CENTER FOR
ECONOMIC
BEHAVIOR &
INEQUALITY

Claus Thustrup Kreiner
Barcelona
June 2019

Danmarks
Grundforskningsfond
Danish National
Research Foundation

UNIVERSITY OF COPENHAGEN

Overview of talk

Research Program

Behavioral Heterogeneity, Inequality and Public Policy

Research Paper

Time Discounting and Wealth Inequality

CEBI team

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INEQUALITY

External members

Many different fields: Public Economics, Labor Economics, Health Economics, Experimental Economics, Behavioral Economics, Household Finance, Political Economy, Microeconometrics...

CEBI research program: Examples of CEBI projects

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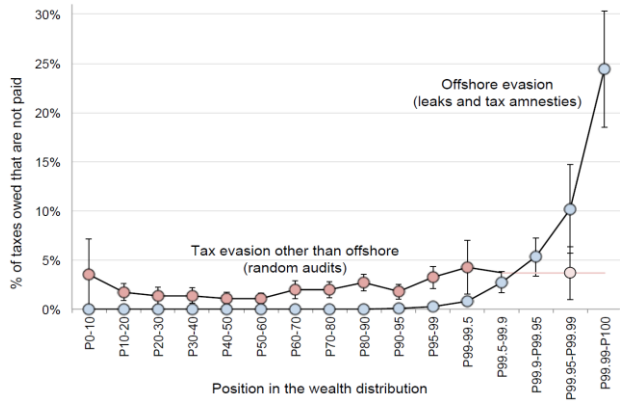
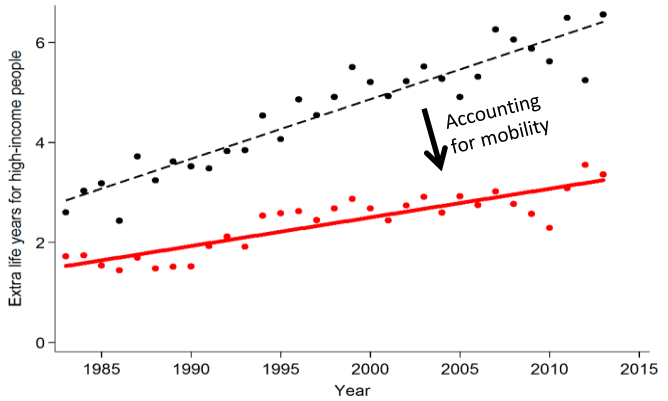
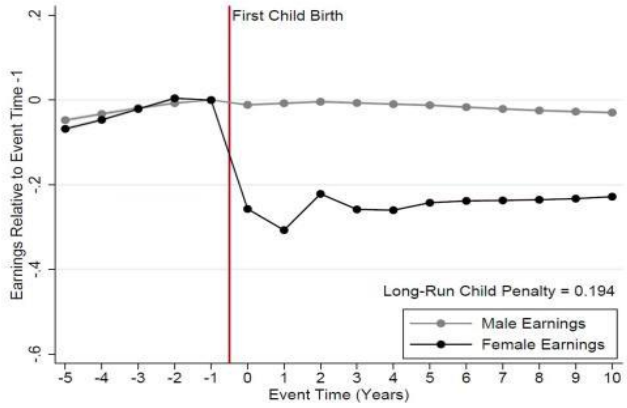
Wealth Inequality: Role of tax evasion behaviour, preference heterogeneity and wealth taxation…



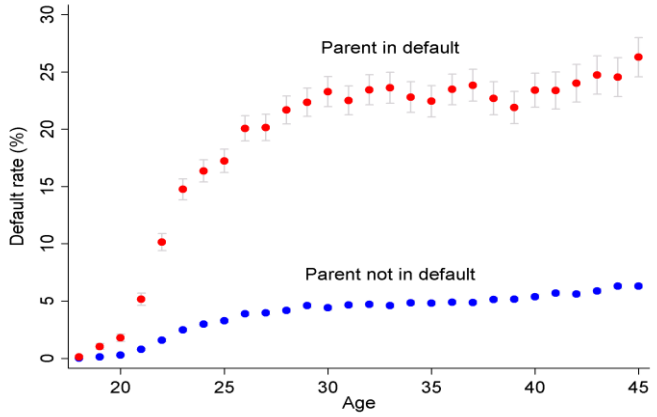
Life-expectancy inequality: Role of income mobility, innovations and technology adoption



Gender inequality: Role of children, social norms and parental leave policy



Inequality in financial trouble: Role of shocks vs behavioral heterogeneity



CEBI research program:
Behavioral Heterogeneity, Inequality and Public Policy

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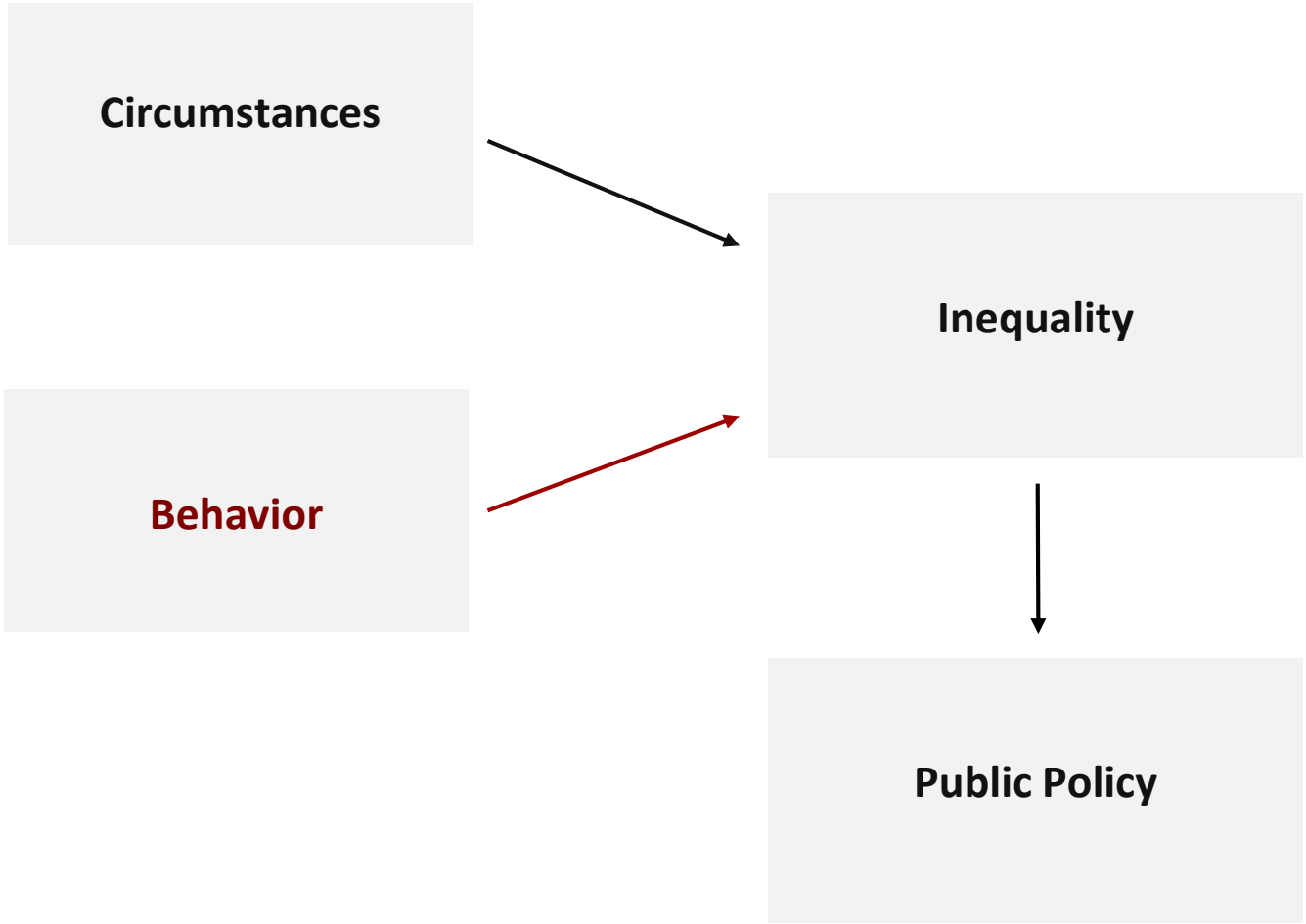
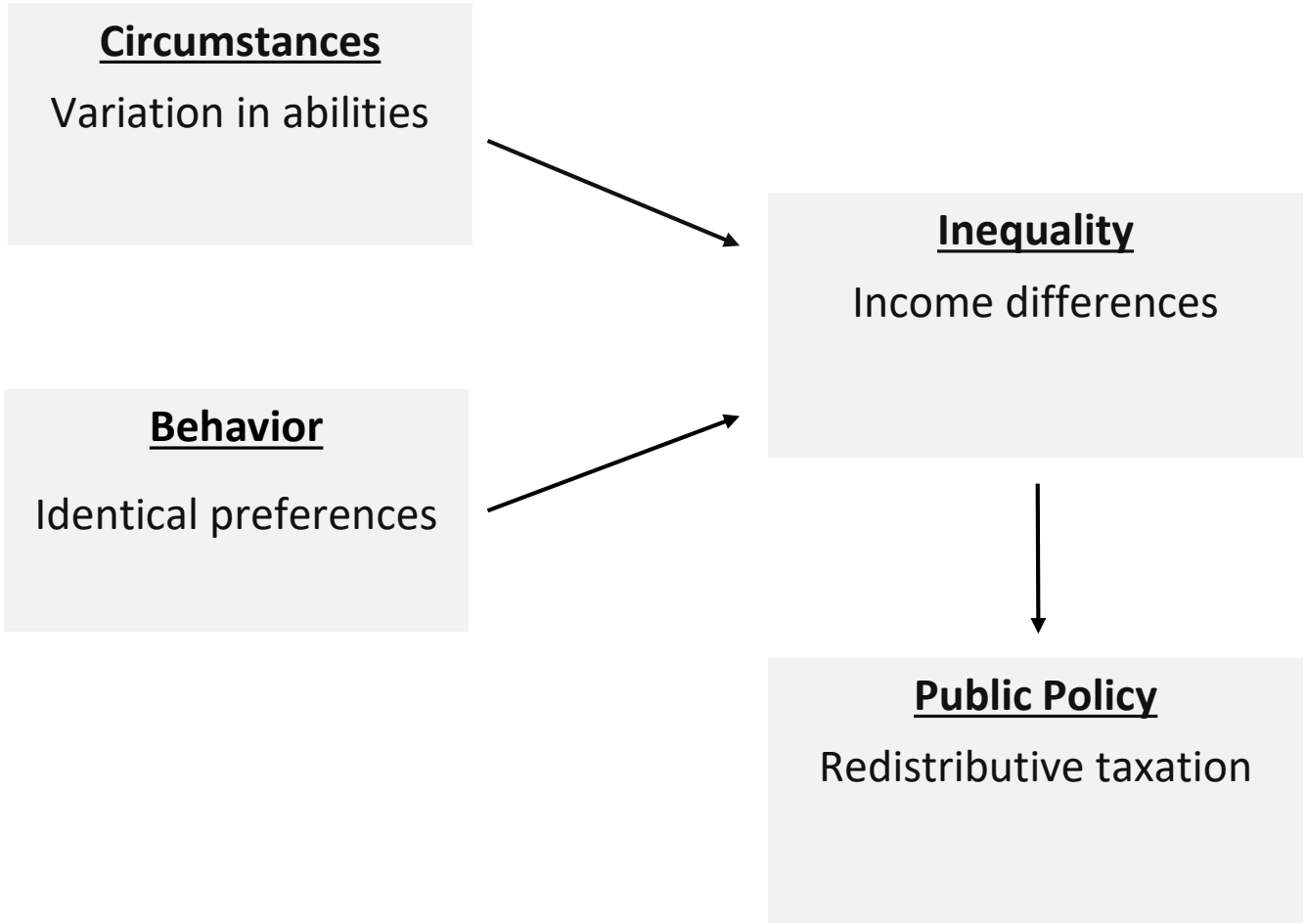
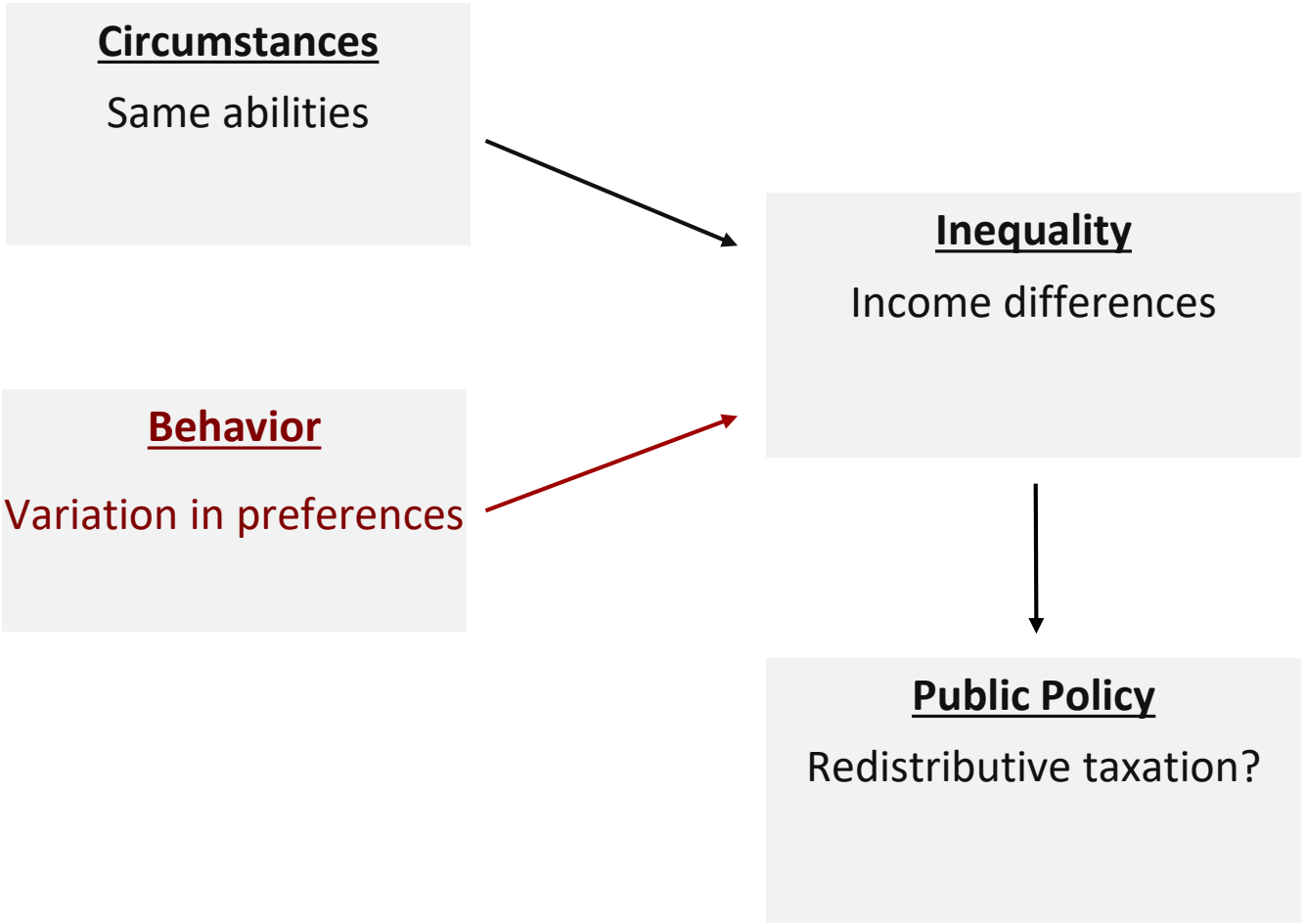


Example: Standard Mirrleesian optimal tax theory



Alternative model:



CEBI research program:
Why focus on behavioural heterogeneity?

Example: Standard Mirrleesian optimal tax theory

$$\max_{T(z)} \int_{\underline{\theta}}^{\overline{\theta}} S\left(u\left(z - T(z), \frac{z}{\theta}\right)\right) f(\theta) d\theta \quad st. \quad \int_{\underline{\theta}}^{\overline{\theta}} T(z)\, f(\theta) d\theta \geq 0$$

where $S(\cdot)$ is social prefs, $u(\cdot)$ is individual utility, z is earnings, $T(\cdot)$ is the tax function, and θ is the hourly wage rate (innate ability).

Variation in abilities (θ) ⇒ unequal income ⇒ redistribution policy

CEBI research program: Why focus on behavioural heterogeneity?

Example: Standard Mirrleesian optimal tax theory

$$\max_{T(z)} \int_{\underline{\theta}}^{\overline{\theta}} S\left(u\left(z - T(z), \frac{z}{\boldsymbol{\theta}}\right)\right) f(\theta) d\theta \quad st. \quad \int_{\underline{\theta}}^{\overline{\theta}} T(z)\, f(\theta) d\theta \geq 0$$

where $S(\cdot)$ is social prefs, $u(\cdot)$ is individual utility, z is earnings, $T(\cdot)$ is the tax function, and θ is the hourly wage rate (innate ability).

Variation in abilities ($\boldsymbol{\theta}$) ⇒ unequal income ⇒ redistribution policy

Alternative interpretation

Variation in leisure preferences ($\boldsymbol{\theta}$) ⇒ unequal income ⇒ redistribution policy?

Unequal opportunities in the standard model, but not in the alternative interpretation!

CEBI research program: Examples of policy relevance

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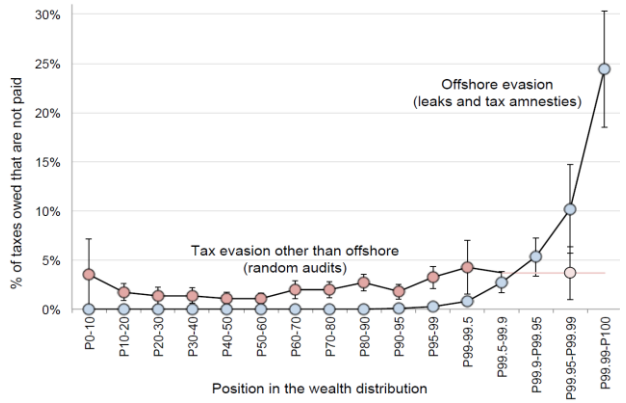
Wealth Inequality: Role of tax evasion behaviour, preference heterogeneity and wealth taxation…



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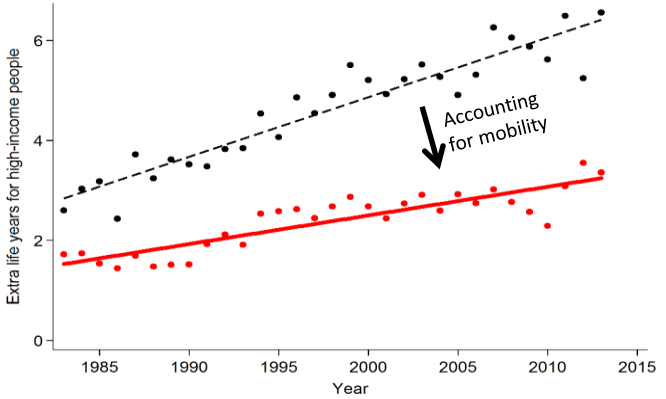

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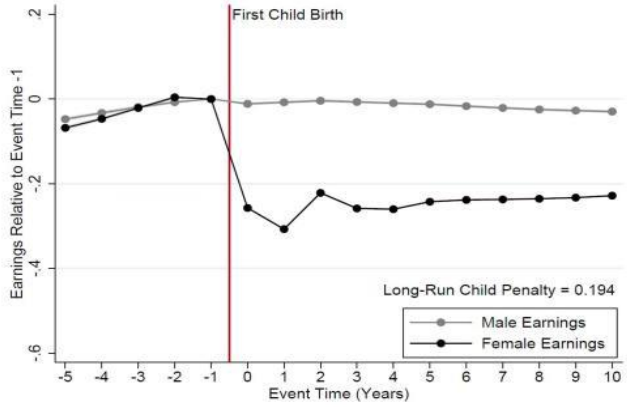

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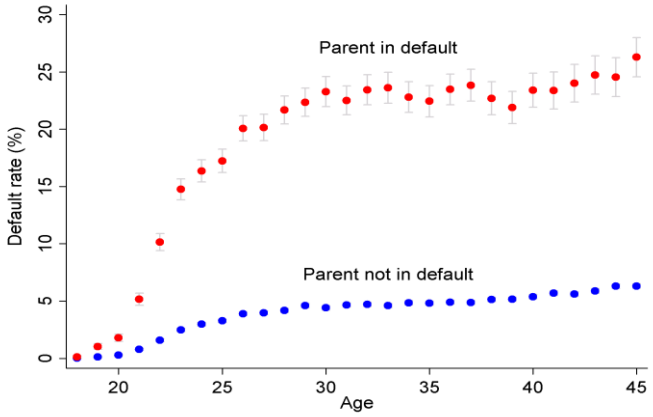

Why little research historically on behavioural heterogeneity?

"The establishment of the proposition that one may usefully treat *tastes* as stable over time and *similar among people* is the central task of this essay." Stigler and Becker ("De Gustibus Non Est Disputandum", American Economic Reiew 1977)

"Preference heterogeneity represents an alternative way to introduce differences in initial conditions. Historically, macroeconomists have been *reluctant to fiddle too much with preferences*, because their *inherent unobservability* puts little discipline on the exercise." Heathcoate, Storesletten and Violante (Annual Review of Economics 2009)

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Time Discounting and Wealth Inequality

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Ernst Fehr
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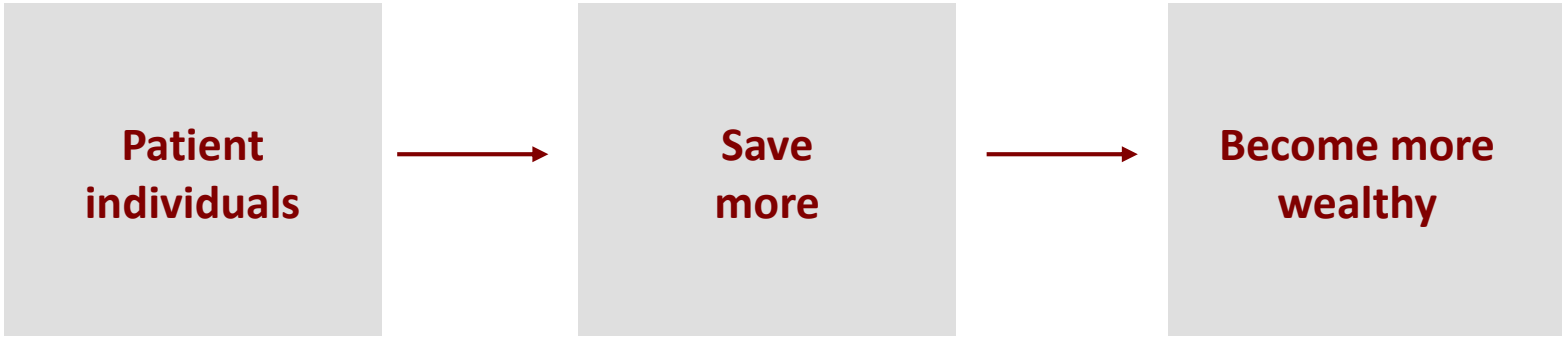
Research agenda

Hypothesis from basic theory of savings behavior:



Contribution

I. Measure whether differences in patience predict wealth inequality:

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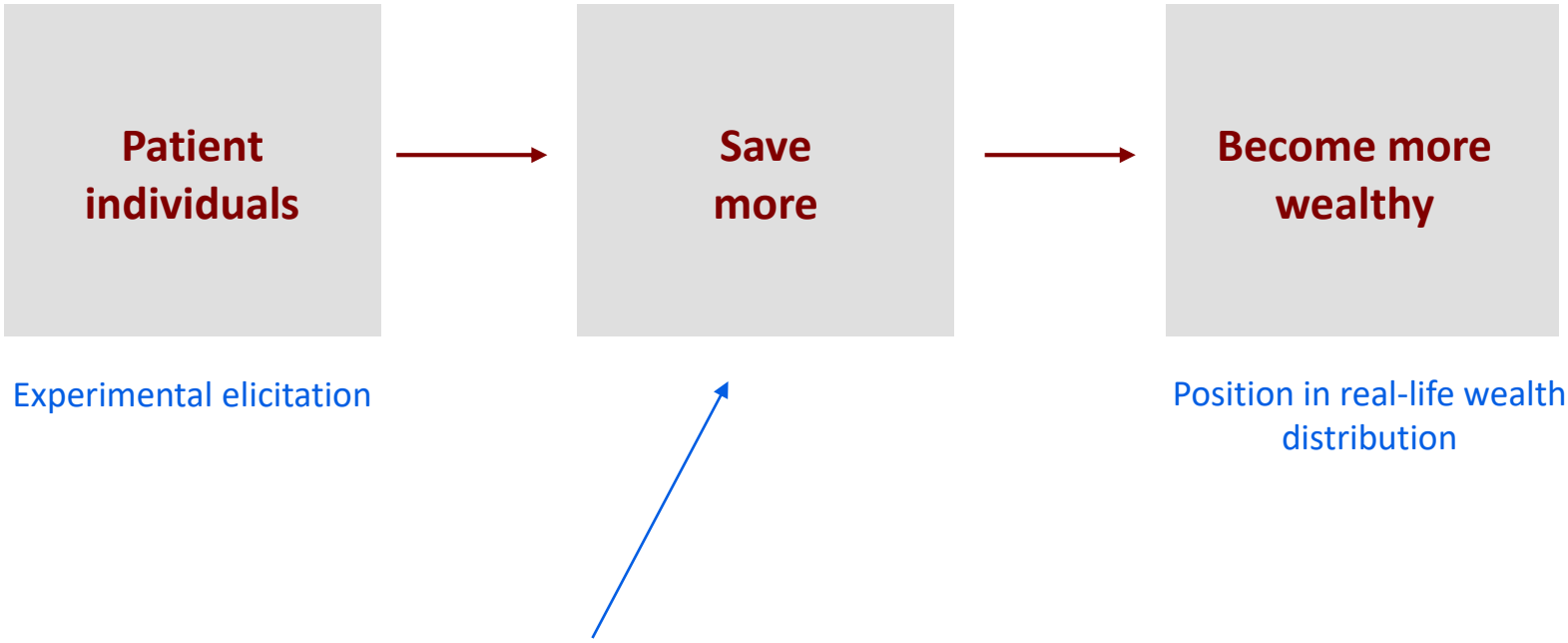

II. Provide suggestive evidence about the role of the savings channel by controlling for other factors relevant according to theory

Contribution

Public Finance and Macro literature (e.g. Krusell & Smith 1998; Carroll et al. 2014, 2017; Krueger et al. 2016; Boserup et al. 2016, 2018; De Nardi and Fella 2017; ...

Models with heterogeneity in time discounting better at matching wealth inequality + propagation of business cycle shocks and effects of stimulus policy

Experimental literature (e.g. Mishel et al 1989; Harrison et al 2002; Andreoni & Sprenger 2012; Attema et al 2016; ….

Evidence starting with the famous marshmallow experiments w. children in the 60s to recent research using intertemporal choices of adults point to pervasive heterogeneity in time discounting

Has predictive power of behavior outside the laboratories

We bridge these literatures

Q: Do differences in *elicited* time discounting predict *real-life* wealth inequality?

Savings Theory

$$\max_{(c(a))_0^T} U = \int_0^T \frac{c(a)^{1-\theta}}{1-\theta} e^{-\rho a} da$$

$$\text{s.t.} \quad \dot{w} = rw(a) + y(a) - c(a)$$

$$\Downarrow$$

$$w(a) = Y\left(\gamma(a) - \frac{1 - e^{\frac{r(1-\theta)-\rho}{\theta}a}}{1 - e^{\frac{r(1-\theta)-\rho}{\theta}T}}\right)e^{ra}$$

where

- Y is life-time resources/permanent income
- $\gamma(a)$ is share of life-time resources received up to age a

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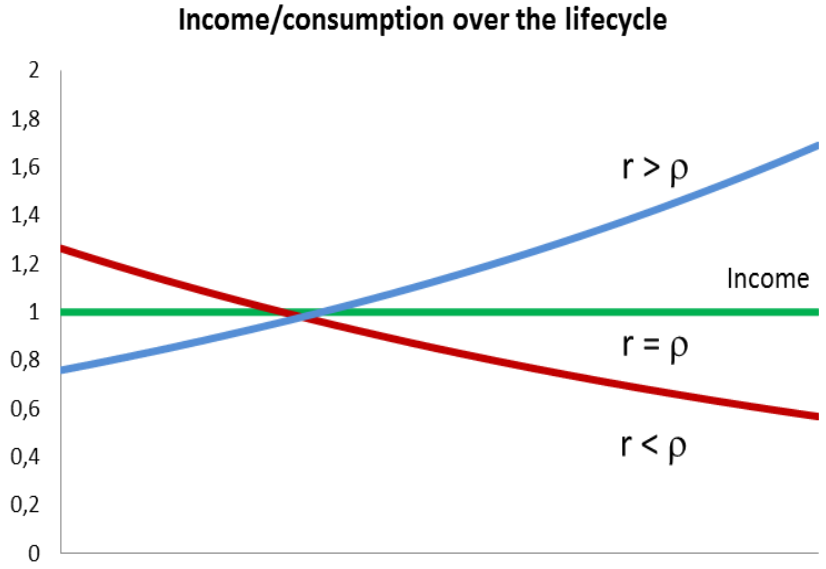
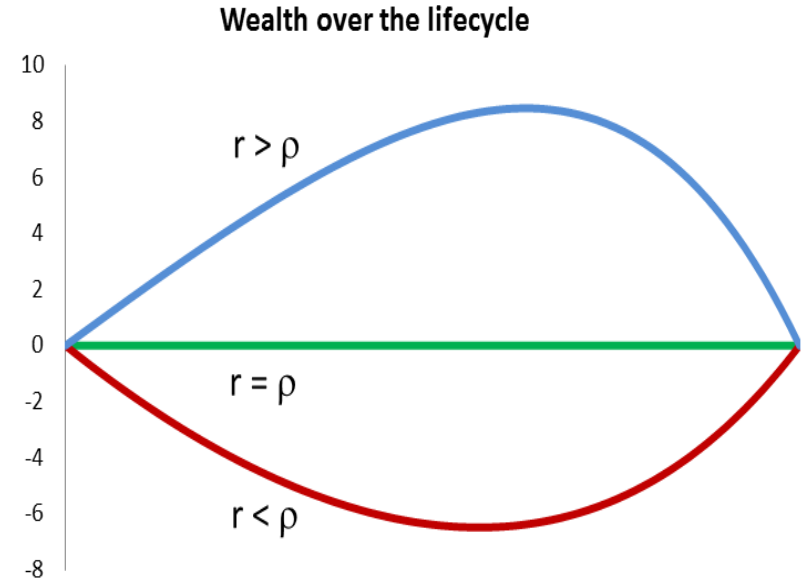




Savings Theory

Main results

- Patient individuals hold more wealth *at all ages* in the life cycle

  (Conditional on permanent income, timing of income, market interest rate, CRRA parameter)

- No clear cross sectional relationship between patience and levels of consumption and savings ⇒ focus on wealth

- Borrowing constraints
  - Low-patience individuals more likely to be borrowing constrained
  - No patience-wealth relationship for borrowing constrained individuals (⇒ mutes the association btw. patience and wealth inequality)

Data: overview

Experimental data

Online Experiment 2015

Invite individuals born in Copenhagen 1973-83

3620 respondents

Choice tasks measuring:

- Patience
- Risk aversion
- Altruism

Typical after-tax payout: 245 DKK (≈€33)

Pay-out transferred directly to bank account

CPR

Administrative data

Info during adulthood about

- Wealth
  - Bank deposits
  - Market value stocks, bonds
  - Tax assessed property value
  - Pension wealth and market value of cars (only 2014-)
- Income
- Education
- Demographics

Also information for

- non-respondents
- 10% random sample

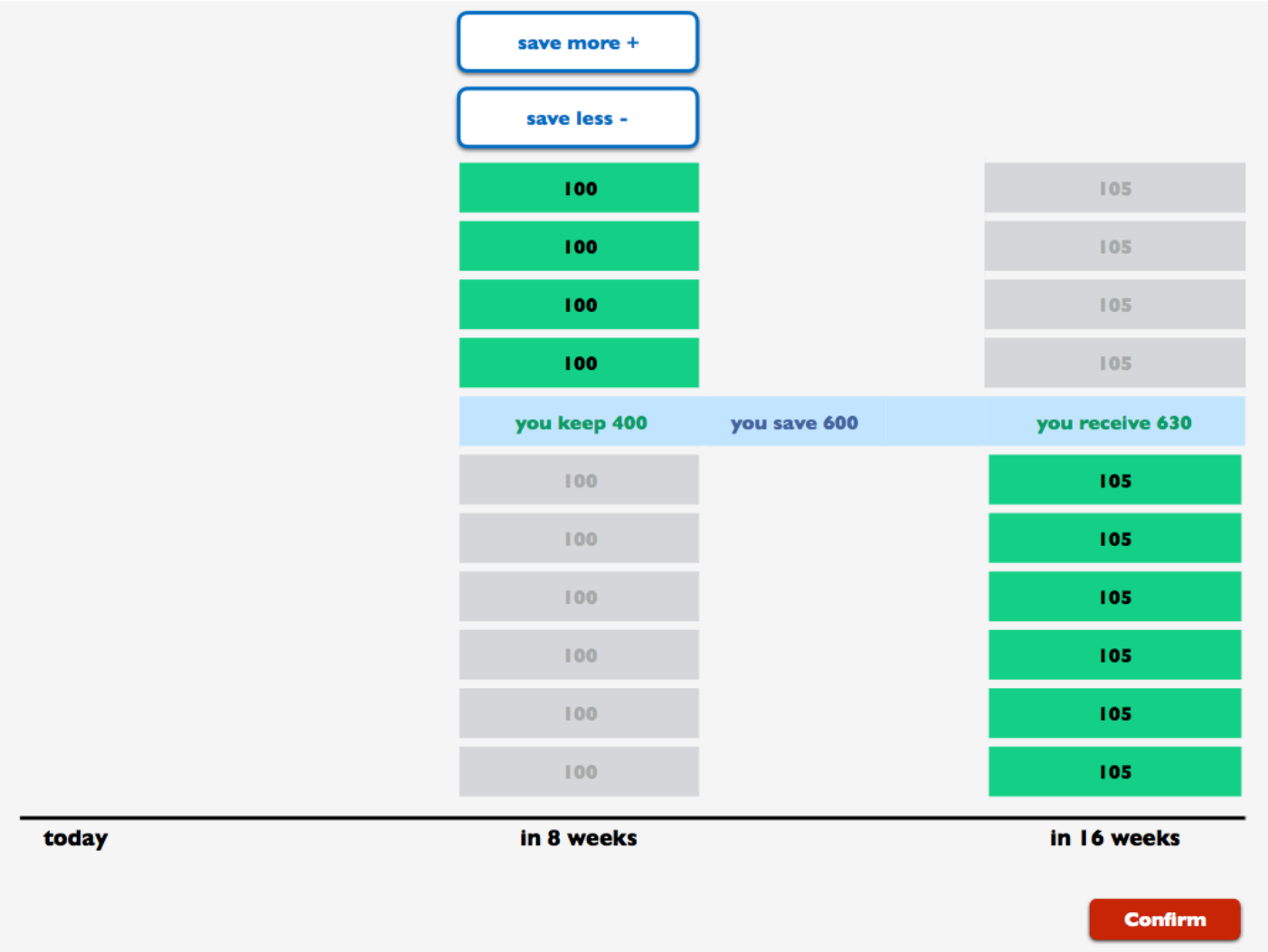
Data construction: Summary statistics

	(1) Respondents vs. non-respondents			(2) Respondents vs. 10% of population	
	(a) Respondents	(b) Non-respondents	(c) Difference, (a)-(b)	(d) Population	(e) Difference, (a)-(d)
Age	37.32	36.46	0.86	37.37	-0.05
Woman (=1)	0.50	0.49	0.01	0.51	-0.01
Single (=1)	0.28	0.38	-0.10	0.28	0.00
Dependent children (=1)	0.61	0.57	0.04	0.63	-0.02
Years of education	14.89	14.16	0.73	14.64	0.25
Gross income distribution					
p5	135745	98974	36772	130343	5402
p25	287472	234966	52506	270900	16572
p50	383040	341611	41429	360132	22908
p75	484472	434678	49795	456263	28209
p95	720178	654999	65179	700517	19661
Wealth distribution					
p5	-337615	-351123	13507	-241803	-95812
p25	93898	48919	44978	144177	-50280
p50	487002	317400	169602	483217	3785
p75	1066942	800074	266868	972420	94522
p95	2397821	2024448	373373	2254289	143532
Observations	3620	23626	27246	67539	71159

Data construction: Experiment

Notes: (a) Five savings tasks with different gains from postponing
(b) 100 points = DKK 25 ≈ €3.60

Data construction: Experiment



Notes: (a) Five savings tasks with different gains from postponing
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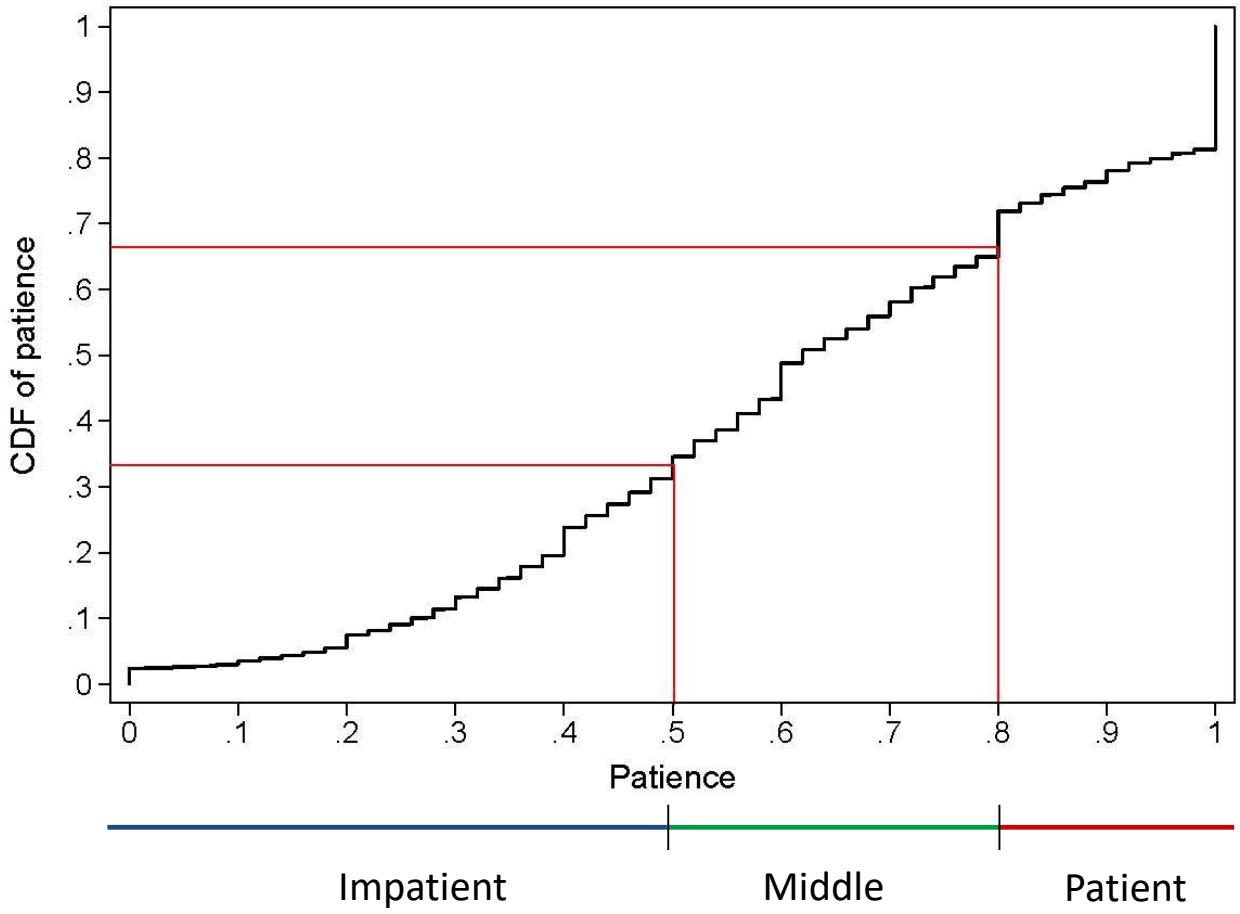
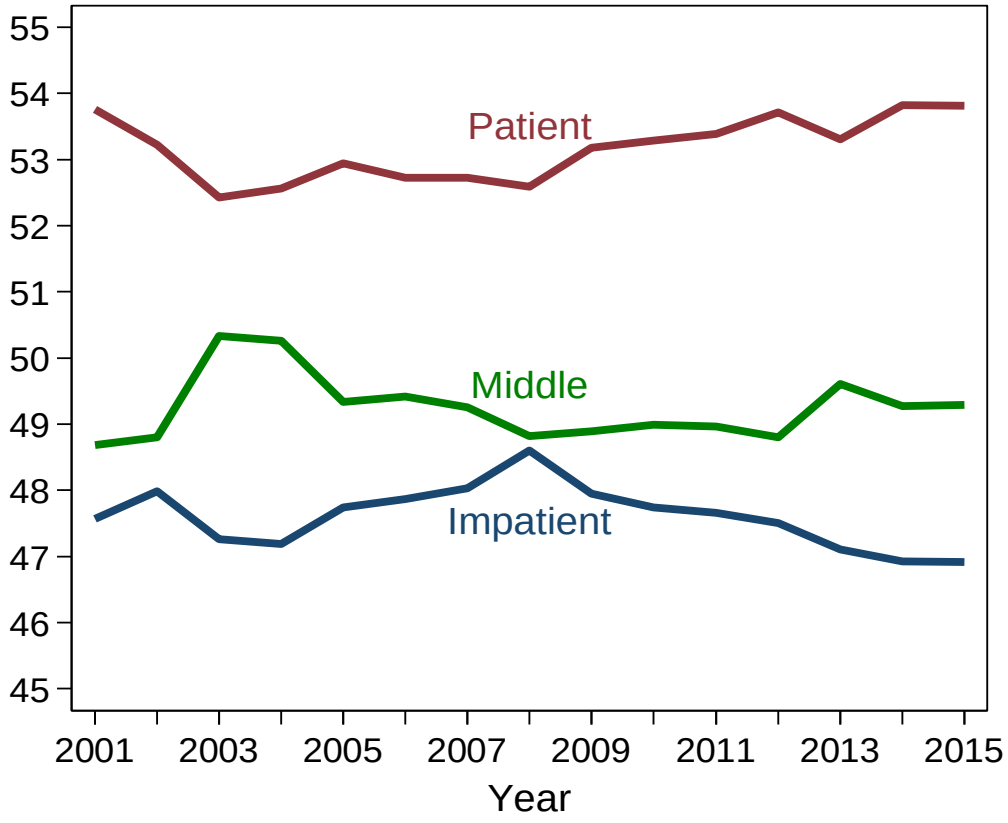
Data construction: Elicited patience

Measure of patience: mean$\left(\frac{z_1}{10}, \ldots, \frac{z_n}{10}\right)$, where z_i is # blocks saved



Results:
Patience and position in the wealth distribution

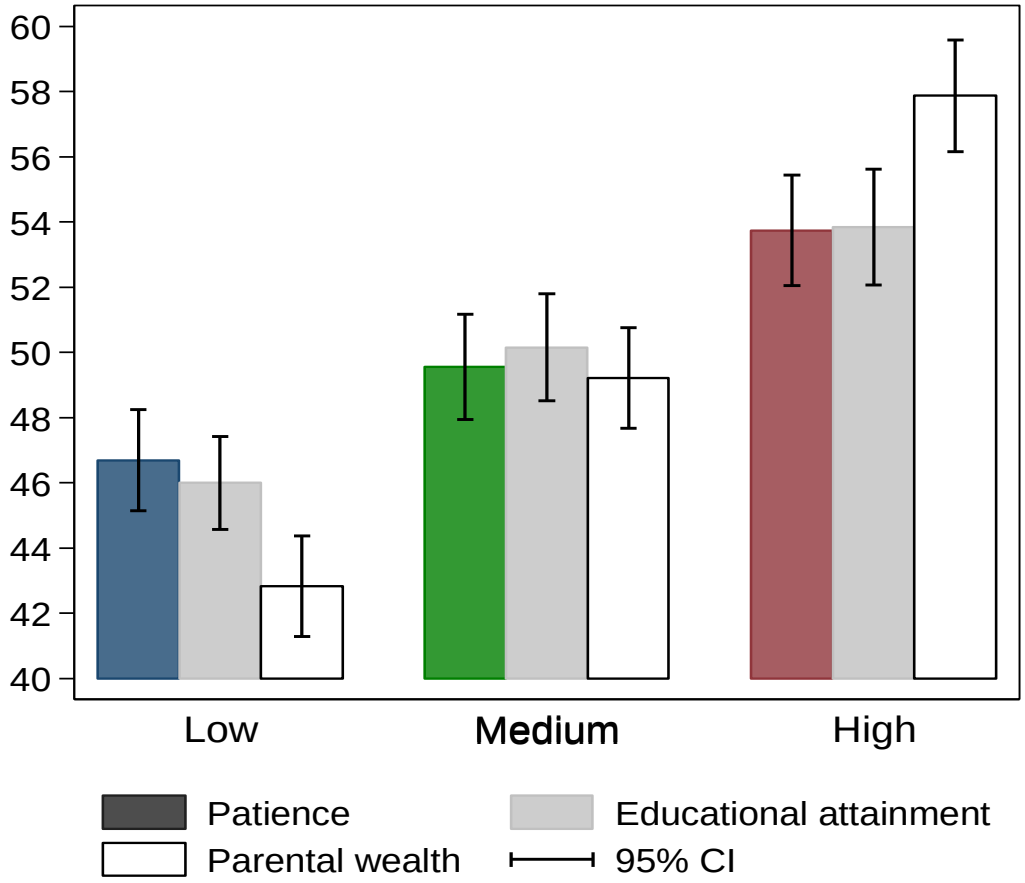
Wealth rank by patience group, 2001-2014



Stable association over more than a decade

Results:
Patience and position in the wealth distribution

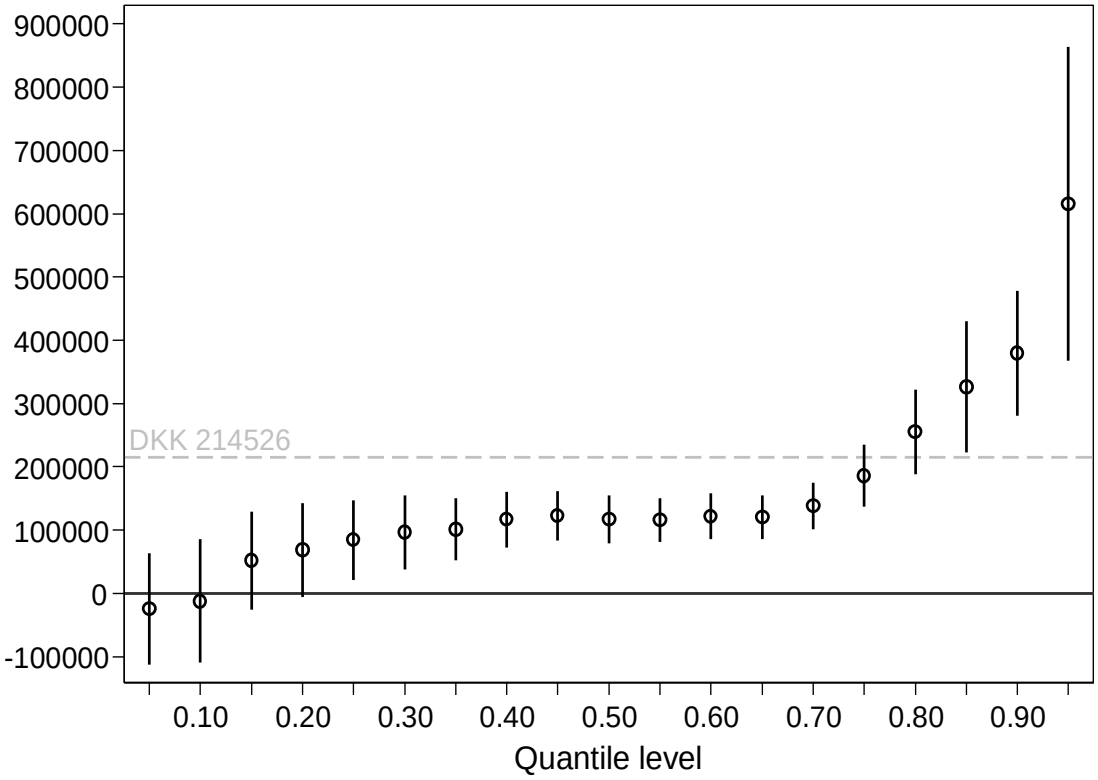
Wealth rank by patience , education, and parental wealth



Association is quantitatively important

Results:
Patience and position in the wealth distribution

Quantile regression of wealth on patience



Association exists throughout the wealth distribution

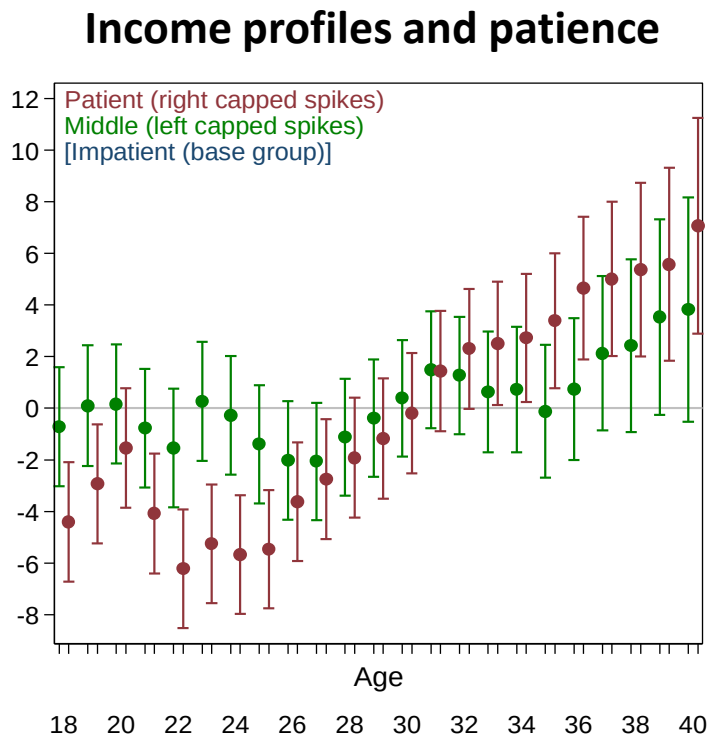
Results:
Effect still large in multivariate setting

Dep. var.: Wealth	(1) Rank	(2) Rank	(3) Rank	(4) DKK	(5) Rank	(6) Rank	(7) Rank	(8) Rank
Patience	11.37***	9.59***	8.45***	146914.66***	9.45***	-1.44	11.14***	7.71***
	(1.73)	(1.75)	(1.75)	(39742.53)	(1.92)	(2.29)	(2.41)	(2.25)
Risk aversion			2.53	49227.45	2.45	-2.81	5.31*	3.18
			(2.04)	(56820.65)	(2.04)	(2.84)	(2.70)	(2.54)
Altruism					-3.67			
					(2.16)			
Future bias=1					2.58			
					(1.32)			
Present bias=1					1.23			
					(1.33)			
Non-monotonic choices in time tasks=1					-1.99			
					(1.07)			
Interest rate on liquidity								-1.63***
								(0.10)
Owned stocks, 2008-2014=1								6.21***
								(1.56)
Rate of return on stocks, 2008-2014								0.36
								(0.54)
Year dummies for educational attainment	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gross income decile dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Steepness of income profile decile dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Expected income growth decile dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Self-reported school grades decile dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Parental wealth decile dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Wealth at age 18 decile dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Demographic controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Age dummies	No	No	No	Yes	No	No	No	No
Constant	42.81***	39.56***	31.84***	-305236.88***	32.13***	38.56***	26.64***	45.80***
	(1.16)	(1.82)	(3.94)	(82509.23)	(4.24)	(4.95)	(6.40)	(6.00)
Observations	3620	3620	3552	3552	3552	1353	2157	2157
Adj. R-squared	0.01	0.02	0.08	0.08	0.08	0.03	0.08	0.19

Bivariate

Results:
Controlling for level and timing of income

Patient individuals have different permanent income and timing of income

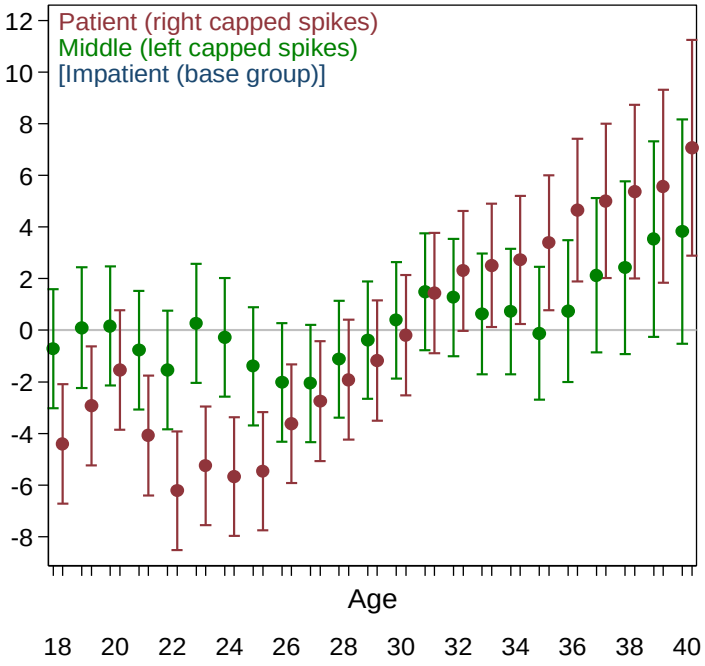


Results:
Controlling for level and timing of income

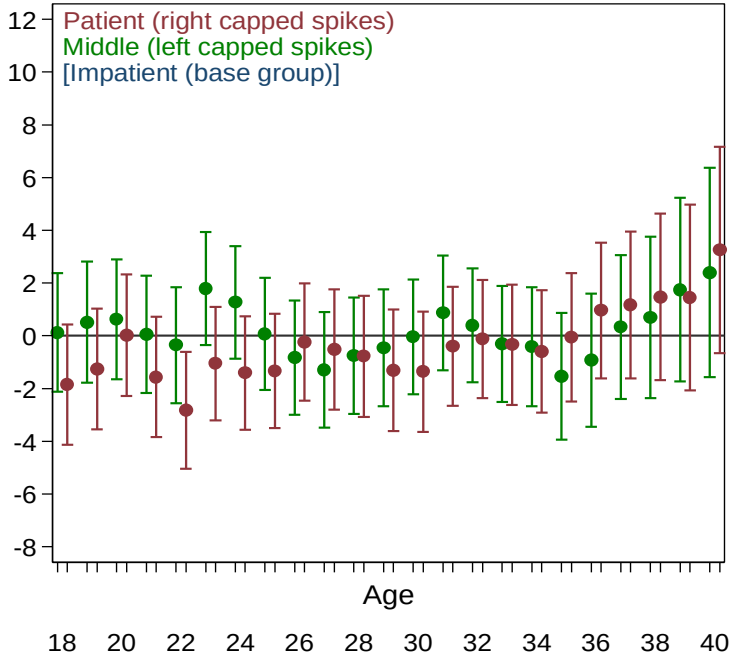
Patient individuals have different permanent income and timing of income

These differences vanish when controlling for education

Income profiles and patience



After controlling for education



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Education

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Adj. R-squared	0.01	0.02	0.08	0.08	0.08	0.03	0.08	0.19

Risk aversion + Education + Income + Income growth + Expected income growth
+ GPA + Initial wealth + Parental wealth + Demographics

Results:
Effect still large in multivariate setting

Dep. var.: Wealth	(1) Rank	(2) Rank	(3) Rank	(4) DKK	(5) Rank	(6) Rank	(7) Rank	(8) Rank
Patience	11.37***	9.59***	8.45***	146914.66***	9.45***	-1.44	11.14***	7.71***
	(1.73)	(1.75)	(1.75)	(39742.53)	(1.92)	(2.29)	(2.41)	(2.25)
Risk aversion			2.53	49227.45	2.45	-2.81	5.31*	3.18
			(2.04)	(56820.65)	(2.04)	(2.84)	(2.70)	(2.54)
Altruism					-3.67			
					(2.16)			
Future bias=1					2.58			
					(1.32)			
Present bias=1					1.23			
					(1.33)			
Non-monotonic choices in time tasks=1					-1.99			
					(1.07)			
Interest rate on liquidity								-1.63***
								(0.10)
Owned stocks, 2008-2014=1								6.21***
								(1.56)
Rate of return on stocks, 2008-2014								0.36
								(0.54)
Year dummies for educational attainment	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gross income decile dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Steepness of income profile decile dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
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Wealth at age 18 decile dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Demographic controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Age dummies	No	No	No	Yes	No	No	No	No
Constant	42.81***	39.56***	31.84***	-305236.88***	32.13***	38.56***	26.64***	45.80***
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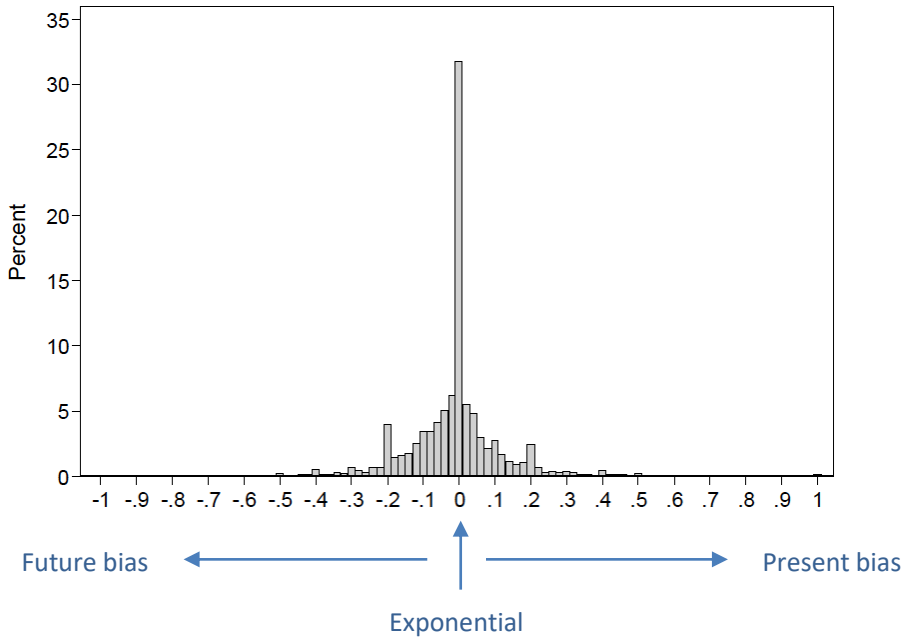
Quantitative effect still large with controls (median: 487k)

Non-constant discounting and monotonicity violations

- Non-constant discounting:
  - # blocks paid out early: (0;8) - (8;16)
  - For each of five interest rates offered in the experiment
  - Calculate average within each individual.



- Monotonicity violations in choice tasks: dummy.

Results:
Effect still large in multivariate setting

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Non-constant time discounting + monotonicity violations + altruism

Credit constraints and slope of the intertemporal budget constraint

- **Credit constraint**: 1[Liquid assets<1 month disposable income]

  E.g. Zeldes 1989; Johnson et al. 2006; Leth-Petersen 2010

- **Soft credit constraint / marginal interest rate**
  - Use account level data for all our subjects (from tax authorities), 2014
  - Marginal interest rate = highest rate from loan accounts or lowest rate from deposit accounts if no loans
  - Kreiner et al. (AEJ: POL 2019)

- **Stock market participation and rate of return**

Results:
Effect still large in multivariate setting

Dep. var.: Wealth	(1) Rank	(2) Rank	(3) Rank	(4) DKK	(5) Rank	(6) Rank	(7) Rank	(8) Rank
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Low / high
Split by hard constraint

Results:
Effect still large in multivariate setting

CENTER FOR ECONOMIC BEHAVIOR & INEQUALITY

Dep. var.: Wealth	(1) Rank	(2) Rank	(3) Rank	(4) DKK	(5) Rank	(6) Rank	(7) Rank	(8) Rank
Patience	11.37***	9.59***	8.45***	146914.66***	9.45***	-1.44	11.14***	7.71***
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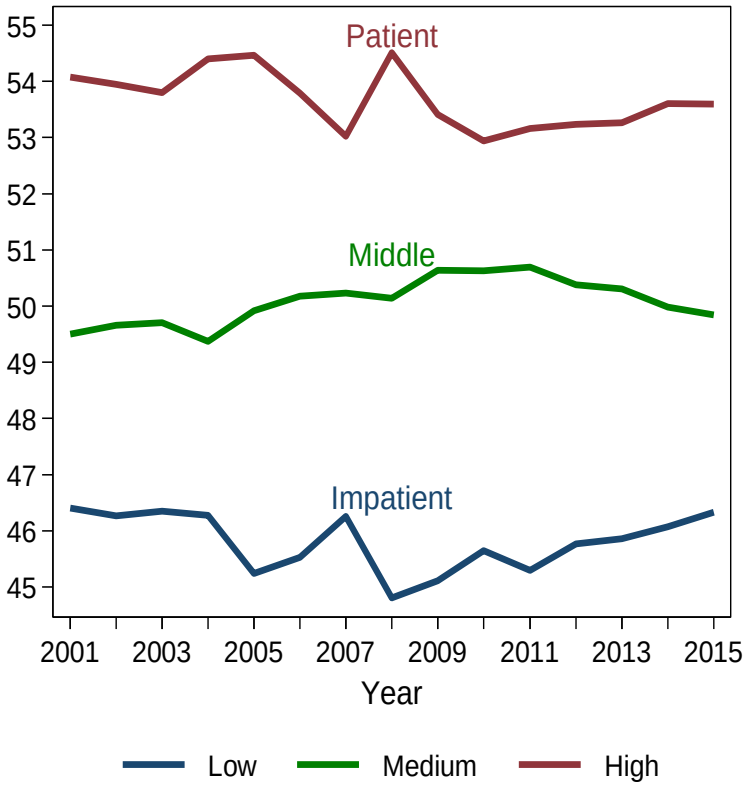
High Liquid asset group: marginal interest rate + stock ownership + stock return

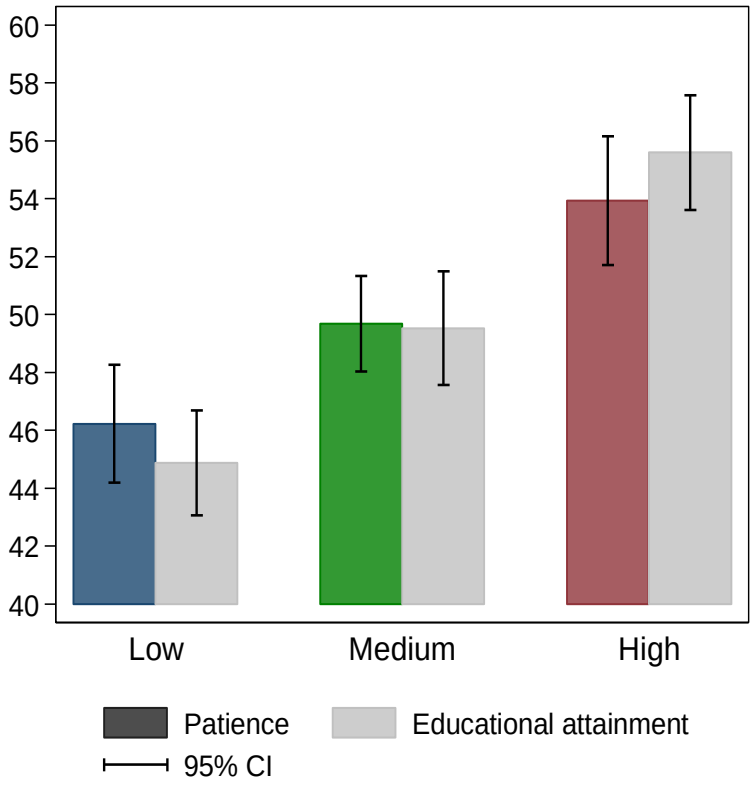
Robustness:
Measure of time discounting thirty years earlier

Patience 1973 and wealth rank

Patience 1973 and wealth rank, 2001-2015



Patience 1973 vs education, wealth rank 2001



Robustness - summary

- Broad wealth concept (housing, car assets, pension wealth – only 2014)
- Narrow wealth concept (financial wealth)
- Structural estimation of preferences (RUM), including present bias
- 248 education groups
- Subsample: Stable income (no health events, no unemployment shocks), average income and wealth over 3, 5, 7 years to reduce importance of transitory components…
- Rank based on wealth-to-permanent income
- Selection into experiment: Inverse probability weighting
  - respondents vs. non-respondents
  - respondents vs. population
- ….

Summary and conclusion

Association between patience and position in the wealth distribution:

- Quantitatively important
- Precisely estimated
- Stable over time
- Operates throughout the wealth distribution

Still large association when including a comprehensive set of theory motivated controls for life-time resources $\Rightarrow$ suggests that savings behaviour is a driver as predicted by standard savings theory

Point to the fruitfulness of incorporating heterogeneous time discounting in models of consumption and savings behavior

Krusell and Smith (1998), Hubmer et al. (2016), Krueger et al. (2016), Carroll et al. (2017), De Nardi and Fella (2017) and Alan et al. (2018)

More generally, the findings suggest that behavioral heterogeneity has an important role to play in the formation of inequality