Intertemporal consumption with anticipating, remembering, and experiencing selves

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Intertemporal consumption: anomalies

Standard toolkit for analyzing intertemporal consumption, *Discounted Utility* $\sum_t \beta^t u(\mathbf{q}_t)$, has strong assumptions:

- *impatience*, with constant discount factors $\beta < 1$
- *consumption smoothing*

Estimates of β vary widely across studies Estimates

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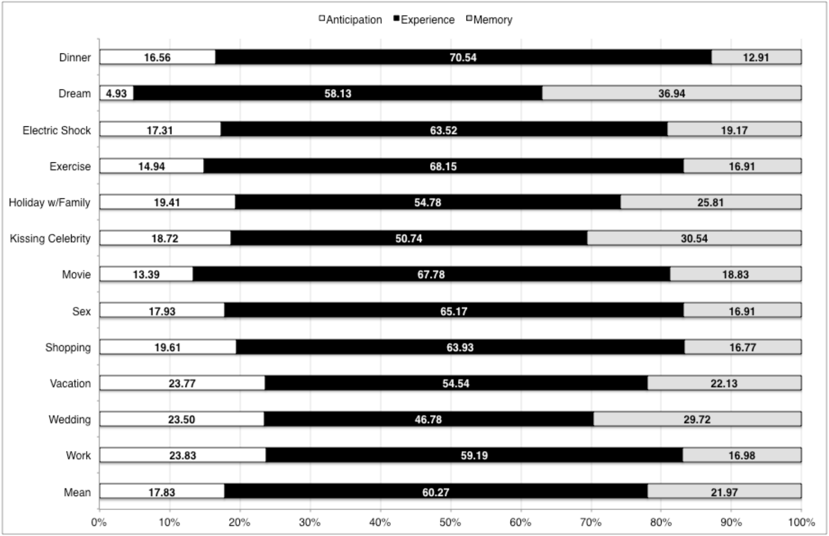
Intertemporal patterns inconsistent with *DU*

- consumers sometimes postpone desirable outcomes: preferences for savoring consumption (Loewenstein, 1987)
- people spend much money on consumption early in life: memorable consumption (Gilboa et al., 2016)

Agents care not just about physical outcomes but also about the mental image of future and past outcomes

Heterogeneity by outcome (source: Morewedge, 2015)



Contributions & Preview of results

1. We present a general yet tractable model of intertemporal consumption
    - bargaining process between anticipating, remembering, and experiencing 'selves': (*ICARES*)
        - the anticipating self prefers consumption in later periods whereas the remembering self prefers consumption earlier
        - selves do not necessarily agree on the valuation of goods
        - the power of each self can also change over time
    - different from the *DU* framework, our model
        - allows a temporal dissocation between consumption and utility
        - and relaxes *independence of discounting from consumption*

Contributions & Preview of results

1. We present a general yet tractable model of intertemporal consumption
2. We derive a simple nonparametric test of *ICARES*
    - the test is independent of the functional form of utility
    - relevant polar cases: *ICAES*, *ICRES*, and *ICES*
    - includes nonparametric test of the *DU* model as a special case
    - it allows to separately identify preferences for anticipation and preferences for recall
        - Crawford and Polisson (2014), Adams et al. (2014)

Contributions & Preview of results

1. We present a general yet tractable model of intertemporal consumption
2. We derive a simple nonparametric test of *ICARES*
3. We test the model using panel data on consumption of Spanish households (ECPF)
   - *ICARES* rationalizes close to 100% of the data, but lacks empirical power
   - *ICAES* is empirically powerful and rationalizes about half of the data

Utility flows from *one* consumption bundle

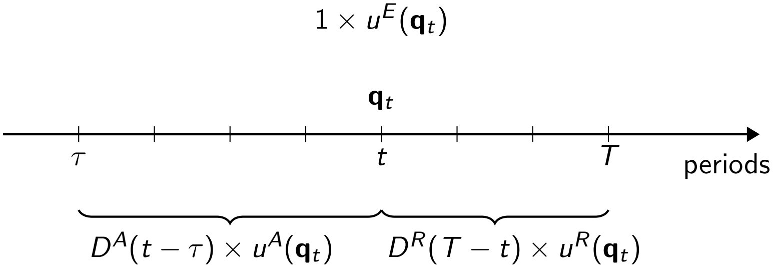


Figure: Timeline of the utility flows from anticipation, recall, and experience of $\mathbf{q}_t$

Utility flows from multiple consumption bundles

Total utility from anticipation is

$$U^A\left((\mathbf{q}_t)_{t\geq\tau}\right) = \sum_{t\geq\tau} D^A(t-\tau)\, u^A(\mathbf{q}_t)$$

Total utility from recall is

$$U^R\left((\mathbf{q}_t)_{t\geq\tau}\right) = \sum_{t\geq\tau} D^R(T-t)\, u^R(\mathbf{q}_t)$$

Total utility from experience is

$$U^E\left((\mathbf{q}_t)_{t\geq\tau}\right) = \sum_{t\geq\tau} u^E(\mathbf{q}_t)$$

The *ICARES* model

Consumers maximize a weighted sum of temporal utilities

$$\max_{(\mathbf{q}_t)_{t\geq\tau}} \omega^A(\tau)\, U^A\left((\mathbf{q}_t)_{t\geq\tau}\right) + \omega^R(\tau)\, U^R\left((\mathbf{q}_t)_{t\geq\tau}\right) + U^E\left((\mathbf{q}_t)_{t\geq\tau}\right),$$

$$\text{subject to } (\mathbf{q}_t)_{t\geq\tau} \in \mathcal{B}\left((\boldsymbol{\rho}_t)_{t\geq\tau}, y_\tau\right)$$

Consumption as outcome of bargaining process between

- anticipating self (with preferences U^A and power ω^A),
- remembering self (with preferences U^R and power ω^R),
- experiencing self (with preferences U^E)

hence '*ICARES*': Intertemporal Consumption with Anticipating, Remembering, and Experiencing Selves

Note: we abstract from uncertainty regarding prices and income

A note on time (in)consistency

As time moves forward, the consumer has incentives to diverge from their original plan

Reverse time inconsistency (Loewenstein, 1987): when the time leading up to the actual consumption shrinks, the agent wants to lower consumption and reshuffle plans accordingly

- because the duration of savoring a future event decreases with time
- compare, e.g., $D^A(t-1)\,u^A(\mathbf{q}_t)$ and $D^A(t-2)\,u^A(\mathbf{q}_t)$

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Attention for (reverse) time inconsistency issues has impeded analyses of savoring and anticipation

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Reverse time inconsistency gives rise to self-credibility concerns

- anticipation is nonetheless prevalent in everyday life
- internal mechanisms to mitigate acts of reverse time inconsistency

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Reverse time inconsistency gives rise to self-credibility concerns

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As time moves forward, the remaining planning period becomes shorter

- shorter time horizons draw attention to the 'sequential' nature of choice (Loewenstein and Prelec, 1993)
- this activates preferences for improvement, thus anticipation

So the effect of a decrease in the duration of savoring is neutralized by an increase in the decision power of the anticipating self

- sufficient condition: $D^A(t-\tau) = \left(\beta^A\right)^{t-\tau+\tau_0}$ and $\omega^A(\tau) = \omega_0^A\left(\beta^A\right)^{\tau-\tau_0}$

Nonparametric characterization

Proposition

Consider the dataset $\mathcal{D} = \{\boldsymbol{\rho}_t, \mathbf{q}_t\}_{t\in\mathcal{T}}$. A consumption plan $(\mathbf{q}_t)_{t\in\mathcal{T}}$ is rationalizable by ICARES if and only if there exist numbers u_t^A, u_t^R, u_t^E, nonnegative shadow prices $\tilde{\mathbf{p}}_t^A, \tilde{\mathbf{p}}_t^R, \tilde{\mathbf{p}}_t^E$, and time factors $\beta^A, \beta^R \geq 1$ such that for all $s, t \in \mathcal{T}$:

$$u_s^A - u_t^A \leq \tilde{\mathbf{p}}_t^A \cdot (\mathbf{q}_s - \mathbf{q}_t)\,; \tag{1}$$

$$u_s^R - u_t^R \leq \tilde{\mathbf{p}}_t^R \cdot (\mathbf{q}_s - \mathbf{q}_t)\,; \tag{2}$$

$$u_s^E - u_t^E \leq \tilde{\mathbf{p}}_t^E \cdot (\mathbf{q}_s - \mathbf{q}_t)\,; \tag{3}$$

$$\left(\beta^A\right)^{t-\tau_0+1} \times \tilde{\mathbf{p}}_t^A + \left(\beta^R\right)^{T-t+1} \times \tilde{\mathbf{p}}_t^R + \tilde{\mathbf{p}}_t^E = \boldsymbol{\rho}_t. \tag{4}$$

In addition, ICAES, respectively ICRES, requires that $\tilde{\mathbf{p}}_t^R = 0$ $(\tilde{\mathbf{p}}_t^A = 0)$.
Finally, ICES requires that $\tilde{\mathbf{p}}_t^A = \tilde{\mathbf{p}}_t^R = 0$.

Data

We use data from the Encuesta Continua de Presupuestos Familiares (ECPF) collected by the Spanish Statistics Office (INE)

- quarterly consumption data from Spanish households (singles and couples), interviewed between 1986 and 1996

Keep observations for consumers

- who completed 4 *consecutive* interviews
- with a fixed number of children
- with a stable employment status

Final dataset consists of 2,052 consumers

Goods categories: food and (nonalcoholic) drinks, clothing, household services, transport, petrol, leisure, personal services, restaurant and bars

Empirical fit

	ICES	*ICAES*	*ICRES*	*ICARES*
		Singles		
Pass rates	0.093	0.494	0.820	0.948
Power	0.955	0.770	0.301	0.121
Selten	0.048	0.265	0.121	0.068
Selten lb	0.005	0.190	0.061	0.033
Selten ub	0.092	0.339	0.180	0.104
		Couples		
Pass rates	0.035	0.455	0.795	0.964
Power	0.953	0.773	0.300	0.121
Selten	-0.012	0.228	0.095	0.085
Selten lb	-0.020	0.205	0.077	0.077
Selten ub	-0.004	0.251	0.113	0.094

Table: Pass rates, power, and predictive success for different specifications of *ICARES*

Estimation

For each good n, we regress expenditure shares w^n_{ht} on

- total intertemporal budget y_h
- interactions between y_h and time dummies $(t=2)$, $(t=3)$, and $(t=4)$
- quarter dummies

We use 3,760 consumer-quarter observations per regression and we cluster standard errors by consumer

$$w^n_{ht} = \eta^n + \gamma^n \times y_h + \theta^n_t \times y_h + \sum_{k=5}^{48} \delta^n_k \times (Calender\ time_{ht} = k) + \varepsilon^n_{ht}$$

Item	Commodity	Mean	Sd	γ	θ_2	θ_3	θ_4
restaurants	Foodout	14.005	13.345	14.152	3.261	3.931	5.728
childfoot	Clothing	1.462	2.601	7.652	1.549	2.934	4.438
mensfoot	Clothing	0.959	2.230	3.996	2.291	1.969	3.956
motfuel	Petrol	7.474	7.929	13.707	3.227	2.937	3.872
womensunder	Clothing	0.581	1.572	5.391	1.088	2.653	3.681
other_trans	Transport	3.272	6.415	7.966	1.666	3.158	3.447
mensouter	Clothing	3.277	6.161	6.191	1.060	0.941	3.404
beer	Allfood	0.540	1.421	5.303	2.248	2.266	3.312
childouter	Clothing	2.294	4.800	7.546	-0.549	1.638	3.229
recservs	Leisure	1.469	3.375	8.971	2.060	1.622	3.162
pcareservs	Pserv	1.100	2.836	6.301	2.617	1.983	3.155
cinema	Leisure	0.655	2.361	4.591	1.687	2.359	2.773
pcarendur	Pserv	1.561	3.474	5.725	1.726	2.352	2.684
nuts	Allfood	0.566	1.051	6.749	-0.117	2.018	2.682
accessories	Clothing	0.619	1.877	5.806	1.257	2.336	2.674
cleaning	Hhserv	2.164	2.811	10.351	0.028	1.462	2.479
longdistance	Transport	0.835	4.110	2.676	2.525	2.174	2.450
pastry	Allfood	2.035	2.469	8.817	1.937	1.929	2.372
processed_meat	Allfood	0.751	1.533	7.665	0.124	2.035	2.297
lamb	Allfood	1.074	2.717	4.758	0.537	2.235	2.216
deli_meat	Allfood	3.234	3.966	8.639	0.838	1.961	2.212
cheese	Allfood	2.194	2.400	12.520	0.336	0.920	2.202
wine	Allfood	0.566	1.619	3.761	0.188	1.494	2.147
sugar	Allfood	0.249	0.601	2.367	1.655	2.161	2.055
womensouter	Clothing	4.057	7.108	8.608	1.731	1.181	2.031
cookoil	Allfood	1.338	2.803	5.529	0.739	1.945	1.978
prime_meat	Allfood	2.229	3.442	8.905	0.704	1.426	1.901
other_alc	Allfood	0.190	1.141	4.104	0.214	1.197	1.887
mensunder	Clothing	0.458	1.572	4.848	-0.334	1.325	1.873
recgoods	Leisure	1.816	4.317	6.213	0.481	2.246	1.824
fruit	Allfood	2.818	2.626	12.587	1.520	1.602	1.751
fooddrink_remain	Allfood	0.663	4.304	3.512	1.246	0.937	1.566
fresh_fish	Allfood	2.688	3.391	10.262	-0.168	1.990	1.550
domservs	Hhserv	1.931	5.843	6.087	0.750	1.110	1.523
chocolate	Allfood	0.523	1.064	6.437	-0.692	1.464	1.466

Conclusion

We present a general yet tractable model of intertemporal consumption

- building the bridge between Kahneman, Wakker, and Sarin (1997)'s theory of total utility and Samuelson (1937)'s discounted utility framework

We provide a nonparametric characterization that is easily implemented

Savoring (*ICAES*) has the best predictive success to explain consumption choices

In ongoing work, we add error to price and quantity data and re-run the analyses

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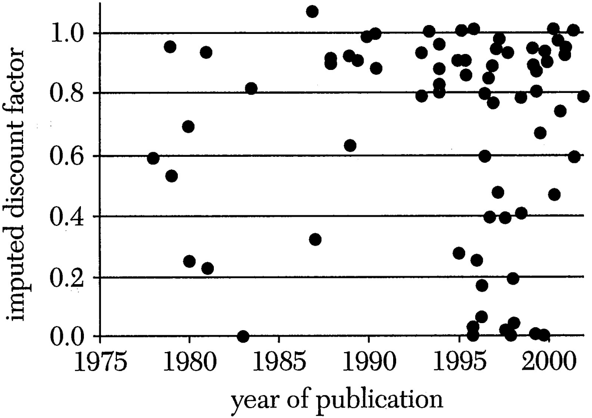

Figure 2. Discount Factor by Year of Study Publication

Source: Frederick et al. (2002)