Back to Edgeworth?
Estimating the Value of Time Using Hedonic Experiences

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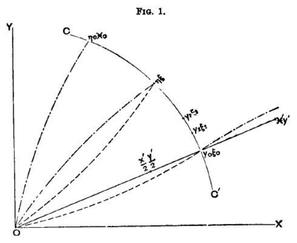
Background & Motivation

- Time matters great deal to people – ultimate scarce resource.
- If markets fail to provide means to optimally allocate time (e.g. via time-saving infrastructure such as faster roads), rationale for policy to intervene.
- But how shall we value time and related time savings?
- Typically, value of time (VOT) is estimated from stated (e.g. choice experiments) or revealed (e.g. quasi-natural experiments, field experiments) preferences.
- Can be problematic due to framing, cognitive biases such as present bias, subjectivity of (passage of) time, and systematic errors in affective forecasting.
- We propose new, two-step method to bypass these problems: *experiential valuation*.
  - Estimates how happy people are when engaging in any activity.
  - Calculates marginal rate of substitution between any activity and income.
- We use our method to estimate VOTs in 42 different activities.

The History

- Basic idea behind experiential valuation goes back to early economist Francis Y. Edgeworth (1845-1926), who also developed the Edgeworth box.
- In "Mathematical Psychics" (1881), Edgeworth argued that new technical developments would make it possible to develop "hedonimeter", which would allow to directly measure utility on physiological basis.
- Our method builds on Edgeworth's hedonimeter but has two key differences:
  1. Collects data in discrete time.
  2. Does not assume that measure of hedonic experiences (i.e. feeling happy) is equal to (flow) utility.
- Our *hedonimeter light* is smartphone app (called *Mappiness*) that sampled hedonic experiences of UK residents longitudinally over several years.



Data

- Mappiness Study: panel data on hedonic experiences of 30,936 UK residents (N=2,235,733) from 2010 to 2017.
- Was downloadable from Apple Store and covered by media (i.e. BBC), hence rather "broad" participant base. Incentivised via providing personalised feedback.
- Messaged participants at *random* points in time and asked them (in this order):
  1. How happy they felt right now.
  2. Where they currently were.
  3. Who they were currently with.
  4. What they were currently doing.
- Location recorded using GPS.
- We use our hedonimeter light to estimate VOTs, first in activity "waiting" as an example and then in 41 other activities.

Estimation & Identification

- We estimate VOT in activity "waiting or queueing" as follows:

$$y_{it} = \alpha + \delta Waiting_{it} + \beta_1' A_{it} + \beta_2' C_{it} + \beta_3' P_{it} + \beta_4' L_{it} + \beta_5' M_{it} + r + t_s + t_{hd} + t_{dw} + t_m + t_y + u_i + \epsilon_{it}$$

- y_{it} is happiness of respondent *i* at time *t*.
- $Waiting_{it}$ is dummy that equals one if reported *waiting or queueing*.
- A_{it} are dummies for 41 other (simultaneous) activities; C_{it} are dummies for (multiple) social company (7 types, e.g. colleagues or classmates); P_{it} for place (3 types, e.g. at work); L_{it} for location (4 types, e.g. indoors); M_{it} are weather controls.
- r are region fixed effects (8,925 MSOAs); t_s are holiday-season, t_{hd} hour-of-day, t_{dw} day-of-week, t_m month, and t_y year fixed effects; u_i are individual fixed effects.
- Identification relies on random timing of sampling and selection on observables.

Results

- "Waiting or queueing" has strong, negative effect on happiness: $\delta = -0.36$ (0-10 scale).
- VOT of "waiting or queueing" (i.e. $VOT_{k=1}$) can be calculated as follows:

$$\begin{aligned} VOT_{k=1} &= (MRS_{k=1} - \sum_{k=2}^{42} MRS_k \times s_k) \times 60 \\ &= (\frac{\frac{\partial y_{it}}{\partial Waiting_{it}}}{\frac{\partial y_{it}}{\partial Income_{it}}} - \sum_{k=2}^{42} \frac{\frac{\partial y_{it}}{\partial A_{it,k}}}{\frac{\partial y_{it}}{\partial Income_{it}}} \times s_k) \times Income_{UK} \times 60 \\ &= \frac{-0.36}{0.0009} \times 0.0003 \times 60 - 3.96 \\ &= -12.2 \end{aligned}$$

- $ln(Income_{it}) = 0.09$ for annual net household income, $Income_{UK} = 18,200$ for median annual net household income in UK, and s_k is response share in activity $A_{it,k}$.

Discussion

- On average, VOT in activity waiting, queueing is £ -12.2 ($ -16.6) per hour.
  - About 87% of median wage rate in UK in 2021, which is £ 14.1 (ONS, 2021).
- Smaller (yet not too far off) than Goldszmidt et al. (2020), who use natural field experiments amongst users of Lyft ride-sharing app in US ($19).
  - Findings from wellbeing data similar to observed behaviour.
- On the right, you can see the VOT in 42 activities in our data.

Activity ($A_{it,k}$)	Response Share s	Daily Duration (Minutes)	Happiness Impact	Happiness Monetised Impact (£)	VOT_k
2. Working, studying	0.25	229.17	-1.61	-3.7	-12.3
3. In meeting, seminar, class	0.03	25.96	0.30	0.7	-6.9
4. Travelling, commuting	0.09	82.38	-1.86	-4.3	-12.4
5. Cooking, preparing food	0.04	39.54	2.24	5.1	-2.2
6. Housework, chores, DIY	0.05	47.61	-0.53	-1.2	-8.9
7. Shopping, running errands	0.03	27.61	0.71	1.6	-5.9
8. Admin, finances, organising	0.04	35.96	-1.27	-2.9	-10.7
9. Childcare, playing with children	0.04	40.82	2.77	6.3	-0.9
10. Petcare, playing with pets	0.02	17.25	3.19	7.3	-0.0
11. Care or help for adults	0.01	4.95	-3.85	-8.8	-16.7
12. Sleeping, resting, relaxing	0.10	90.46	0.92	2.1	-5.3
13. Sick in bed	0.02	14.04	-18.37	-41.9	-51.2
14. Meditating, religious activities	0.00	2.84	3.95	9.0	1.6
15. Washing, dressing, grooming	0.04	33.76	2.01	4.6	-2.8
16. Talking, chatting, socialising	0.15	136.97	4.17	9.5	3.6
17. Intimacy, making love	0.01	5.14	12.66	28.9	22.1
18. Eating, snacking	0.10	90.09	2.01	4.6	-2.5
19. Drinking tea or coffee	0.06	58.90	1.39	3.2	-4.2
20. Drinking alcohol	0.05	46.51	3.61	8.2	1.2
21. Smoking	0.01	12.11	0.45	1.0	-6.6
22. Texting, email, social media	0.06	51.56	0.92	2.1	-5.4
23. Browsing the Internet	0.05	47.06	0.78	1.8	-5.7
24. Watching TV, film	0.18	165.13	2.28	5.2	-1.4
25. Listening to music	0.06	57.52	3.28	7.5	0.5
26. Listening to speech or podcast	0.02	19.17	1.75	4.0	-3.5
27. Reading	0.03	30.27	1.93	4.4	-3.00
28. Theatre, dance, concert	0.00	3.03	6.55	15.0	7.7
29. Exhibition, museum, library	0.00	2.11	5.18	11.8	4.5
30. Match, sporting event	0.01	5.50	2.37	5.4	-2.1
31. Walking, hiking	0.01	13.58	2.40	5.5	-1.9
32. Sports, running, exercise	0.01	11.47	6.71	15.3	8.3
33. Gardening, allotment	0.00	2.84	4.83	11.0	3.7
34. Birdwatching, nature watching	0.00	1.47	4.52	10.3	3.0
35. Computer games, smartphone games	0.03	25.87	2.59	5.9	-1.4
36. Hunting, fishing	0.00	0.18	3.59	8.2	0.8
37. Other games, puzzles	0.00	3.67	2.70	6.2	-1.3
38. Gambling, betting	0.00	0.64	1.61	3.7	-3.9
39. Hobbies, arts, crafts	0.01	9.45	5.14	11.7	4.5
40. Singing, performing	0.00	3.67	6.00	13.7	6.5
41. Something else	0.01	11.74	-1.54	-3.5	-11.3
42. Other	0.03	28.71	-3.58	-8.2	-16.3

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