"about N weeks from now"* ($N \in \{1, 2, 4\}$)
- *"about n weeks before going to the airport"* ($n \in \{1, 2, 4\}$), *"about 24h before going to the airport"*
- *on a specific day of my choice*

If did not select *"today, after I completed the survey"*, then gave MPL:

1.	REVEALING LATER	●	○	REVEALING NOW + £5
2.	REVEALING LATER	●	○	REVEALING NOW + £10
3.	REVEALING LATER	●	○	REVEALING NOW + £15
4.	REVEALING LATER	○	●	REVEALING NOW + £20
5.	REVEALING LATER	○	●	REVEALING NOW + £30
6.	REVEALING LATER	○	●	REVEALING NOW + £40
7.	REVEALING LATER	○	●	REVEALING NOW + £50

Would this happen with money?

Multidimensional object: even when the preference ordering is clear, might want to randomize over characteristics.

What happens in the one-dimensional "cold" world of money?

To test this, I ask participants to complete 3 binary choice problems with monetary amounts:

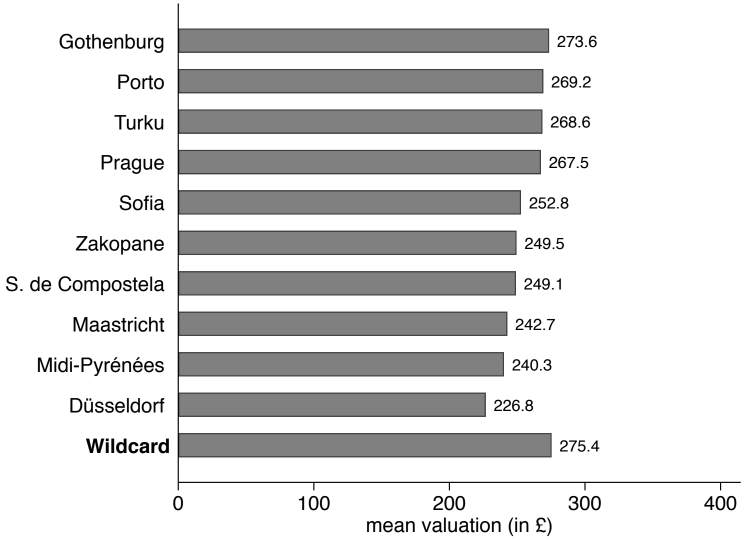
- 3 decisions taken from the set of 45 choice problems presented earlier
- Replace trips with equivalent amount of money
- Prize to be received on same date as trip
- Fix timing of the resolution of uncertainty at one week

Summary of dataset

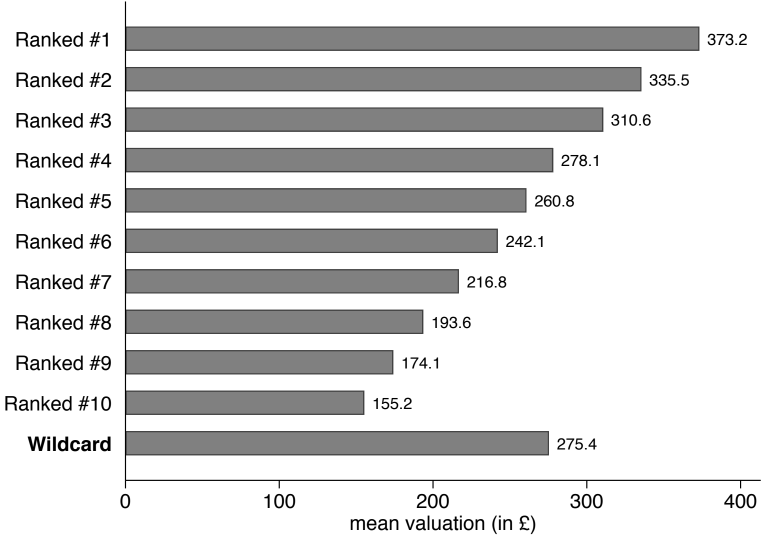
Sample with 83 respondents and for each respondent, I observe:

1. A preference ordering $\succeq$ on set of 10 destinations + WTP for each.
2. 45 choices between Option A (sure trip) and Option B (sure or lottery)
3. One "design-your-own lottery" task
4. Two valuation tasks: choose your realization date + "wildcard" trip
5. One control task (with money) + information on travellers' preferences

Mean WTP (1)


Gothenburg
273.6
Porto
269.2
Turku
268.6
Prague
267.5
Sofia
252.8
Zakopane
249.5
S. de Compostela
249.1
Maastricht
242.7
Midi-Pyrénées
240.3
Düsseldorf
226.8
Wildcard
275.4
0
100
200
300
400
mean valuation (in £)

Mean WTP (2)


Ranked #1
373.2
Ranked #2
335.5
Ranked #3
310.6
Ranked #4
278.1
Ranked #5
260.8
Ranked #6
242.1
Ranked #7
216.8
Ranked #8
193.6
Ranked #9
174.1
Ranked #10
155.2
Wildcard
275.4
0
100
200
300
400
mean valuation (in £)

Data quality

1. Inconsistencies between ordinal ranking and WTP:
   - 88% (73/83): no violation
   - 6% (5/83): 1 violation
   - 6% (5/83): > 1 violation

2. Indifferences (e.g., same WTP for cities #1 & #2):
   - 52% (43/83): strict ordering
   - Modal (median) number of indifferences is 1 (2)

3. Binary choice problems with 6 direct choices:
   - (x_1, x_2), (x_1, x_3), (x_2, x_3), (x_1, x_5), (x_1, x_{10}), (x_5, x_{10})
   - 81% (67/83) never contradict their initial ranking
   - 11% (9/83) consistent 5 out of 6 times
   - More violations for 8% (7/83)

$\Rightarrow$ Give ranges depending on definition of what constitutes a violation.

Summary of findings from binary choice problems

1. Violations in favor of “surprise” are pretty **common**:
   - On average, violations occur 20% - 26% of the time.

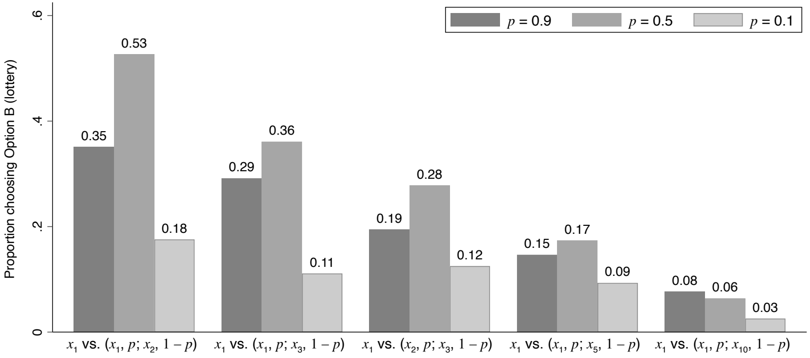
2. There is substantial **heterogeneity**:
   - 29% never violate SD in favor of surprise
   - 20% violate SD in favor of surprise $\geq$ 9 times (max of 24 possibilities)

3. When people randomize, they prefer lotteries with **higher entropy**:
   - $(x_1, 0.5; x_2, 0.5) \succ x_1$ for over 50%
   - $(x_1, 0.9; x_2, 0.1) \succ x_1$ for 35%

4. Lotteries with medium support are pretty popular:
   - $(x_1, 0.4; x_2, 0.4; x_3, 0.3) \succ x_1$ for 37%
   - $(x_1, 0.2; x_2, 0.2; x_3, 0.2; x_4, 0.2; x_5, 0.2) \succ x_1$ for 37%

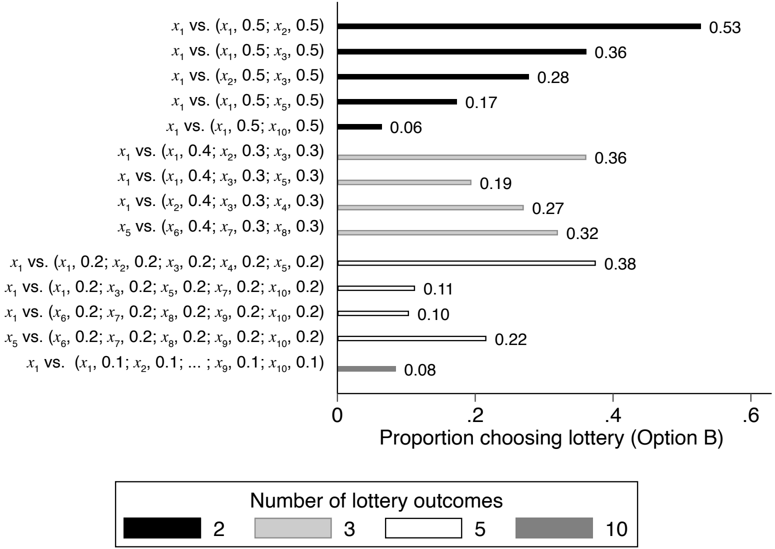
5. Willingness to randomize **drops fast with worse options** in lottery:
   - $(x_1, 0.5; x_3, 0.5) \succ x_1$ for 36%
   - $(x_1, 0.5; x_5, 0.5) \succ x_1$ for 17%
   - $(x_1, 0.5; x_{10}, 0.5) \succ x_1$ for 6%

Stochastic dominance violations as a function of p (binary lotteries)

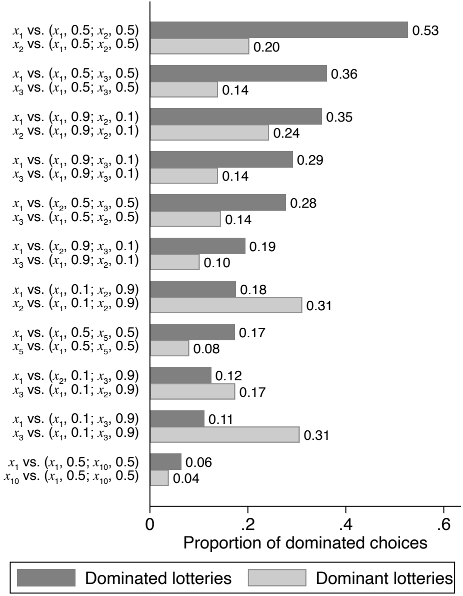


Notes: Respondents for whom the problem does not qualify as a stochastic dominance problem (due to an indifference or inconsistency) were removed from the denominator.

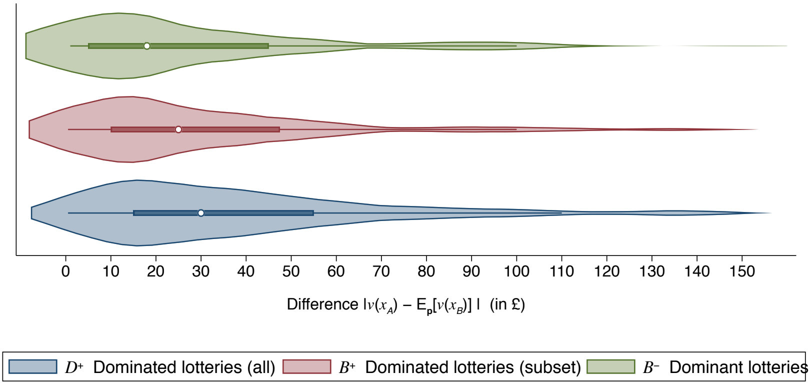
Stochastic dominance violations as a function of the size of the support



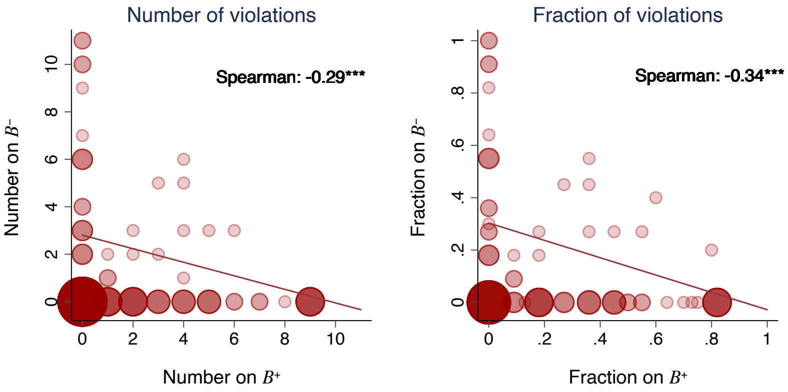
Preference for randomization vs. preference for certainty



Monetary cost of SD violations



Link between preference for randomization vs. certainty

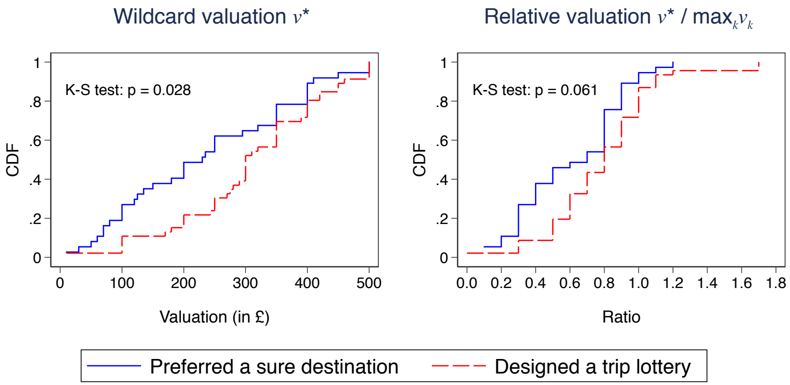


- Consider 4 stochastic choice benchmarks
- Would generate either positive or zero correlation

Favorite lottery

- 55% (46/83) build a lottery instead of picking a sure destination.
  - Strong relationship with decisions in discrete choice problems.
- Lottery characteristics:
  - Choose on average to put 4 destinations in the support.
  - Generally, higher probabilities on options ranked higher.
- Preferred date:
  - Only about 25% choose *"today, after I completed the survey"*.
  - There is large variance in amount of delay.
  - Over 60% willing to pay for preferred date; avg. WTP around 15 GBP.

Link between WTP for wildcard and design decisions



Summary

1. Violations are quite frequent, non-trivial, and have specific shape:
   - *Prevalence*: Stochastic dominance violations in favor of randomization on average occur $\approx 20\%$ of the time. Substantial heterogeneity.

     $\Rightarrow$ Preference for certainty vs. randomization correspond to $\neq$ types.
   - *Size*: £20-30 median loss in expected value, 5-7% of trip market value.
   - *Shape*: Preference for higher entropy (P-MON violations).
2. Associated with preference for delaying the resolution of uncertainty.
3. Linked to preferences for more radical uncertainty (wildcard).

Last stop: What happens when using money instead of trips?

Almost no violations in the money domain

Offered 3 decision tasks involving money:

- Decision 1: v_1 vs. $(0.5, v_1; 0.5, v_2)$ (or 400 and 350)
- Decision 2: v_2 vs. $(0.5, v_1; 0.5, v_2)$ (or 400 and 350)
- Decision 3: v_1 vs. $(0.2, v_1; 0.2, v_2; 0.2, v_3; 0.2, v_4; 0.2, v_5)$ (or 400, 370, 350, 320, 300)

$\Rightarrow$ Total violations: 4%, 11% and 1%.

Next steps (1): Randomization over attributes

- Money is not the right space. Too abstract and one-dimensional.
- Stochastic dominance violations likely come from randomization over attributes of the trips.
- Basic idea:
  - Difference in attributes creates variance in the dream.
  - Generate excitement and avoid boredom.

Next steps (2): Attention and anticipatory utility

- Preference for randomization: fantasizing / exploring various worlds
- Preference for certainty: savoring / dwelling on specific world
- Have to trade the richness of the dream for the salience of the dream (breadth vs. depth) because attention is limited.
- Need to incorporate attention into models of anticipatory utility

Next steps (3): Outcome valence

- Importance of the **valence** of the outcomes over which randomization takes place:
  - Trips are pleasurable events.
  - Money is a neutral good.
- Would you randomize over doctor appointments?
- What about if good and bad outcomes were mixed in the lottery?

Going beyond...

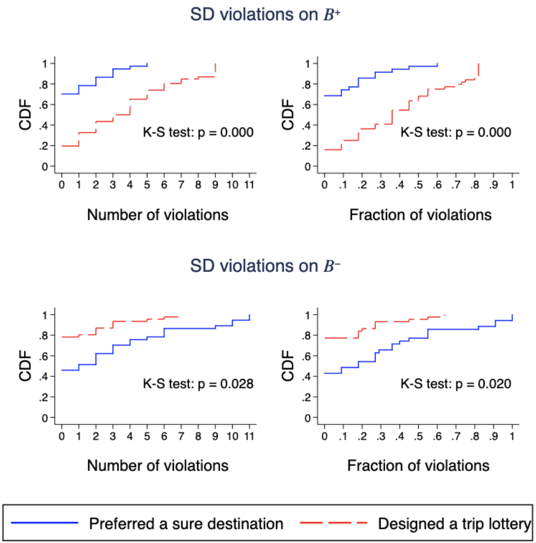
Many, many open questions!

1. **Going from objective to subjective uncertainty**:
   - Risky lotteries ignore ambiguity and unawareness.
   - Quantification of uncertainty outside of risk is hard.
   - Insights for product design?
2. **Timing of the resolution of uncertainty**:
   - Determinants of chosen delays?
   - Need exogenous variation in distance to consumption date, costs and benefits, one-shot vs. gradual, etc.
3. **Population prevalence and predictors of heterogeneity**:
   - Stable across domains? Different personality types?
   - Substitution effects?

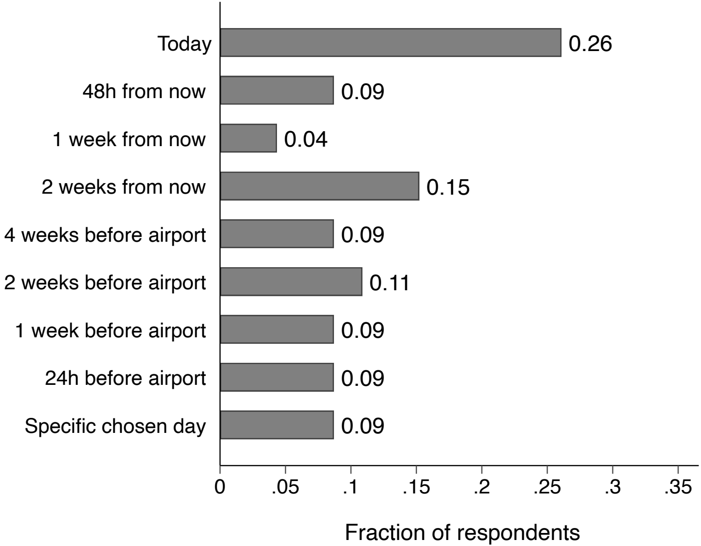
Ok, I promised something before...

I went to...

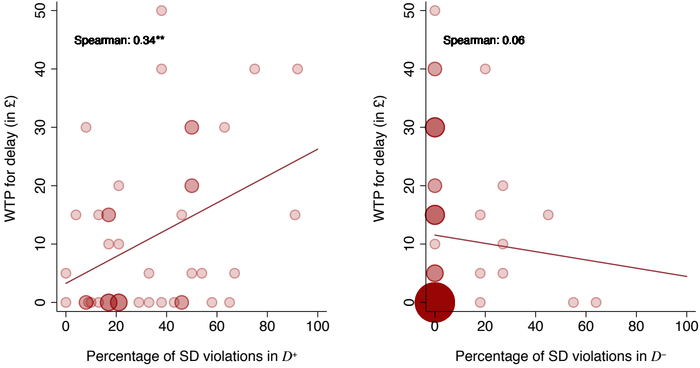
Link between SD violations and design decisions



Distribution of chosen delays (N = 46)

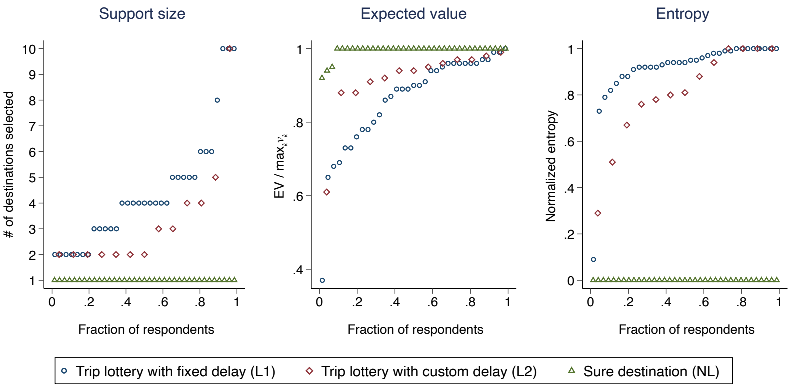


Link between SD violations and WTP for delay

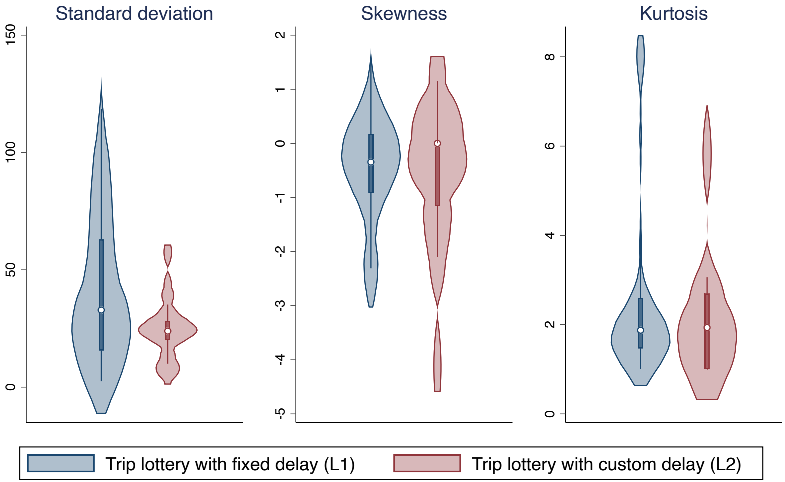


- Some (non robust evidence) of positive correlation between SD violations on $\mathcal{D}^+$ and WTP for delay.
- WTP for delay increasing in monetary value loss and entropy of designed lottery (no relationship with support).
- Larger chosen delays $\Rightarrow$ higher WTP for delay.

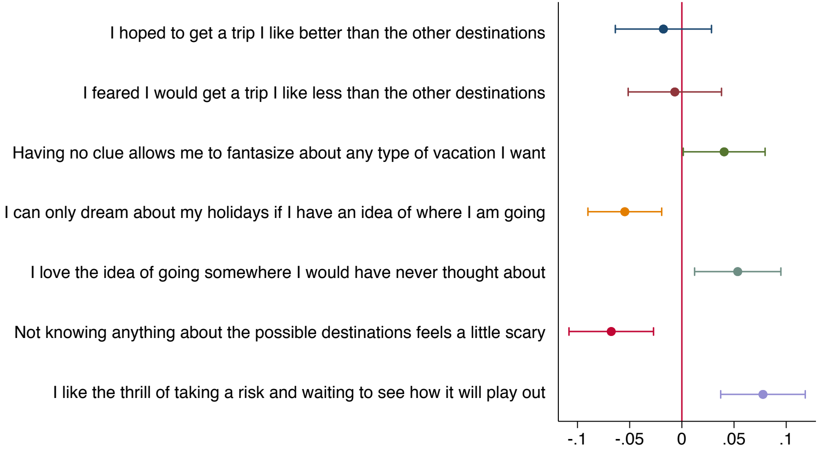
Characteristics of favorite lottery (1)



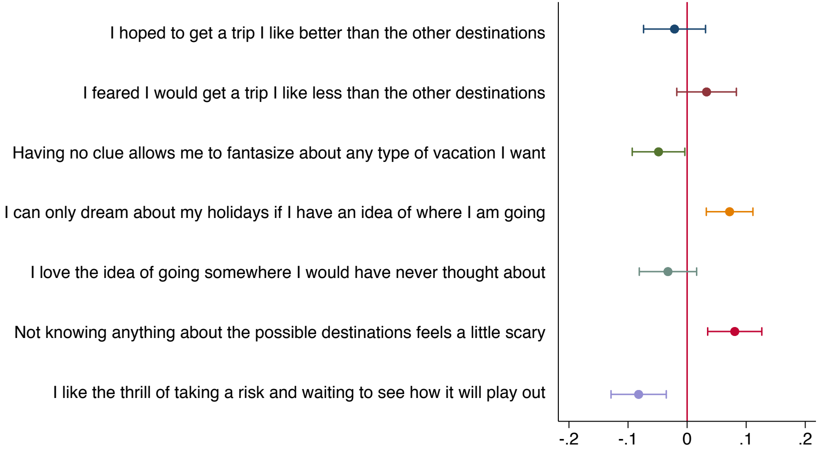
Characteristics of favorite lottery (2)



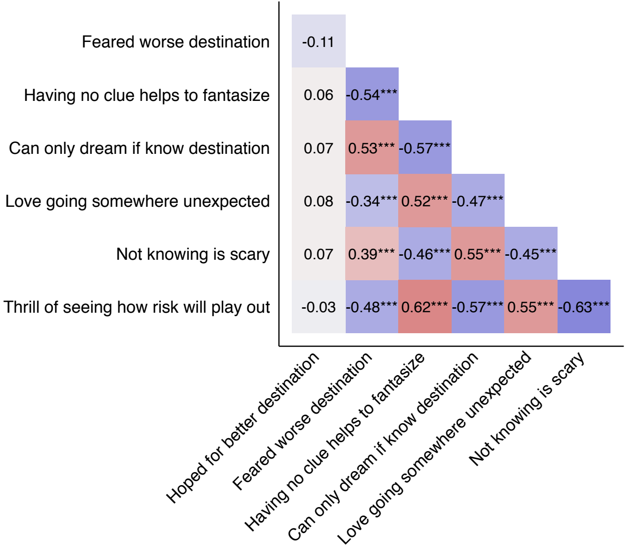
Relationship between motives for wildcard and SD violations on $\mathcal{D}^+$



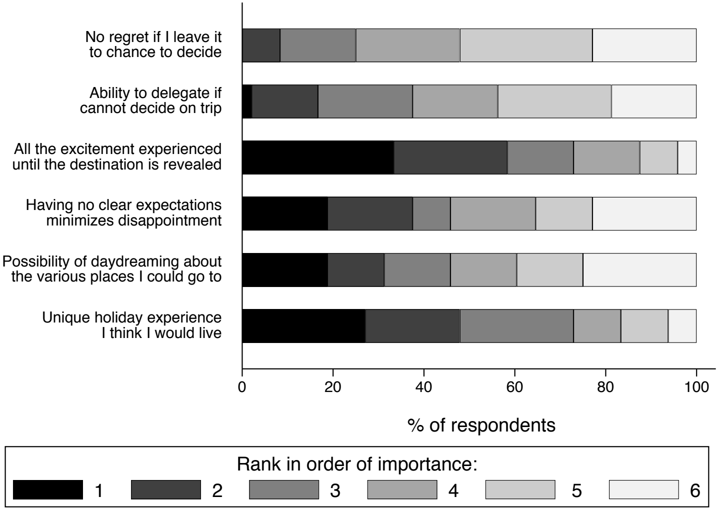
Relationship between motives for wildcard and SD violations on $\mathcal{D}^-$



Correlation between motives for wildcard

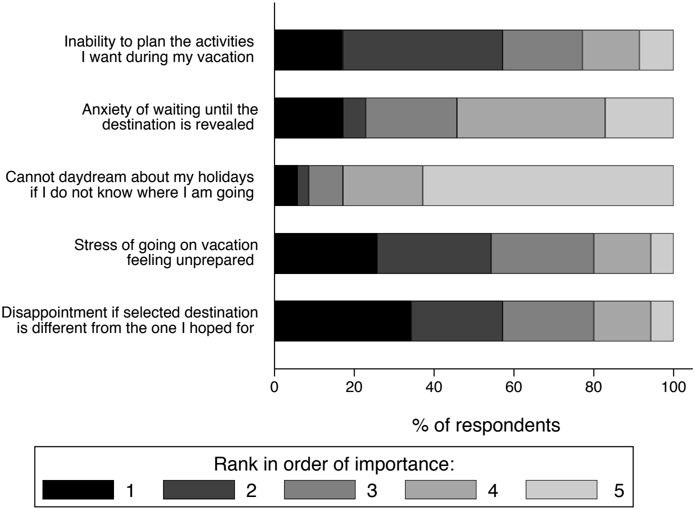


Why likes "surprise trips"



Notes: N= 48

Why does not like “surprise trips”



Notes: N= 35

Holiday trip preferences (4)