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The relation between time preferences and Covid vaccination hesitancy

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Background

- Many health-related and financial decisions involve costs and consequences that occur at different points in time.
- Consequently, such decisions frequently require intertemporal tradeoffs, which are affected by the decision maker's time preference.
- One important preventive behavior where time preferences are influential concerns vaccination against possible future diseases (Chapman et al., 2001; Chapman and Coups, 1999; Jit and Mibei, 2015; Westra et al., 2012).

Theory

- Getting vaccinated entails a cost now (mostly in terms of travel costs and side-effects, as most Covid-19 vaccines are funded by the government)
- Future benefits in terms of protection against future infection and lower health loss in case of an infection
- According to discounted utility (DU), this yields:

$$U(-c, t0) + D(t1)*E(U(b, t1))$$

- Ignoring other factors such as externalities for simplicity
- There may also be a risk of future side-effects of a vaccination

Vaccination decision

- Obviously, the decision to vaccinate depends on many factors, e.g.
  - Availability and quality
  - Government regulations (e.g. needed for work, to attend events, etc.)
  - Desire for traveling
  - Medical condition
  - Herd immunity
  - Trust
  - Risk attitude (Courbage and Peter, 2021; Lepinteur et al. 2023)
    - Risk of getting (sick from) Covid
    - Risk of side-effects of vaccine Time preference

Contribution

- We disentangle the discount rate and the present bias
- The first to measure time preference in the context of Covid vaccination by means of choice list methodology
- We control for willingness to take risks
- Using a very large, multi-country sample (over 49,232 respondents in 21 countries)

Predicted effect of time preferences

- Higher discounting may reduce the demand for vaccination if the immediate rewards are low/unclear
- On the other hand, high discounters may be more likely to accept a worse vaccine now to get access to particular activities (e.g. traveling, bars, events) without testing and/or to reduce the current chance of a Covid-19 infection
- Low discounters may wait very long, hoping for a better/safer vaccine

Time preferences

- We assume the quasi-hyperbolic discounting model: $D(t)=\beta*exp(-rt)$ for $t>0$
- Additionally, we consider the constant discounting model ($\beta=1$), using the average discount rate of the 2 choice lists
- Linear utility assumed given the small stakes involved
- Hypothetical incentives
- Two choice lists to separately estimate the 2 parameters:
  - One with 2 delayed options (r)
  - One with a present and a delayed option (β, given estimate of r from 1st choice list)

Related literature

- Many studies found a negative relation between time preference and vaccination behavior:
  - Influenza (Chapman and Coups 1999)
  - Hepatitis B (Guo et al. 2020)
  - Polio (Andreoni et al. 2022)
  - Covid-19 (Strickland et al. 2022, Halilova et al. 2022, Hudson et al. 2022, Okamoto et al. 2021)

Vaccination behaviours

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1. **Which of the following best represents your COVID-19 vaccination status?** Please tick ✓ one box only.

Accepter

- ☐ I already received the booster (3rd doses)
- ☐ I already received the 2 vaccine shots and waiting for the booster
- ☐ I already received the 2 vaccine shots
- ☐ I already received the 1st shot and I am waiting for the 2nd one

- ☐ I want to receive the vaccine, but it is difficult for me to get it

Hesitater

- ☐ I am planning to get vaccinated
- ☐ I will be vaccinated only when I am sure it is effective
- ☐ I will be vaccinated only when I know more about the possible long-term side-effects

Rejecter

- ☐ I have no intention to get the vaccine
- ☐ Due to a health condition, the vaccine is strongly not recommended for me
- ☐ Other, please specify in the box below

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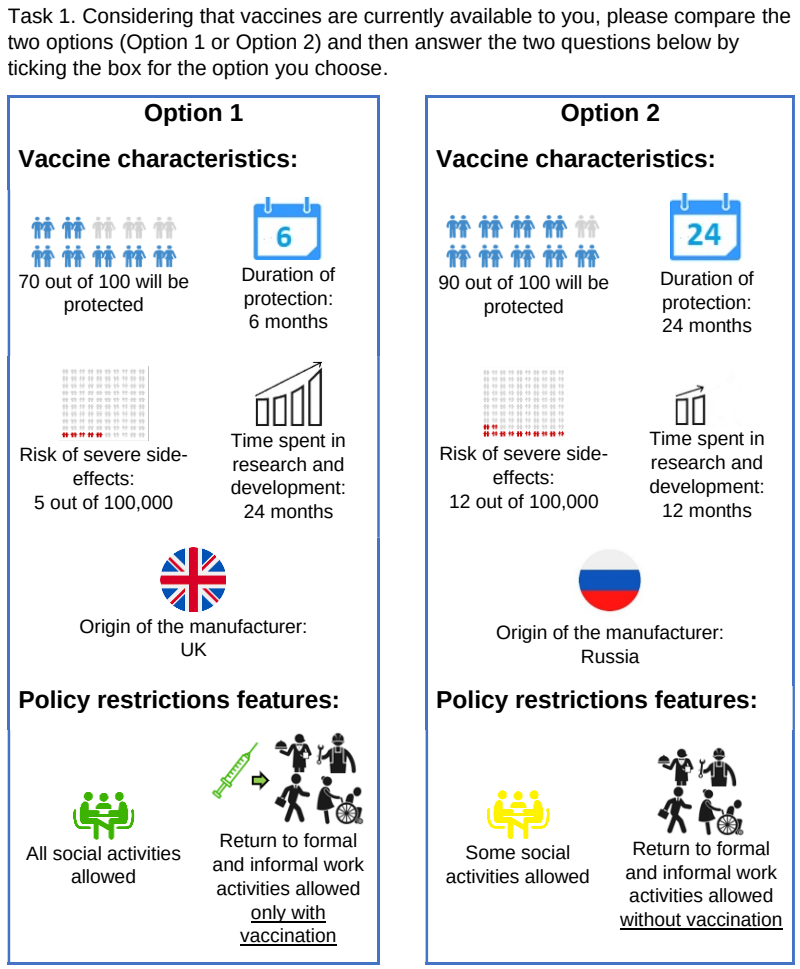
DCE task

- 12 hypothetical choice tasks
- DCE included 7 attributes:
  - Effectiveness of vaccine
  - Risk of severe side-effects
  - Duration of protection
  - Time to market approval
  - Origin of manufacturer
  - Allowance of leisure activities
  - Vaccination mandates



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DCE

- DCE results not reported in this study
- We only use the answers to the Vaccination (Yes/No) questions as a measure of preferences for vaccination
- This is because the revealed vaccination status need not necessarily reflect preferences but may be affected by mandates

Time preference

- Imagine that you have won a lottery and have to choose whether to receive the prize immediately or in three months. Which of the options reported below do you prefer - Option A or Option B?

	Option A	Option B
1.	□ $5 today	□ $100 in 3 months
2.	□ $10 today	□ $100 in 3 months
3.	□ $15 today	□ $100 in 3 months
4.	□ $20 today	□ $100 in 3 months
5.	□ $25 today	□ $100 in 3 months
6.	□ $30 today	□ $100 in 3 months
7.	□ $35 today	□ $100 in 3 months
8.	□ $40 today	□ $100 in 3 months
9.	□ $45 today	□ $100 in 3 months
10.	□ $50 today	□ $100 in 3 months
11.	□ $55 today	□ $100 in 3 months
12.	□ $60 today	□ $100 in 3 months
13.	□ $65 today	□ $100 in 3 months
14.	□ $70 today	□ $100 in 3 months
15.	□ $75 today	□ $100 in 3 months
16.	□ $80 today	□ $100 in 3 months
17.	□ $85 today	□ $100 in 3 months
18.	□ $90 today	□ $100 in 3 months
19.	□ $95 today	□ $100 in 3 months
20.	□ $100 today	□ $100 in 3 months

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Results

Discount rates by country

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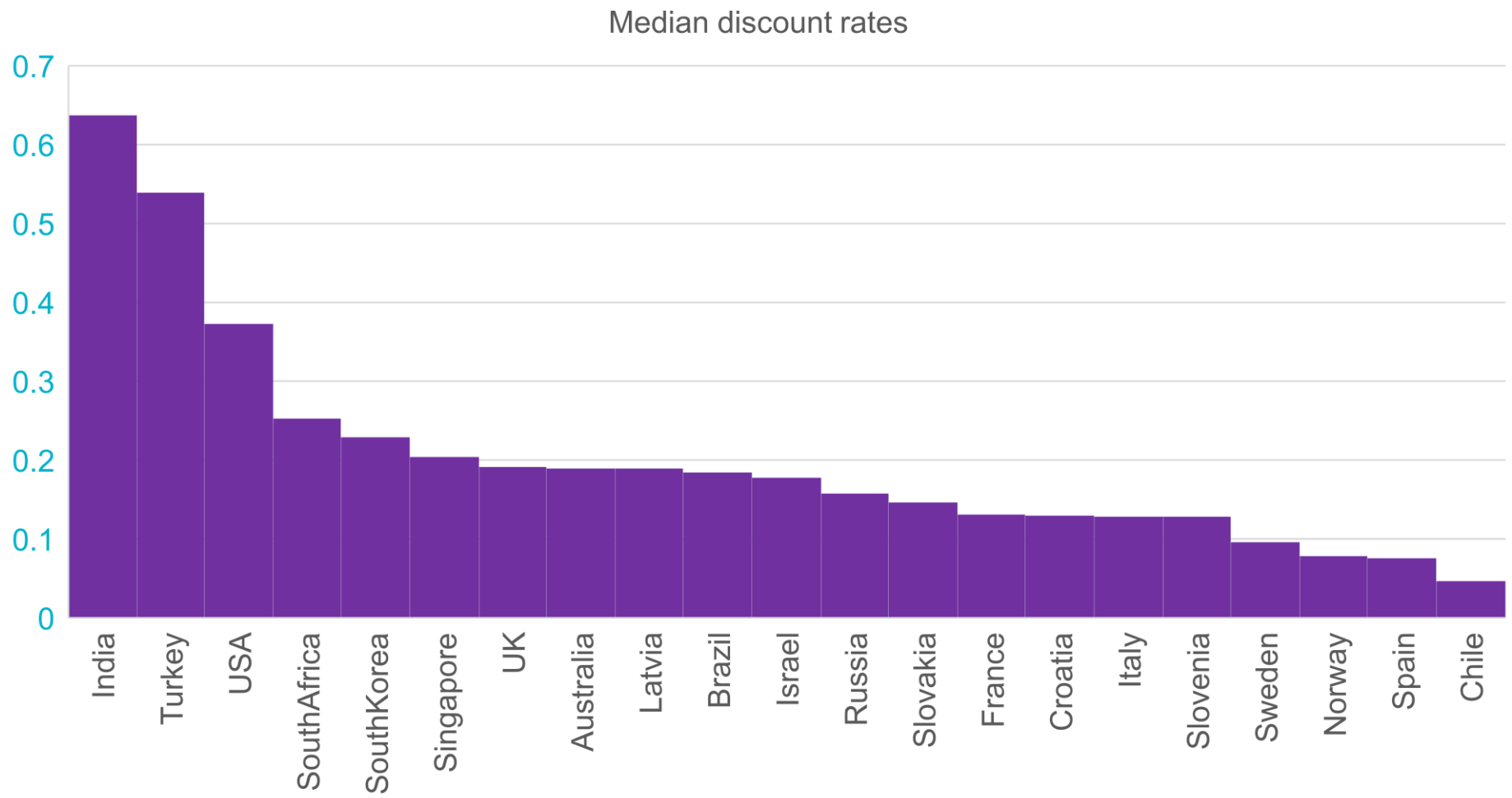

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Present bias by country

Some other observations on beta

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- Females have higher beta than males
- Elderly and higher educated have lower beta
- Low- and high-income people have higher beta than middle-income people

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Results – discount rates

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Multinomial logistic regression with the average discount rate from the 2 choice lists assuming constant discounting (REVEALED PREFERENCES)

		Pooled dataset Vacc_hesitancy
Refuser	**Rho (avg list 1 & 2)**	**-.02**
		(.04)
	cons	-2.29***
		(.02)
Hesitant	**Rho (avg list 1 & 2)**	**.18*** **
		(.05)
	cons	-2.96***
		(.03)
	Vaccinated (baseline)	-
Observations		48241
Pseudo R2		<0.01
ll		-23334.17
Chi2		14.8
Akaike's Crit		46676.34
Bayesian Crit		46711.47
	Standard errors are in parentheses	
	*** p<.01, ** p<.05, * p<.1	

Results – discount rates

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Logistic regression on vaccine hesitancy (Non vaccinated =0 vs vaccinated=1) assuming constant discounting & controlling for countries effect (REVEALED PREFERENCES)

		Pooled dataset Vacc hesitancy
	Rho (avg list 1 & 2)	**-.11*** (.03)**
country	Australia (baseline)	-
	Brazil	.89*** (.12)
	Chile	.81*** (.12)
	Croatia	-1.69*** (.1)
	France	-.57*** (.09)
	India	1.16*** (.13)
	Israel	-.11 (.11)
	Italy	.28*** (.1)
	Latvia	-1.39*** (.1)
	Norway	.16 (.14)
	Russia	-2.24*** (.08)
	Singapore	1.29*** (.22)
	Slovakia	-1.59*** (.1)
	Slovenia	-1.66*** (.1)
	South Africa	-1.48*** (.08)
	South Korea	.06 (.1)
	Spain	.24** (.1)
	Sweden	-.48*** (.1)
	Turkey	-.38*** (.09)
	UK	-.28*** (.09)
	USA	-1.17*** (.08)
	_cons	2.5*** (.07)
	Observations	48241
	Pseudo R2	.13
	ll	-16665.95
	Chi2	4855.67
	Akaike's Crit	33375.91
	Bayesian Crit	33569.15

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

Results – stated preferences

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Ordinal logistic regression with the average discount rate from the 2 choice lists assuming constant discounting (STATED PREFERENCES)

	Pooled dataset Vacc_hesitancy (1)	Pooled dataset Vacc_hesitancy (2)*
Rho (avg list 1 & 2)	**.03***	**.05****
	(.02)	**(.02)**
/cut1	-1.56***	-1.59***
	(.01)	(.01)
/cut2	-1.44***	-1.47***
	(.01)	(.01)
/cut3	-1.36***	-1.39***
	(.01)	(.01)
/cut4	-1.28***	-1.31***
	(.01)	(.01)
/cut5	-1.19***	-1.22***
	(.01)	(.01)
/cut6	-1.08***	-1.11***
	(.01)	(.01)
/cut7	-.96***	-.99***
	(.01)	(.01)
/cut8	-.81***	-.84***
	(.01)	(.01)
/cut9	-.63***	-.66***
	(.01)	(.01)
/cut10	-.47***	-.5***
	(.01)	(.01)
/cut11	-.3***	-.32***
	(.01)	(.01)
/cut12	-.04***	-.06***
	(.01)	(.01)
Observations	49232	48241
Pseudo R2	<0.01	<0.01
ll	-84839.75	-82589.85
Chi2	3.18	5.17
Akaike's Crit	169705.5	165205.71
Bayesian Crit	169819.95	165319.9

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

Comparison with Falk et al. (2018)

TABLE III

REGIONAL AVERAGES AND VARIANCE DECOMPOSITION

	Patience	Risk taking	Pos. recip.	Neg. recip.	Altruism	Trust	# Obs.
Western Europe	0.49	−0.11	0.06	0.04	−0.04	0.10	11
Eastern Europe	−0.12	−0.12	−0.02	0.10	−0.22	−0.07	16
Neo-Europe	0.73	0.15	0.16	0.02	0.26	0.23	3
South and East Asia	−0.00	−0.10	0.07	0.11	0.13	0.04	13
North Africa and ME	−0.14	0.16	0.07	0.08	0.13	0.23	9
Sub-Saharan Africa	−0.16	0.34	−0.34	−0.11	−0.15	−0.33	11
South America	−0.21	−0.03	−0.08	−0.16	−0.05	−0.10	13
% between-country variation	13.5	9.0	12.0	7.0	12.3	8.2	

Notes. Neo-Europe includes the United States, Canada, and Australia. Regional averages of each preference are expressed in terms of standard deviations from the world individual mean. The variance decomposition in the bottom row decomposes the individual-level variation into the variance of the average preference across countries and the average of the within-country variance. Formally, the between-country variation corresponds to the R^2 of an OLS regression of all individual-level observations on a set of country dummies in which all observations are weighted by the sampling weights provided by Gallup to achieve (ex post) representativeness. ME = Middle East.

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Falk et al. (2018)

- They find populations of European ancestry are more patient
- Especially Scandinavian
- African, South American and Middle East the least patient

- We find highest impatience for India, Turkey, USA and South Africa
- Lowest impatience for Sweden, Norway, Spain and Chile

- Conclusion: mixed agreement with the results of Falk et al. (2018)

Future research directions

- Extend to multivariate preferences – correlation attitudes (e.g. health and wealth, Peter 2021, Attema et al. 2019)
- Extend to ambiguity (e.g. possibility of side-effects may be deemed more/less ambiguous than possibility of getting sick from Covid; Courbage and Peter 2021, Attema et al. 2018)
- Replicate with alternative time and risk preference measurements
- Correct for inflation/interest rates
- Include more African countries
- Use real incentives and personal interviews if possible

Conclusion

- Hesitants are more impatient than vaccinated and refusing people
- No evidence of a present bias in most countries
- Higher present bias (lower future bias) for males, in agreement with Meissner et al. (2023)
- Negative relation between beta and age
- Results for the stated preferences on vaccinations are largely consistent with the revealed vaccination preferences

THANK YOU!

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Questions?

More info and updates: https://www.value-health-economics-policy.org/our-research/the-covid-19-vaccine-preferences-project

The Economics of Hesitancy, Behaviors and Preferences Towards Vaccination and Policy Stringency: Results from a Standardised Stated Choice Survey on 21-Countries