Intertemporal choice bracketing and the measurement of time preferences

Yonas Alem*, John Loeser†, Aprajit Mahajan‡

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* University of Gothenburg, J-PAL
† Development Impact Evaluation, World Bank
‡ UC Berkeley

- Time preferences are central to understanding household finance
- Money earlier or later is commonly used to estimate time preferences (Cohen et al., 2020)

"Would you prefer to receive 200 KSH today or 220 KSH in 2 weeks?"

"Would you prefer to receive **200 KSH today** or **220 KSH in 2 weeks**?"

"Narrow bracketing"

- Responses reflect preferences not directly affected by household finances

- Patience, Stress, Cognition, Framing, "Marshmellow test"

- Andreoni et al. (2018), Balakrishnan et al. (2020)

"Broad bracketing"

- Responses reflect broader optimization, tradeoffs across savings and credit opportunities

- Return on investment, Interest rate, Credit constraints, MPK

- Cubitt & Read (2007), Dean & Sautmann (2021)

- **Money earlier or later (MEL)**: Repeated MEL
  - e.g., "Would you prefer to receive 200 KSH today or 220 KSH in 2 weeks?"

- **Savings**: Access to Savings opportunity $\equiv$ Choosing later MEL payoff
  - e.g., option to deposit 200 KSH today to receive 220 KSH in 2 weeks

- **Cash transfer (CT)**: Randomize CT $\approx$3 months of subjects' income

"Narrow bracketing": CT $\not\Rightarrow$ MEL   "Broad bracketing": MEL = Savings

1. Reject Narrow bracketing: CT $\Rightarrow$ MEL

2. Reject Broad bracketing: MEL $\neq$ Savings

3. Present heterogeneity:

Lower income subjects:	Higher income subjects:
a. (NB) CT $\not\Rightarrow$ MEL	a. (BB) CT $\Rightarrow$ MEL
b. (NB) ΔMEL $\not\Rightarrow$ ΔSavings	b. (BB) ΔMEL $\Rightarrow$ ΔSavings
c. $\overline{\text{MEL}}$ ($\propto$ PREF) $\Rightarrow$ Savings	c. $\overline{\text{MEL}}$ ($\propto$ $\overline{\text{MPK}}$) $\not\Rightarrow$ Savings

$\Rightarrow$ Interpret heterogeneity through conceptual framework: Observed correlation between MEL and financial choices reflects preferences, not financial environment
  - Consistent with common empirical practice in economics

- We recruited subjects (typically informal sector workers in Nairobi) through Busara Lab in March 2017

- **Week 0** Lab: Survey, Incentivized MEL (Balakrishnan et al., 2020)

- **Weeks 1, 2, 4, 6, 8** Phone: Incentivized MEL

- **Week 2** CT $\rightarrow$ Incentivized MEL $\rightarrow$ Savings onboarding
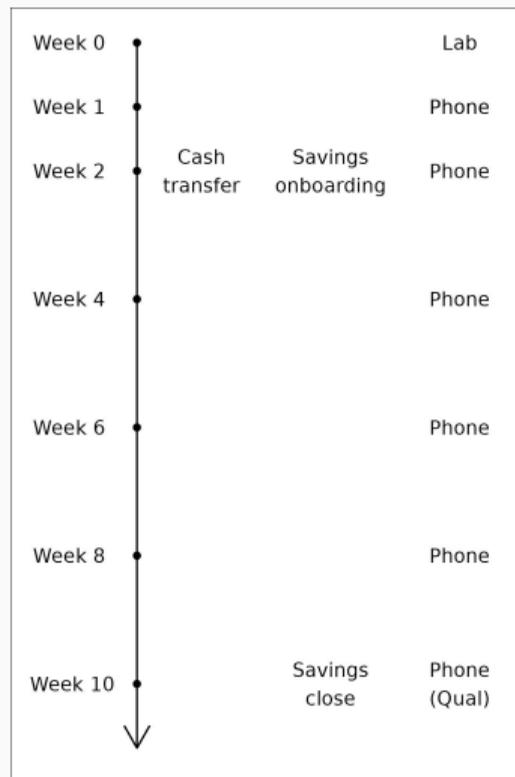
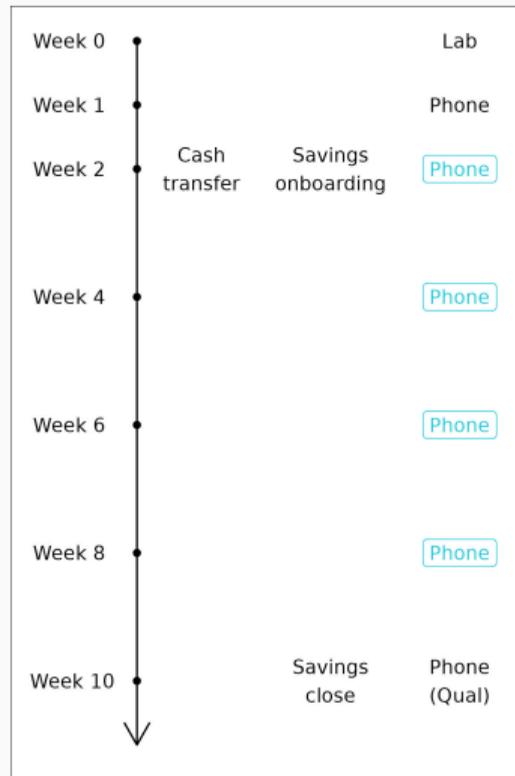|			
Week 0			Lab
Week 1			Phone
Week 2	Cash transfer	Savings onboarding	Phone
Week 4			Phone
Week 6			Phone
Week 8			Phone
Week 10		Savings close	Phone (Qual)

In biweekly phone surveys, subjects were asked:

"Would you prefer to receive 200 KSH today or receive X KSH in T weeks?"

- $X \in \{180, 200, 220, 240, 260, 300, 350, 400, 600\}$
- $T \in \{2, 4, 6, 8\}$
- 1 of 36 choices randomly selected, subject's choice implemented
- Payments made by M-Pesa (widely used Kenyan mobile money platform) to account registered in subject's name

Week 0		Lab
Week 1		Phone
Week 2	Cash transfer	Savings onboarding	Phone
Week 4		Phone
Week 6		Phone
Week 8		Phone
Week 10		Savings close	Phone (Qual)

- Subjects given access to an illiquid savings account
  - No withdrawals (similar to commitment savings)
  - Weekly reminders
  - Deposits and payout by same M-Pesa account as for MEL

- Depositing forgoes 1 KSH today, for R^{SAVE} KSH in Week 10
  - $\equiv$ Choosing later in MEL
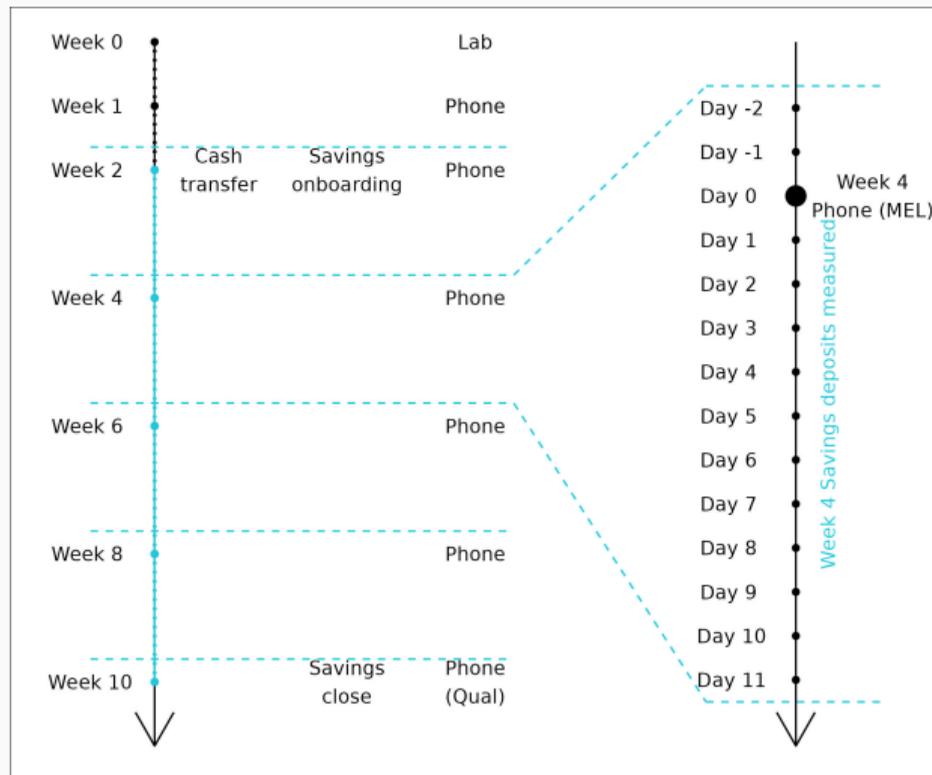
	Monthly savings interest rate		
	Low		High
	-3%	0%	20%
Cash transfer 0 KSH	66	66	67
8,000 KSH	50	50	50

- Sequentially stratified randomization (after lab sessions)
- 8,000 KSH ≈ 3 months of subject income
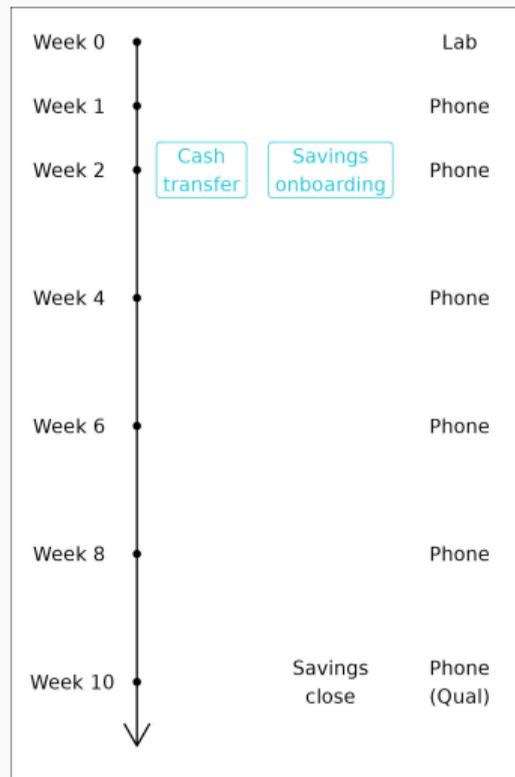
- Subjects receiving CT are 9.5pp (29%) more likely to choose later (Reject NB) (▸ Table)

- Corresponds to 15% increase in willingness-to-pay for money later (Week 8)
  - One third as large as rescaled estimates from Dean & Sautmann (2021) using smaller and higher frequency variation in nonlabor income
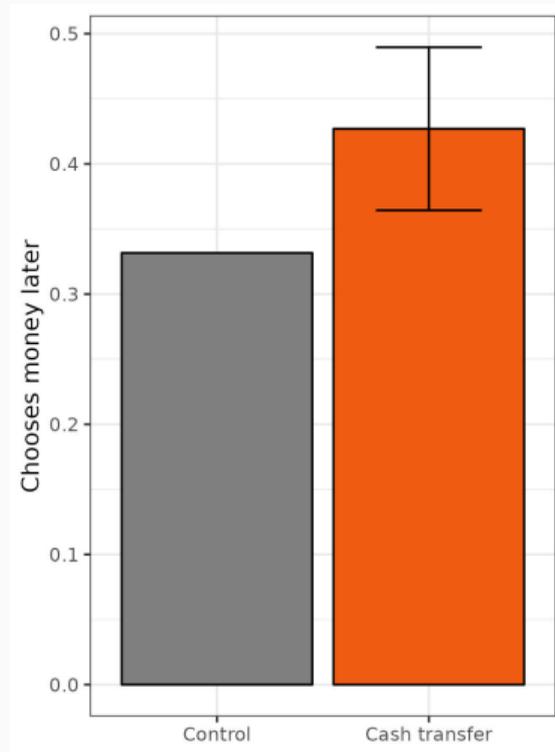
- Savers often choose 200 KSH today over 600 KSH in Week 10 (Reject **BB**)
  - 77% as often as non-savers

- Non-savers often choose 180 KSH in Week 10 over 200 KSH today (Reject **BB**)
  - 75% as often as savers

- Heterogeneity rules out alternative explanations of inconsistency ▸ Table
  - MEL noise or inattention
  - Within-biweek shocks
  - Savings comprehension
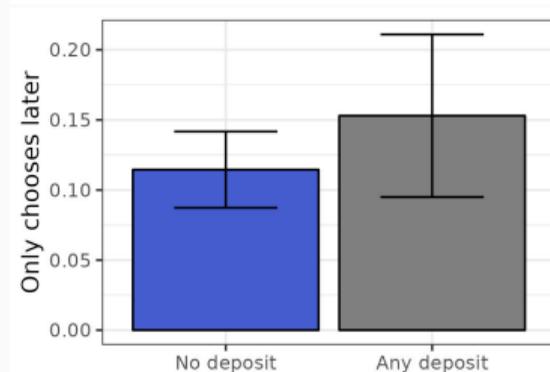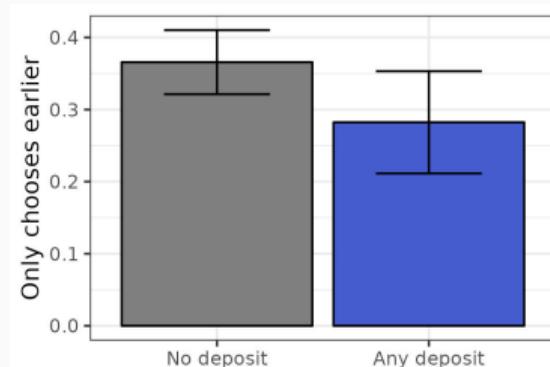
- Explore across-subject heterogeneity:
  - Standard (Gender, Age, Married)
  - Likely correlated with NB (Education, Income; Stango & Zinman, 2023)

- Fail to reject NB for below median income subjects (▸ Table)

- Replicate finding using...
  - data from (▸ Carvalho et al. (2016))
  - measure of NB from baseline CTB (▸ Andreoni & Sprenger (2012))
  - within-subject association between MEL and Savings (▸ Panel within)

Below median income

Above median income
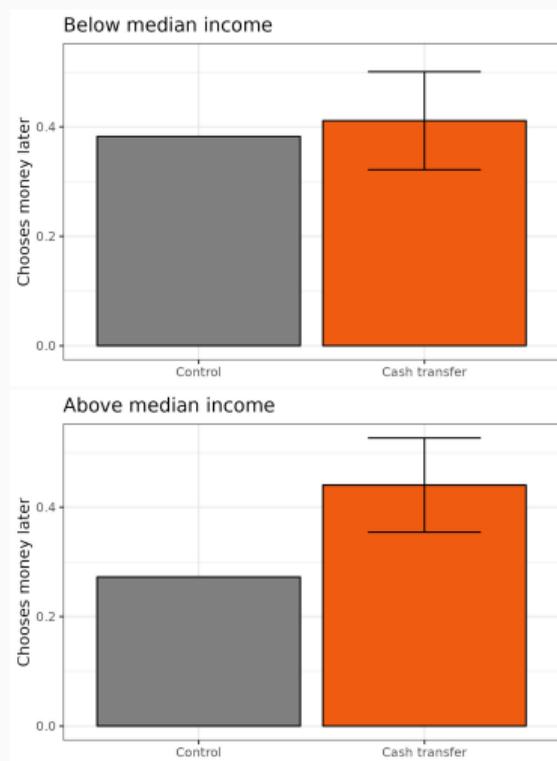
Preferences, not financial environment, drive association between MEL & Savings

- Run common regression
  - `reg save mel0`
  - Split by NB (Below med. inc.) and BB (Above med. inc.)

- Association between savings and (baseline/average) MEL choices...
  - is + for NB: reflects stable across-subject variation in preferences
  - vanishes for BB: suggests limited stable across-subject variation in returns to investment

	Any deposit			
	(1)	(2)	(3)	(4)
$\overline{\text{Later}}_{*,10}$	0.094	0.173		
	(0.056)	(0.067)		
	[0.093]	[0.011]		
$\overline{\text{Later}}_{0,8}$			0.057	0.120
			(0.045)	(0.063)
			[0.204]	[0.057]
$\overline{\text{Later}}_{*,10}$ * High income		-0.154		
		(0.111)		
		[0.164]		
$\overline{\text{Later}}_{0,8}$ * High income				-0.112
				(0.085)
				[0.187]
Dep. var. mean	0.205	0.205	0.190	0.190
(CT, High IR)	X	X	X	X
Strata FE	X	X	X	X
High income		X		X
(CT, High IR) * High income		X		X
# of observations	1,242	1,242	1,388	1,388
# of clusters	345	345	347	347

Conclusion

- We test "NB" and "BB" models of interpreting MEL choices
  - Contribution: Novel experimental design in a common sample
  - Builds on approaches applied to static setting (e.g., Rabin & Weizsäcker, 2009; Ellis & Freeman, 2020)

- We reject both models (on average), consistent with existing work rejecting NB (Carvalho et al., 2016; Dean & Sautmann, 2021) and BB (Andreoni et al., 2018; Balakrishnan et al., 2020)
  - Our results rationalize the common practice of interpreting association between MEL and savings as reflecting preferences (e.g., Ashraf et al., 2006; Meier & Sprenger, 2013; Schaner, 2015; Sunde et al., 2022; Mahajan et al., 2023)

Thanks!

Attrition

	Cash transfer			Savings interest rate		
	Control mean (sd) # of obs. (1)	Treatment mean (sd) (2)	Coefficient (SE) [p-value] (3)	Low interest mean (sd) (4)	High interest mean (sd) (5)	Coefficient (SE) [p-value] (6)
Consistent$_{t,10}$	0.863 (0.344) 1,242	0.861 (0.346)	-0.003 (0.024) [0.908]	0.864 (0.343)	0.859 (0.349)	-0.005 (0.026) [0.858]
Attrited, Week 1	0.050 (0.219) 349	0.040 (0.197)	-0.010 (0.023) [0.661]	0.039 (0.194)	0.060 (0.238)	0.021 (0.026) [0.404]
Attrited, Week 2	0.065 (0.248) 349	0.040 (0.197)	-0.026 (0.024) [0.274]	0.060 (0.239)	0.043 (0.203)	-0.019 (0.025) [0.455]
Attrited, Week 4	0.121 (0.326) 349	0.093 (0.292)	-0.028 (0.033) [0.395]	0.103 (0.305)	0.120 (0.326)	0.015 (0.036) [0.679]
Attrited, Week 6	0.090 (0.288) 349	0.100 (0.301)	0.010 (0.032) [0.765]	0.095 (0.294)	0.094 (0.293)	-0.001 (0.034) [0.985]
Attrited, Week 8	0.201 (0.402) 349	0.160 (0.368)	-0.045 (0.034) [0.189]	0.159 (0.367)	0.231 (0.423)	0.064 (0.038) [0.090]
Attrited, Week 10	0.302 (0.460) 349	0.260 (0.440)	-0.042 (0.037) [0.258]	0.297 (0.458)	0.256 (0.439)	-0.041 (0.039) [0.290]

Balance

	Cash transfer			Savings interest rate		
	Control mean (sd) # of obs. (1)	Treatment mean (sd) (2)	Coefficient (SE) [p-value] (3)	Low interest mean (sd) (4)	High interest mean (sd) (5)	Coefficient (SE) [p-value] (6)
Female	0.649 (0.479) 330	0.676 (0.470)	0.026 (0.052) [0.618]	0.671 (0.471)	0.640 (0.482)	-0.033 (0.055) [0.549]
Age	38.1 (10.9) 330	38.1 (11.0)	-0.0 (1.2) [0.996]	38.3 (10.9)	37.7 (11.0)	-0.6 (1.3) [0.645]
HHH	0.819 (0.386) 330	0.775 (0.419)	-0.044 (0.045) [0.328]	0.804 (0.398)	0.793 (0.407)	-0.011 (0.047) [0.812]
Married	0.447 (0.498) 330	0.423 (0.496)	-0.024 (0.056) [0.665]	0.438 (0.497)	0.432 (0.498)	-0.006 (0.058) [0.917]
Some secondary education	0.553 (0.498) 349	0.527 (0.501)	-0.026 (0.053) [0.631]	0.526 (0.500)	0.573 (0.497)	0.047 (0.055) [0.389]
Income, past two weeks (KSH)	1367 (1742) 349	1363 (1529)	2 (175) [0.991]	1297 (1645)	1500 (1665)	211 (190) [0.266]
Trusts Busara to pay on time	0.957 (0.202) 330	0.951 (0.217)	-0.006 (0.024) [0.788]	0.945 (0.228)	0.973 (0.163)	0.028 (0.022) [0.217]
$\overline{\text{Later}}_{0.2}$	0.579 (0.308) 344	0.574 (0.314)	-0.006 (0.034) [0.856]	0.568 (0.315)	0.595 (0.301)	0.027 (0.035) [0.433]
$\overline{\text{Later}}_{0.8}$	0.529 (0.337) 347	0.565 (0.347)	0.037 (0.037) [0.320]	0.529 (0.345)	0.577 (0.332)	0.049 (0.039) [0.206]
Consistent$_{0.8}$	0.779 (0.416) 349	0.813 (0.391)	0.034 (0.043) [0.435]	0.815 (0.389)	0.752 (0.434)	-0.063 (0.047) [0.180]

Sample characteristics

	Mean	Std. dev.	# of obs.
Female	0.661	0.474	330
Age	38.1	10.9	330
Head of household	0.800	0.401	330
Married	0.436	0.497	330
Some secondary education	0.542	0.499	330
Income, past two weeks (KSH)	1365	1652	349
Trust earnings paid on time	0.955	0.209	330
Decision on spending...			
200 KSH made alone	0.870	0.337	330
20,000 KSH made alone	0.591	0.492	330

Subjects delay payoffs in response to UCT ⇒ Reject narrow bracketing

	Chooses money later			$\log(1 + RRR_{t,10})$		
	(1)	(2)	(3)	(4)	(5)	(6)
Cash transfer	0.095	0.095	0.078	-0.148	-0.131	-0.133
	(0.031)	(0.038)	(0.033)	(0.047)	(0.057)	(0.051)
	[0.002]	[0.013]	[0.016]	[0.002]	[0.023]	[0.009]
High interest rate	-0.006	0.002	0.005	0.000	-0.023	-0.012
	(0.032)	(0.040)	(0.034)	(0.049)	(0.060)	(0.053)
	[0.842]	[0.958]	[0.874]	[0.997]	[0.706]	[0.819]
Dep. var. mean	0.373	0.372	0.356	0.607	0.610	0.618
Strata FE	X	X	X	X	X	X
Consistent		X			X	
Drop all extreme			X			X
# of observations	11,178	7,164	8,982	1,242	796	998
# of clusters	345	222	276	345	222	276

Subjects delay payoffs in response to UCT $\Rightarrow$ Reject narrow bracketing

	Chooses money later			$\log(1 + RRR_{t,10})$			Any deposit			Total deposits		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Cash transfer	0.095	0.095	0.078	-0.148	-0.131	-0.133	0.106	0.108	0.093	88	108	97
	(0.031)	(0.038)	(0.033)	(0.047)	(0.057)	(0.051)	(0.030)	(0.039)	(0.033)	(35)	(50)	(42)
	[0.002]	[0.013]	[0.016]	[0.002]	[0.023]	[0.009]	[0.000]	[0.006]	[0.005]	[0.012]	[0.029]	[0.019]
High interest rate	-0.006	0.002	0.005	0.000	-0.023	-0.012	0.018	0.052	0.026	83	124	104
	(0.032)	(0.040)	(0.034)	(0.049)	(0.060)	(0.053)	(0.031)	(0.043)	(0.034)	(42)	(67)	(51)
	[0.842]	[0.958]	[0.874]	[0.997]	[0.706]	[0.819]	[0.566]	[0.221]	[0.439]	[0.045]	[0.066]	[0.040]
Dep. var. mean	0.373	0.372	0.356	0.607	0.610	0.618	0.190	0.206	0.188	105	131	116
Strata FE	X	X	X	X	X	X	X	X	X	X	X	X
Consistent		X			X			X			X	
Drop all extreme			X			X			X			X
# of observations	11,178	7,164	8,982	1,242	796	998	1,396	896	1,120	1,396	896	1,120
# of clusters	345	222	276	345	222	276	349	224	280	349	224	280

(◂ Figure)

Subjects make inconsistent MEL and savings choices ⇒ Reject broad bracketing

	Chooses 180 KSH later					Chooses 600 KSH later				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
No deposit	0.157	0.150	0.118	0.166	0.130	0.593	0.589	0.606	0.604	0.587
	(0.016)	(0.020)	(0.015)	(0.015)	(0.020)	(0.022)	(0.028)	(0.025)	(0.021)	(0.031)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Any deposit	0.212	0.225	0.172	0.234	0.205	0.671	0.691	0.672	0.723	0.673
	(0.033)	(0.042)	(0.032)	(0.062)	(0.043)	(0.038)	(0.047)	(0.043)	(0.075)	(0.047)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Consistent		X					X			
Drop all extreme			X					X		
Any deposit on MEL day				X					X	
Recalls interest rate at Week 10					X					X
# of observations	1,242	796	998	1,242	655	1,242	796	998	1,242	655
# of clusters	345	222	276	345	175	345	222	276	345	175

(▸ Figure)

Reject NB for higher inc. (CT⇒MEL), not lower inc. (CT⇏MEL)

	Chooses money later				
	(1)	(2)	(3)	(4)	(5)
Cash transfer	0.048	0.112	0.064	0.108	0.038
	(0.053)	(0.044)	(0.040)	(0.046)	(0.045)
	[0.371]	[0.011]	[0.105]	[0.017]	[0.395]
High interest rate	0.010	0.007	0.009	-0.006	-0.004
	(0.033)	(0.033)	(0.033)	(0.032)	(0.032)
	[0.760]	[0.823]	[0.787]	[0.860]	[0.905]
X_i	0.033	0.003	-0.043	0.002	-0.102
	(0.044)	(0.043)	(0.043)	(0.042)	(0.040)
	[0.455]	[0.952]	[0.315]	[0.966]	[0.012]
Cash transfer * X_i	0.054	-0.057	0.044	-0.024	0.121
	(0.067)	(0.065)	(0.067)	(0.063)	(0.063)
	[0.418]	[0.379]	[0.513]	[0.699]	[0.057]
Cash transfer + Cash transfer * X_i	0.102	0.055	0.108	0.084	0.159
	(0.039)	(0.046)	(0.052)	(0.043)	(0.043)
	[0.010]	[0.233]	[0.039]	[0.049]	[0.000]
X	Female	High age	Married	Some secondary education	High income
# of observations	10,584	10,584	10,584	11,178	11,178
# of clusters	326	326	326	345	345

Reject NB for higher inc. (Payday⇒MEL), not lower inc. (Payday⇏MEL)

	Chooses money later		Fraction chosen for money later	
	(1)	(2)	(3)	(4)
Positive income shock	0.095	0.038	0.004	-0.027
	(0.031)	(0.045)	(0.015)	(0.022)
	[0.002]	[0.394]	[0.807]	[0.222]
High interest rate	-0.006	0.001		
	(0.032)	(0.048)		
	[0.842]	[0.979]		
High income		-0.098		-0.020
		(0.045)		(0.021)
		[0.029]		[0.340]
Positive income shock * High income		0.120		0.054
		(0.063)		(0.029)
		[0.057]		[0.064]
High interest rate * High income		-0.010		
		(0.067)		
		[0.883]		
Dep. var. mean	0.373	0.373	0.512	0.512
Carvalho et al. (2016)			X	X
Strata FE	X	X		
# of observations	11,178	11,178	4,240	4,240
# of clusters	345	345	1,060	1,060

Lower inc. associated with interior choices in Lab CTB (measure of NB)

	Fraction interior choices (CTB)					
	(1)	(2)	(3)	(4)	(5)	(6)
Female	0.018					-0.016
	(0.044)					(0.048)
	[0.674]					[0.748]
High age		0.044				0.039
		(0.041)				(0.042)
		[0.282]				[0.349]
Married			-0.052			-0.048
			(0.042)			(0.044)
			[0.224]			[0.270]
Some secondary education				-0.034		-0.025
				(0.042)		(0.045)
				[0.417]		[0.584]
High income					-0.083	-0.070
					(0.041)	(0.042)
					[0.047]	[0.098]
Strata FE	X	X	X	X	X	X
# of observations	330	330	330	349	349	330
# of clusters	330	330	330	349	349	330

Reject NB for higher inc. (ΔMEL⇒ΔSavings), not lower inc. (ΔMEL⇏ΔSavings)

	Any deposit	
	(1)	(2)
$\overline{\text{Later}}_{t,10}$	0.008	-0.050
	(0.043)	(0.060)
	[0.855]	[0.402]
$\overline{\text{Later}}_{t,10}$ * High income		0.142
		(0.083)
		[0.089]
Dep. var. mean	0.205	0.205
HH FE	X	X
# of observations	1,242	1,242
# of clusters	345	345