

Mistakes in Future Consumption, High MPCs Now

Chen Lian¹

¹UC Berkeley and NBER

March 27, 2022

Outline

- 1 Introduction
- 2 The Simplest Example
- 3 Environment
- 4 Mistakes in Future Consumption, High MPCs Now
- 5 Behavioral Foundations
- 6 Gauging the Magnitudes
- 7 Other Applications
- 8 Conclusion

Motivation

- Consensus: **behavioral biases** important in **consumption**
- Example: **high MPCs away from liquidity constraints**
 - ▶ Fagereng et al. (21): $MPC \geq 0.4$ (highest-liquidity quartile)
 - ▶ Parker (17); Kueng (18); Olafsson & Pagel (18); Thakral & To (21)
- Challenge: how to **systematically incorporate behavioral biases**
 - ▶ Inattention, present bias, diagnostic expectations, and imperfect problem solving
 - ▶ Any predictions independent of specific biases?
- Here: **robust** predictions of **sophistication (anticipated future mistakes) on MPCs**
 - ▶ Crucial in other contexts (O'Donoghue & Rabin), but implications for MPCs not studied
 - ▶ Always studied in the context of specific biases
 - ▶ Broad lesson: **study implications of sophistication without fixing a specific bias**

This Paper

Method: **wedges** for mistakes, accommodate different biases

- Systematically study the implication of sophistication on consumption behavior

Future consumption mistakes in response to saving changes \implies higher MPCs now

- Value of changing saving diminishes (relative value of changing consumption)
- After an income shock, more willing to adjust current consumption instead of savings
- “Robust:” no matter future over-reaction or under-reaction

Precautionary motive: future mistakes + prudence \implies lower consumption **levels**

- **Not directly about MPCs**

Other applications:

- Excess discounting to future income
- Larger risk aversion & equity premium puzzle

Outline

- 1 Introduction
- 2 The Simplest Example**
- 3 Environment
- 4 Mistakes in Future Consumption, High MPCs Now
- 5 Behavioral Foundations
- 6 Gauging the Magnitudes
- 7 Other Applications
- 8 Conclusion

The Simplest Example

$$u(c_0) + u(c_1) + u(c_2)$$

- One asset, $R = 1$, standard intertemporal budget.
- Quadratic utility (general concave later).
- Focus on responses to an income shock Δ at $t = 0$ (only source of income).
- $t = 2$: $c_2(w_2) = w_2$.
- $t = 1$: **future mistakes to saving changes** ($\lambda_1 > 0$ under-reaction; $\lambda_1 < 0$: over-reaction)

$$c_1(w_1) = \frac{1}{2}(1 - \lambda_1)w_1 \quad \text{and} \quad w_2 = w_1 - c_1 = \frac{1}{2}(1 + \lambda_1)w_1,$$

where λ_1 may come from inattention, present bias, diagnostic expectations, etc.

- $t = 0$: **taking future mistakes as given**, subject to the budget $w_1 = \Delta - c_0$.

Future “Response” Mistakes \implies High Current MPCs

$$c_1 = \frac{1}{2}(1 - \lambda_1)w_1 \quad \text{and} \quad c_2 = \frac{1}{2}(1 + \lambda_1)w_1$$

Proposition. Future Consumption Mistakes, High MPCs Now

$$c_0 = \phi_0 \Delta \quad , \quad \phi_0 \text{ increases with future } |\lambda_1|$$

- Key: future consumption mistakes **in response to saving changes** ($|\lambda_1|$)
 - ▶ **Future consumption responses will be more concentrated in some periods**
 - ▶ **Value of changing saving diminishes** (relative to value of changing consumption)
 - ▶ After Δ , **more willing to adjust current consumption** instead of savings
- Robust: high current MPC ϕ_0
 - ▶ no matter future under-reaction ($\lambda_1 > 0$) & over-reaction ($\lambda_1 < 0$)

Outline

- 1 Introduction
- 2 The Simplest Example
- 3 Environment**
- 4 Mistakes in Future Consumption, High MPCs Now
- 5 Behavioral Foundations
- 6 Gauging the Magnitudes
- 7 Other Applications
- 8 Conclusion

A Single-agent Intertemporal Consumption Problem

$$U_0 \equiv \sum_{t=0}^{T-1} \delta^t u(c_t) + \delta^T v(a_T + y_T)$$

$$\text{s.t. } a_{t+1} = R(a_t + y_t - c_t) \quad \forall t \in \{0, \dots, T-1\}$$

- u : consumption util. & $v: \mathbb{R} \rightarrow \mathbb{R}$, retirement util. Strictly concave.
- One risk-free asset, R fixed. No borrowing constraints.
 - ▶ Only $w_t = a_t + y_t + \sum_{k=1}^{T-t} R^{-k} y_{t+k}$ matters
 - ▶ Budget $w_{t+1} = R(w_t - c_t)$
- Focus on responses to an income shock Δ at $t=0$ ($\bar{w}_0 \rightarrow \bar{w}_0 + \Delta$)
 - ▶ uncertainty resolved at period 0 (extended in the paper)

Behavioral Consumption Rules

How do behavioral biases impact **actual consumption** $c_t(w_t)$ (and MPC $\phi_t \equiv \frac{\partial c_t}{\partial w_t}$)?

$$c_t(w_t) = c_t\left(w_t; \Lambda_t, \{\Lambda_{t+k}\}_{k=1}^{T-t-1}\right)$$

- Direct impact of the current mistake Λ_t
 - ▶ inattention, present bias, diagnostic expectations, etc.
 - ▶ implications for MPCs well understood, can go either way
- **Anticipation** of **future mistakes** $\{\Lambda_{t+k}\}_{k=1}^{T-t-1}$
 - ▶ implications for MPCs not well understand
 - ▶ sophistication in O'Donoghue & Rabin

Isolate the Impact of Future Mistakes

- **Deliberate consumption:** consumption if self t were not subject to any mistake

$$c_t^{\text{Deliberate}}(w_t) \equiv \arg \max_{c_t} u(c_t) + \sum_{k=1}^{T-t-1} \delta^{k-1} u(c_{t+k}(w_{t+k})) + \delta^{T-t} v(w_T)$$

where future actual consumption rules are taken as given.

- ▶ Isolate the impact from future mistakes $\{\Lambda_{t+k}\}_{k=1}^{T-t-1}$ (i.e., sophistication)
- A decomposition of actual current consumption rule:

$$c_t(w_t) \equiv \mathcal{S} \left(c_t^{\text{Deliberate}}(w_t), \Lambda_t \right)$$

- Question of interest: how future mistakes $\{\Lambda_{t+k}\}_{k=1}^{T-t-1}$ impact the current MPC

$$\phi_t^{\text{Deliberate}} \equiv \frac{\partial c_t^{\text{Deliberate}}(w_t)}{\partial w_t}$$

Outline

- 1 Introduction
- 2 The Simplest Example
- 3 Environment
- 4 Mistakes in Future Consumption, High MPCs Now**
- 5 Behavioral Foundations
- 6 Gauging the Magnitudes
- 7 Other Applications
- 8 Conclusion

The Benchmark Quadratic-Linear Case

Actual future consumption (\bar{c}_{t+k} and \bar{w}_{t+k} capture the pre-shock ($\Delta = 0$) outcome)

$$c_{t+k}(w_{t+k}) = \bar{c}_{t+k} + \phi_{t+k}(w_{t+k} - \bar{w}_{t+k}), \quad (1)$$

- Allow two types of mistakes $\Lambda_{t+k} = (\lambda_{t+k}, \bar{\lambda}_{t+k})$ compared to its deliberate counterpart

$$c_{t+k}^{\text{Deliberate}}(w_{t+k}) = \phi_{t+k}^{\text{Deliberate}}(w_{t+k} - \bar{w}_{t+k}) + \bar{c}_{t+k}^{\text{Deliberate}}$$

- 1 **Future mistakes in response to saving changes** (crucial for high current MPCs)

$$\phi_{t+k} = (1 - \lambda_{t+k}) \phi_{t+k}^{\text{Deliberate}}$$

- ▶ $\lambda_{t+k} > 0$: under-reaction; $\lambda_{t+k} < 0$: over-reaction
- ▶ Nest: inattention, present bias, rules of thumb, etc
- ▶ Key: anticipation of λ_{t+k} will increase the current MPC $\phi_t^{\text{Deliberate}}$

- 2 **Mistakes in future consumption level** (irrelevant for current MPCs)

$$\bar{c}_{t+k} = \bar{c}_{t+k}^{\text{Deliberate}} - \bar{\lambda}_{t+k}$$

Excess Concavity of Continuation Value

Continuation value given future actual consumption & the budget

$$V_{t+1}(w_{t+1}) \equiv \sum_{k=1}^{T-t-1} \delta^{k-1} u(c_{t+k}(w_{t+k})) + \delta^{T-t-1} v(w_T).$$

Concavity: $V''_{t+1} \equiv u'' \cdot \Gamma_{t+1}$ (a function of λ s, δ and R)

Proposition. Excess Concavity of continuation Value

$\Gamma_{t+1} > 0$ increases with future mistakes $\{|\lambda_{t+k}|\}_{k=1}^{T-t-1}$.

Intuition: a larger $\{|\lambda_{t+k}|\}_{k=1}^{T-t-1}$

⇒ More inefficient responses to saving changes

⇒ Future consumption responses will be more concentrated in some periods

⇒ **Value of changing saving diminishes**

High MPCs Today

$$c_t^{\text{Deliberate}}(w_t) = \max_{c_t} u(c_t) + \delta V_{t+1}(R(w_t - c_t))$$

$$\phi_t^{\text{Deliberate}} \equiv \frac{\partial c_t^{\text{Deliberate}}}{\partial w_t} = \frac{V_{t+1}''}{u'' + V_{t+1}''}$$

Proposition. Future Consumption Mistakes, High MPCs Now

- $\phi_t^{\text{Deliberate}}$ increases with future mistake $\{|\lambda_{t+k}|\}_{k=1}^{T-t-1}$.
- $\phi_t^{\text{Deliberate}} \geq \phi_t^{\text{Frictionless}}$. The latter is the MPC when all $\lambda_{t+k} = 0$.

Intuition: In response to Δ , with future mistakes in response to saving w_{t+1}
 \implies Less willing to change savings w_{t+1} (value of changing saving diminishes)

\implies **Change current consumption** c_t **more**

High MPCs Today

$$c_t^{\text{Deliberate}}(w_t) = \max_{c_t} u(c_t) + \delta V_{t+1}(R(w_t - c_t))$$

Proposition. Future Consumption Mistakes, High MPCs Now

- $\phi_t^{\text{Deliberate}}$ increases with future mistake $\{|\lambda_{t+k}|\}_{k=1}^{T-t-1}$.
- $\phi_t^{\text{Deliberate}} \geq \phi_t^{\text{Frictionless}}$. The latter is the MPC when all $\lambda_{t+k} = 0$.

Driven by future mistakes in response to saving changes $\{|\lambda_{t+k}|\}_{k=1}^{T-t-1}$.

- **Not mistakes in future consumption level** ($\bar{\lambda}_{t+k} = \bar{c}_{t+k}^{\text{Deliberate}} - \bar{c}_{t+k}$)
- **No matter over-/under-reaction** ($\lambda_{t+k} > 0$ or < 0)

The General Concave Case (Details in the Paper)

The same high current MPCs if

- Focus on future mistakes in response to saving changes (λ_{t+k} as above)

$$\phi_{t+k} = (1 - \lambda_{t+k}) \phi_{t+k}^{\text{Deliberate}},$$

$$\text{where } \phi_{t+k} \equiv \frac{\partial c_{t+k}(\bar{w}_{t+k})}{\partial w_{t+k}} \text{ and } \phi_{t+k}^{\text{Deliberate}} \equiv \frac{\partial c_{t+k}^{\text{Deliberate}}(\bar{w}_{t+k})}{\partial w_{t+k}}.$$

- Shut down mistakes in future consumption level (nest many applications)
 - ▶ without the shock ($\Delta = 0$), no mistakes in future actual consumption

$$\bar{c}_{t+k} = \bar{c}_{t+k}^{\text{Deliberate}} \quad \text{i.e.} \quad \bar{\lambda}_{t+k} = 0 \quad (2)$$

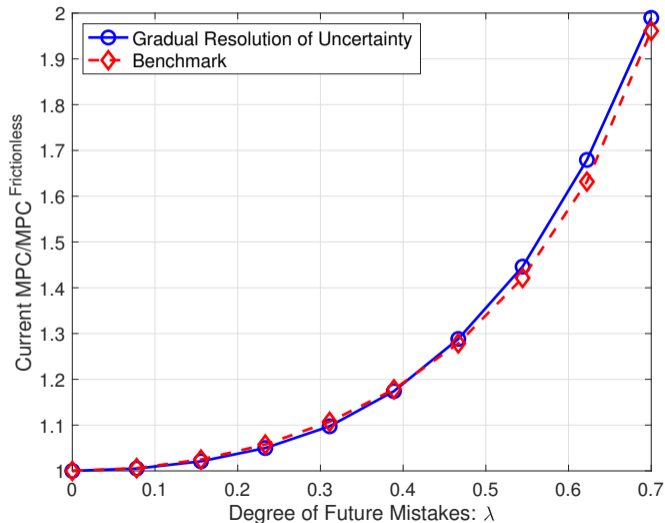
Proposition. Future Consumption Mistakes, High MPCs Now

For arbitrary concave u ,

- $\phi_t^{\text{Deliberate}} \equiv \frac{\partial c_t^{\text{Deliberate}}(w_t)}{\partial w_t}$ increases with future mistake $\{|\lambda_{t+k}|\}_{k=1}^{T-t-1}$.
- $\phi_t^{\text{Deliberate}} \geq \phi_t^{\text{Frictionless}}$. The latter is the MPC when all $\lambda_{t+k} = 0$.

Gradual Resolution of Uncertainty

- Similar high-MPCs if no consumption mistakes when incomes are at median levels.



The Precautionary Saving Motive (Details in the Paper)

- The high MPC result **does not come from the precautionary saving motive**.
 - ▶ can easily see from the quadratic case
- **Precautionary motive**: dispersion of future consumption levels across states or time

⇒ **lower the *level* of current consumption**

⇒ does not directly impact current *MPCs*

- Paper: a detailed exposition in my framework why it is a separate channel

Outline

- 1 Introduction
- 2 The Simplest Example
- 3 Environment
- 4 Mistakes in Future Consumption, High MPCs Now
- 5 Behavioral Foundations**
- 6 Gauging the Magnitudes
- 7 Other Applications
- 8 Conclusion

Overview

Main results accommodate most commonly studied behavioral mistakes (in the paper)

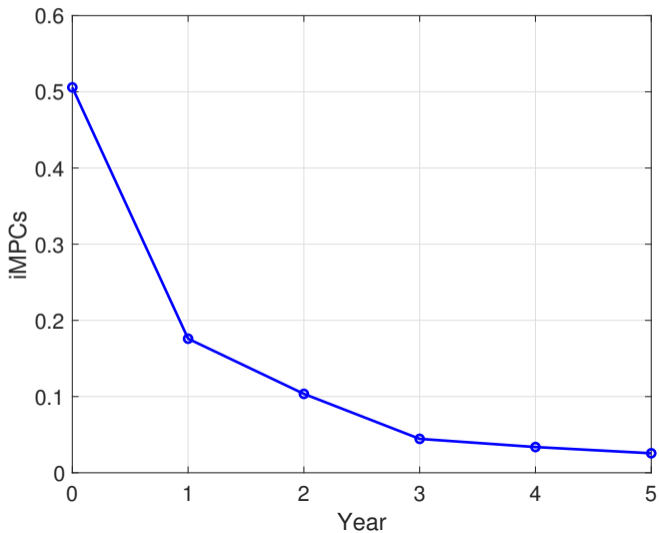
- Inattention (Sims, 03; Gabaix, 14)
- Diagnostic expectations (Bianchi, Ilut, Saijo, 21)
- Hyperbolic discounting (Laibson, 96)
- Near-rationality and ε -mistakes (Cochrane, 89; Kueng, 18)
- Intra-household bargaining (Mazzocco, 07)
- Illustrate the **general applicability of main results on high current MPCs**

Outline

- 1 Introduction
- 2 The Simplest Example
- 3 Environment
- 4 Mistakes in Future Consumption, High MPCs Now
- 5 Behavioral Foundations
- 6 Gauging the Magnitudes**
- 7 Other Applications
- 8 Conclusion

Gauging the Magnitudes: a Wedge-based Strategy

- Using IRFs of consumption to lottery prizes from Fagereng et al. (2021)
 - ▶ used as “**intertemporal MPCs**” in Auclert, Rognlie, Straub (2018)



Gauging the Magnitudes: a Wedge-based Strategy

- Back out **future wedges/mistakes** $\{\lambda_k\}_{k=1}^5$
 - ▶ iMPCs (year 1-5) & (δ, R, γ) estimated in the paper
 - ▶ accommodating different behavioral micro-foundations
- How much these future mistakes $\{\lambda_k\}_{k=1}^5$ can increase current MPC $\phi_0^{\text{Deliberate}}$?
- Result

$$\phi_0^{\text{Deliberate}} \approx 0.18 \approx 2\phi_0^{\text{Frictionless}}$$

- Quantitatively very meaningful
 - ▶ cannot fully explained $\phi_0 \approx 0.5$, but that is by design
 - ▶ current mistakes λ_0 also important!

Outline

- 1 Introduction
- 2 The Simplest Example
- 3 Environment
- 4 Mistakes in Future Consumption, High MPCs Now
- 5 Behavioral Foundations
- 6 Gauging the Magnitudes
- 7 Other Applications**
- 8 Conclusion

Other Applications

Risk aversion connected to the concavity of value function $\frac{\partial^2 V}{\partial w^2}$

- Future mistakes in response to saving changes
 - ⇒ Excess concavity of value function
 - ⇒ **Larger risk aversion**
 - ⇒ Help resolve equity premium puzzle

Excess discounting of future income

- Future mistakes in response to saving changes
 - ⇒ Less willing to change savings
 - ⇒ **Smaller response of current consumption to future income shocks**
 - ⇒ Evidence on limited “announcement effect”, e.g. Kueng (18)

Outline

- 1 Introduction
- 2 The Simplest Example
- 3 Environment
- 4 Mistakes in Future Consumption, High MPCs Now
- 5 Behavioral Foundations
- 6 Gauging the Magnitudes
- 7 Other Applications
- 8 Conclusion**

Conclusion

Anticipation of **future consumption mistakes**

- Help resolve empirical puzzle: **High-liquidity consumers' high MPCs**
- Accommodate many potential biases
 - ▶ inattention, hyperbolic discounting, ε -errors, rules of thumb

Key theme: **predictions of sophistication independent of behavioral bias**

- “Wedges” for behavioral mistakes
- A fruitful method to study and synthesize the impact of sophistication